Section 4
New Alternatives: Alternatives 4A, 2D, and 5A

4.1 Introduction

As stated in Section 1, *Introduction*, the RDEIR/SDEIS considers additional sub-alternatives that meet the goals of restoring the ecological functions of the Delta and improving water supply reliability. These alternatives were developed in response to input from the public on the Draft EIR/EIS comment period as well as from agencies. Specifically among the comments received on the Draft EIR/EIS was the suggestion that DWR should pursue permit terms shorter than 50 years due to the levels of uncertainty regarding both the long-term effectiveness of habitat restoration in recovering fish populations and the future effects of climate change on the Delta and the Sacramento River watershed. Other comments suggested that the proposed conveyance facilities should be untethered from the habitat restoration components of the BDCP, with the latter to be pursued separately.

Consistent with this input, the Lead Agencies are analyzing an alternative implementation strategy considered within the new alternatives in this RDEIR/SDEIS (Alternatives 4A, 2D, and 5A) (see Figure 4.1-1). The alternative implementation strategy would achieve the project objectives and purpose and need by constructing conveyance facility improvements and associated ecosystem improvements. These changes are necessary for the SWP and CVP to address more immediate water supply reliability needs while reducing the severity of existing ongoing environmental impacts. The strategy would achieve the latter objective and purpose in part by reducing reverse flows and direct fish species impacts associated with the existing south Delta intakes. The alternative implementation strategy allows for other state and federal programs to address the long term conservation efforts for species recovery in programs separate from the proposed project.

The primary differences between Alternatives 4A, 2D, and 5A presented in this RDEIR/SDEIS and Alternatives 4, 2A, and 5 presented in the BDCP Draft EIR/EIS are as follows. The California Department of Water Resources (DWR) would not seek 50-year permits under the federal and state endangered species laws for Alternatives 4A, 2D, or 5A. The originally proposed BDCP habitat restoration measures and related Conservation Measures (CMs) (i.e., CM2 through CM21) would not be included as parts of Alternatives 4A, 2D, and 5A, except to the extent required to mitigate significant environmental effects under CEQA and meet the regulatory standards of ESA Section 7 and California Endangered Species Act (CESA) Section 2081(b).

Alternatives 4A, 2D, and 5A would not serve as habitat conservation plans/natural community conservation plans (HCPs/NCCPs) under ESA Section 10 and the NCCPA, but rather would achieve incidental take authorization under ESA Section 7 and CESA Section 2081(b).

Alternatives 4A, 2D, and 5A would enable DWR to construct and operate new conveyance facilities that improve conditions for endangered and threatened aquatic species in the Delta while at the same time improving water supply reliability, consistent with California law (see, e.g., Cal.Wat. Code, § 85001[c]). Implementing the conveyance facilities alone, as now proposed under Alternatives 4A, 2D, and 5A, would help resolve many of the concerns with the current south Delta conveyance system, and would help reduce threats to endangered and threatened species in the Delta. For instance, implementing a dual conveyance system would align water operations to better reflect natural seasonal flow patterns by creating new water diversions in the north Delta equipped with state-of-the-art fish screens, thus reducing reliance on south Delta exports.

The existing operation of the SWP and CVP pumps in the south Delta can cause reversals in river flows, potentially altering salmon migratory patterns and contributing to the decline of sensitive fish species such as delta smelt. The new system would reduce the ongoing physical impacts associated with sole reliance on the southern diversion facilities and allow for greater operational flexibility to better protect fish. Minimizing south Delta pumping would provide more natural east–west flow patterns. The new diversions would also help protect critical water supplies against the threats of sea level rise and earthquakes. Alternatives 4A, 2D, and 5A comprise only the conveyance facilities and operations that formerly constituted CM1 and no longer includes habitat restoration measures beyond those needed to provide mitigation for specific regulatory compliance purposes. However habitat restoration is still recognized as a critical component of the State's long-term plans for the Delta, and such endeavors will likely be implemented over time under actions separate and apart from the chosen alternative. If Alternative 4A, 2D, or 5A is approved at the end of the CEQA/NEPA process, restoration of habitat in the Delta, beyond these alternatives' mitigation requirements, will instead occur through California EcoRestore[1], and these activities will be further developed and evaluated independent of the water conveyance facilities. Although DWR and Reclamation have identified these alternatives with a new implementation strategy, they are nevertheless consistent with the Coordinated Operation Agreement (COA) governing the coordinated operation of the federal Central Valley Project (CVP) and State Water Project (SWP). These new alternatives would, like Alternative 4, address compliance with federal and state endangered species laws with respect to the operation of the existing SWP Delta intake and conveyance facilities, as well as for the construction and operation of conveyance facilities for the movement of water entering the Delta from the Sacramento Valley watershed to the existing SWP and CVP pumping plants in the southern Delta.

4.1.1 Rationale for Revisions to the Proposed Project

At their cores, both CEQA and NEPA are intended to allow agency decision makers and members of the public to consider the environmental consequences of proposed actions and to consider ways of reducing or avoiding adverse impacts. The statutes function best when agencies use the information they acquire through the environmental review process to modify their proposed actions to make them more environmentally benign.

California courts have recognized that project changes are a desirable and foreseeable byproduct of the CEQA process. In fact, courts have noted that CEQA "encourages" public agencies to revise projects in light of new information revealed during the CEQA process.[2] Indeed, as the courts have emphasized, "one of the major objectives of the CEQA process …[is] to foster better (more environmentally sensitive) projects through revisions which are precipitated by the preparation of EIRs."[3] It is thus "the very nature of CEQA" that "projects will be 'modified' to protect the environment."[4]

1 https://s3.amazonaws.com/californiawater/pdfs/ECO_FS_Overview.pdf

2 *Citizens for a Sustainable Treasure Island v. City and County of San Francisco* (2014) 227 (*Treasure Island*).

3 / *County of Orange v. Superior Court* (2003) 113 Cal.App.4th 1, 10.

4 *Ibid.*

As further noted by the courts, "[t]he CEQA reporting process is not designed to freeze the ultimate proposal in the precise mold of the initial project; indeed, new and unforeseen insights may emerge during investigation, evoking revision of the original proposal."[5] Project reductions, in particular, are encouraged to the extent that they address environmental needs and facilitate the goals of CEQA. In certain situations, for example, an agency may approve only a portion of the project analyzed in an EIR.[6] As one court summarized these points, "'CEQA compels an interactive process of assessment of environmental impacts and responsive project modification which must be genuine. It must be open to the public, premised upon a full and meaningful disclosure of the scope, purposes, and effect of a consistently described project, with flexibility to respond to unforeseen insights that emerge from the process.' In short, a project must be open for public discussion and subject to agency modification during the CEQA process."[7]

NEPA imposes similar obligations on federal agencies and, like CEQA, encourages project revisions based on environmental concerns brought to light during the environmental review process. Although NEPA, unlike CEQA, is considered a "purely procedural statue" (meaning that it does not mandate particular results), it provides the necessary process to ensure that federal agencies take a "hard look" at the environmental consequences of their actions.[8]

NEPA and its implementing regulations specifically require federal officials to consider the recommendations of other government entities and the public who present reasonable solutions or alternative approaches that may improve a proposed action. When preparing a Final EIS, a federal lead agency must respond to comments on a Draft EIS in one of several ways, "including by modifying alternatives including the proposed action and by developing and evaluating alternatives not previously given serious consideration by the agency."[9] As stated in the NEPA regulations, "[u]ltimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment."[10]

Accordingly, like CEQA, NEPA encourages agencies to make changes to proposed projects based on information gathered during the environmental review process and based on public comments received on a Draft EIS. The NEPA regulations note that "[a]n agency can modify a proposed action in light of public comments received in response to a draft EIS."[11] Moreover, federal courts have long recognized that "agencies must have some flexibility to modify alternatives canvassed in the Draft

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[5] / *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 736–737, quoting *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 199; see also *River Valley Preservation Project v. Metropolitan Transit Development Bd.* (1995) 37 Cal. App. 4th 154, 168, fn. 11.

[6] / See *Dusek v. Anaheim Redevelopment Agency* (1985) 173 Cal.App.3d 1029, 1041 [decisionmakers have "the flexibility to implement that portion of a project which satisfies their environmental concerns"].

[7] / *Concerned Citizens of Costa Mesa, Inc. v. 32nd District Agricultural Association* (1986) 42 Cal.3d 929, 936.

[8] / *Muckleshoot Indian Tribe v. U.S. Forest Serv.* (9th Cir.1999) 177 F.3d 800, 814 (quoting *Robertson v. Methow Valley Citizens Council* (1989) 490 U.S. 332, 350) (quotation marks omitted).

[9] / 40 C.F.R. § 1503.4(a).

[10] / 40 C.F.R. § 1500.1(c).

[11] / See 40 C.F.R. § 1503.4(a).

EIS to reflect public input."[12] Indeed, the very purpose of a Draft EIS and the ensuing comment period is to elicit suggestions and criticisms to enhance the proposed project.[13]

As the forgoing discussion demonstrates, a primary measure of success under both CEQA and NEPA is when the environmental review process and public comments prompt the lead agencies to make changes that result in a project that is better than the original proposal. That is precisely what has occurred here. Because of the robust public response during the extended public comment period on the Draft EIR/EIS, as well as the data acquired during the environmental review process, the Lead Agencies have been able to better identify and understand the proposed project's potential adverse effects, and have been able to identify a solution that will reduce many of these impacts and ease the burden on the environment and Delta communities.

4.1.2 Description of Alternative 4A

This section provides description of the components and operation of water conveyance facilities, ESA and CESA compliance process, and environmental commitments that will implemented under Alternative 4A. Table 4.4-1 below, provides a brief summary comparison of these elements between Alternatives 4A and 4.

4.1.2.1 Water Conveyance Facility Construction and Maintenance

Under Alternative 4A, water conveyance facilities would be constructed and maintained identically to those proposed and analyzed under Alternative 4 (including the modifications described in Section 3, *Conveyance Facility Modifications to Alternative 4*, of this RDEIR/SDEIS). Water would primarily be conveyed from the north Delta to the south Delta through pipelines/tunnels. Water would be diverted from the Sacramento River through three fish-screened intakes on the east bank of the Sacramento River between Clarksburg and Courtland (Intakes 2, 3, and 5). Water would travel from the intakes to a sedimentation basin before reaching the tunnels. From the intakes water would flow into an initial single-bore tunnel, which would lead to an intermediate forebay on Glannvale Tract. From the southern end of this forebay, water would pass through an outlet structure into a dual-bore tunnel where it would flow by gravity to the south Delta. Water would then reach pumping plants northeast of the Clifton Court Forebay, where it would be pumped into the north cell of the expanded Clifton Court Forebay from the tunnels. The forebay would be dredged and redesigned to provide an area that would isolate water flowing from the new north Delta facilities from water diverted from south Delta channels.

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[12] / *California v. Block* (9th Cir.1982) 690 F.2d 753, 771; *Russell Country Sportsmen v. U.S. Forest Service* (9th Cir. 2011) 668 F.3d 1037, 1045.)

[13] / *City of Carmel-By-The-Sea v. U.S. Dept. of Transp.* (9th Cir 1997) 123 F.3d 1142, 1156; see also *National Committee for the New River v. FERC* (D.C. Cir. 2004) 373 F.3d 1323, 1329 ["By its very name, the [Draft] EIS is a draft of the agency's proposed [Final] EIS, and as such the purpose of a [Draft] EIS 'is to elicit suggestions for change'"], quoting *City of Grapevine, Tex. v. Dept. of Transp.* (D.C. Cir. 1994) 17 F.3d 1502, 1507.

Table 4.1-1. Comparison of Alternative 4 and Alternative 4A

Element of Project Description	Alternative 4 (BDCP)	Alternative 4A
ESA Compliance	Section 10 (DWR)/Section 7 (Reclamation)	Section 7
California Endangered Species law Compliance	NCCPA	2081(b) permit
Facilities	Modified Pipeline/Tunnel Alignment: 3 intakes, 9,000 cfs	Modified Pipeline/Tunnel Alignment: 3 intakes, 9,000 cfs
Operations	Dual Conveyance; Operational Scenarios H1–H4 with Decision Tree (see Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS); evaluated at LLT	Dual Conveyance; Operational Scenario H3+ (a new operational scenario which includes a criterion for spring outflow bounded by the criteria associated with Scenarios H3 and Scenario H4, as described in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS); evaluated as Scenarios H3–H4 at early long-term (ELT, which is associated with conditions around 2025)
Conservation Measures/ Environmental Commitments	Conservation Measures 2–21; includes Yolo Bypass Improvements and 65,000 acres of tidal wetland restoration	Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, 16; includes up to 59 acres of tidal wetland restoration
CEQA Baseline	Existing Conditions	Existing Conditions
NEPA Baseline	No Action Alternative at LLT	No Action Alternative at ELT

A map and a schematic diagram depicting the conveyance facilities associated with Alternative 4A are provided in Mapbook Figure M3-4 in the Mapbook Volume and Figure 3-10 in Appendix A of this RDEIR/SDEIS. A new pumping facility would be constructed northeast of the north cell of the expanded Clifton Court Forebay, along with control structures to regulate the relative quantities of water flowing from the north Delta and the south Delta to the Banks and Jones Pumping Plants. Alternative 4A would entail the continued use of the SWP/CVP south Delta export facilities.

All aspects of water conveyance facility design, construction, and maintenance would be identical to those described for Alternative 4 in the revised text in Chapter 3, Sections 3.4, 3.5.9, and 3.6.1 and Appendix 3C, as provided in Appendix A, *Revisions to the Draft EIR/EIS*, of this RDEIR/SDEIS.

4.1.2.2 Water Conveyance Facility Operations

Operational components of the water conveyance facilities under Alternative 4A would be similar, but not identical, to those described under Scenario H in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Alternative 4A starting operations will be determined through the continued coordination process as outlined in the Section 7 consultation process and 2081(b) permit prior to the start of construction. An adaptive management and monitoring program, as described below, will be implemented to develop additional science during the course of project construction and operation to inform and improve conveyance facility operational limits and criteria. Additionally, operational elements associated with Fremont Weir modifications would not be incorporated as part of this alternative, because Yolo Bypass improvements contemplated in the BDCP (under CM2) would not be implemented as part of Alternative 4A; instead, they would be assumed to occur as part of the No Action Alternative because they are required by the existing BiOps (see below). For a detailed characterization of operational criteria, please refer to Table 4.1-2.[14]

Implementation of the proposed project will include operations of both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Operational limits included in this proposed project for south Delta export facilities would supplement the south Delta operational limits currently implemented in compliance with the USFWS (2008) and NMFS (2009) BiOps. The proposed project also incorporates existing criteria from the 2008 and 2009 BiOps (including Fall X2), and adds additional criteria for spring outflow and new minimum flow criteria at Rio Vista from January through August. The North Delta Diversions and the head of Old River barrier are new facilities for the CVP and SWP and will be operated consistent with the proposed operating criteria for each of these facilities. All other criteria included in the USFWS (2008) and NMFS (2009) BiOps and D-1641will continue to be complied with, subject to adjustments made pursuant to the adaptive management process as already described in the 2008 and 2009 BiOps, as part of the continued operations of the CVP and SWP. The proposed project includes modified or new operations of only the following:

- North Delta bypass flows
- South Delta export operations (including export rates and OMR flows)
- Head of Old River barrier operations
- Spring Delta outflow
- Rio Vista minimum flow standard in January through August

The proposed criteria are further described in the following subsections and in Table 4.1-2. The proposed project operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times.

The Longfin Smelt is a species listed under the California Endangered Species Act (CESA). Therefore, it will be necessary to meet CESA permit issuance criteria for this species. To avoid a reduction in overall abundance for this species, the proposed project includes spring outflow criteria, which are intended to be provided through the acquisition of water from willing sellers. If sufficient water cannot be acquired for this purpose, the spring outflow criteria will be accomplished through operations of the SWP and CVP to the extent an obligation is imposed on either the SWP or CVP under federal or applicable state law. Best available science, including that developed through a collaborative science program, will be used to analyze and make recommendations on the role of such flow in supporting Longfin Smelt abundance to DFW, who will determine if it is necessary to meet CESA permitting criteria.

As described in Section 4.1.2.4, *Collaborative Science and Adaptive Management Program*, for Alternative 4A will be used to consider and address scientific uncertainty regarding the Delta ecosystem and to inform implementation of the operational criteria in the existing BiOps for the

[14] Note that these proposed operational criteria would only take effect after the proposed conveyance facilities are operational. Until that time, operations would occur as described in the USFWS 2008 and NMFS 2009 BiOps or as modified by the outcome of ongoing ESA compliance processes pertaining to operation of the existing facilities.

coordinated operations of the SWP and CVP and the 2081b permit for the SWP facilities and operations, as well as for the new biological opinion and 2081b for this proposed project. Hypotheses will be tested using the following steps:

1. Clearly articulate the management objectives of the actions, along with the criteria that will be used to assess the efficacy of the actions.
2. Clearly articulate the scientific uncertainties and specific hypotheses designed to reduce that uncertainties regarding questions of management importance.
3. Develop and implement a science plan and data collection program to test the hypotheses and reduce the relevant uncertainties.
4. Based on the data collected and analysis of the data, the Collaborative Science process will prepare a written report that presents findings and synthesis of the analyses for submittal to an independent panel review process.

Table 4.1-2. New and Existing Water Operations Flow Criteria and Relationship to Assumptions in CALSIM Modeling

Parameter	Criteria	Summary of CALSIM Modeling[a]
New Criteria Included in Alternative 4A		
North Delta bypass flows	• Initial Pulse Protection: ○ Low-level pumping of up to 6% of total Sacramento River flow such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake. ○ If the initial pulse begins and ends before Dec 1, post-pulse criteria for May go into effect after the pulse until Dec 1. On Dec 1, the Level 1 rules defined in Table 3-16 in the Draft EIR/EIS apply unless a second pulse occurs. If a second pulse occurs, the second pulse will have the same protective operation as the first pulse. • Post-pulse Criteria (specifies bypass flow required to remain downstream of the North Delta intakes): ○ October, November: bypass flows of 7,000 cfs before diverting at the North Delta intakes. ○ July, August, September: bypass flows of 5,000 cfs before diverting at the North Delta intakes. • December through June: post-pulse bypass flow operations will not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3 as defined in the Section 3.6.4 of the Draft EIR/EIS. If those criteria are met, operations can proceed as defined in Table 3.4.1-2 in the BDCP Public draft. The specific criteria for transitioning between and among pulse protection, Level 1, Level 2, and/or Level 3 operations, will be developed and based on real-time fish monitoring and hydrologic/behavioral cues upstream of and in the Delta. During operations, adjustments are expected to be made to improve water supply and/or migratory conditions for fish by making real-time adjustments to the pumping levels at the north Delta diversions. These adjustments would be managed under Real Time Operations (RTO).	• Same as CM1 criteria, as proposed in the Draft BDCP (hereafter “CM1 criteria”).

Parameter	Criteria	Summary of CALSIM Modeling[a]
South Delta operations	• October, November: No south Delta exports during the D-1641 San Joaquin River 2-week pulse, no Old and Middle River (OMR) flow restriction during 2 weeks prior to pulse, and a monthly average of −5,000 cfs in November after pulse. • December: OMR flows will not be more negative than an average of −5,000 cfs when the Sacramento River at Wilkins Slough pulse triggers, and no more negative than an average of −2,000 cfs when the delta smelt action 1 triggers. No OMR flow restriction prior to the Sacramento River pulse, or delta smelt action 1 triggers. • January, February[15]: OMR flows will not be more negative than an average of 0 cfs during wet years, −3,500 cfs during above-normal years, or −4,000 cfs during below-normal to critical years, except −5,000 in January of dry and critical years. • March[16]: OMR flows will not be more negative than an average of 0 cfs during wet or above- normal years or −3,500 cfs during below-normal and dry year and −3,000 cfs during critical years. • April, May: Allowable OMR flows depend on gaged flow measured at Vernalis, and will be determined by a linear relationship. If Vernalis flow is below 5,000 cfs, OMR flows will not be more negative than−2,000 cfs. If Vernalis is 6,000 cfs, OMR flows will not be less than +1,000 cfs. If Vernalis is 10,000 cfs, OMR flows will be at least 1,000 cfs. If Vernalis exceeds 10,000 cfs, OMR flows will be at least +2,000 cfs. If Vernalis is 15,000 cfs, OMR flows will be at least +3,000 cfs. If Vernalis is at or exceeds 30,000 cfs, OMR flows will be at least 6,000 cfs. • June: Similar to April, allowable flows depend on gaged flow measured at Vernalis. However, if Vernalis is less than 3,500 cfs, OMR flows will not be more negative than −3,500 cfs. If Vernalis exceeds 3,500 cfs and up to 10,000 cfs, OMR flows will be at least 0 cfs. If Vernalis exceeds 10,000 cfs and up to 15,000 cfs, OMR flows will be at least +1,000 cfs. If Vernalis exceeds 15,000 cfs, OMR flows will be at least +2,000 cfs. • July, August, September: No OMR flow constraints.	• October, November: Assumed no south Delta exports during the D-1641 San Joaquin River 2-week pulse, no OMR restriction during 2 weeks prior to pulse, and −5,000 cfs in November after pulse. • December: −5,000 cfs only when the Sacramento River pulse based on the Wilkins Slough flow (same as the pulse for the north Delta diversion) occurs, if no OMR requirement was applied. If the USFWS (2008) BiOp Action 1 is triggered, after which −2,000 cfs requirement is assumed. • April, May: OMR requirement for the Vernalis flows falling between the specified flows were determined by linear interpolation. When Vernalis flow is between 5,000 cfs and 6,000 cfs, OMR requirement is determined by linearly interpolating between −2,000 cfs and +1,000 cfs. • January–March and July–September: Same as CM1 criteria

[15] Sacramento River 40-30-30 index based water year types. For January and February, anticipated water year type based on the forecasted hydrology will be used. The frequency of exceedance of the forecasted hydrology will be consistent with current practices. CALSIM II modeling uses previous water year type for October through January, and the current water year type from February onwards.

[16] Sacramento River 40-30-30 index based water year types. For March, anticipated water year type based on the forecasted hydrology will be used. The frequency of exceedance of the forecasted hydrology will be consistent with current practices. CALSIM II modeling uses previous water year type for October through January, and the current water year type from February onwards.

Parameter	Criteria	Summary of CALSIM Modeling[a]
Head of Old River gate operations	• October 1–November 30th: RTO management in order to protect the D-1641 pulse flow designed to attract upstream migrating adult Fall-Run Chinook Salmon. HORB will be closed approximately 50% during the time immediately before and after the SJR pulse and that it will be fully closed during the pulse unless new information suggests alternative operations are better for fish. • January: When salmon fry are migrating, (determined based on real time monitoring), initial operating criterion will be to close the gate subject to RTO for purposes of water quality, stage, and flood control considerations. • February–June 15th: Initial operating criterion will be to close the gate subject to RTO for purposes of water quality, stage, and flood control considerations. The agencies will actively explore the implementation of reliable juvenile salmonid tracking technology which may enable shifting to a more flexible real time operating criterion based on the presence/absence of covered fishes. • June 16 to September 30, December: Operable gates will be open.	• Assumed 50% open from January 1 to June 15, and during days in October prior to the D-1641 San Joaquin River pulse. Closed during the pulse. 100% open in the remaining months.
Spring outflow	• March, April, May: To ensure maintenance of longfin smelt abundance, initial operations will provide a March–May average Delta outflow bounded by the requirements of Scenario H3, which are consistent with D-1641 standards, and Scenario H4, which would be scaled to Table 3-24 in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Over the course of the 2081(b) permit term the longfin smelt indices of annual recruitment based upon the 1980–2011 trend in recruitment relative to winter-spring flow conditions will be used to evaluate the effect of operations on longfin smelt (i.e., evaluate positive cohort over cohort population growth). Adjustments to the criteria above and these outflow targets may be made using the Adaptive Management Process and the best available scientific information available regarding all factors affecting longfin smelt abundance.[17]	• Same as CM1 criteria, assuming outflow from export reductions first, then Oroville releases
Rio Vista minimum flow standard	• January through August: flows will exceed 3,000 cfs • September through December: flows per D-1641	• Same as CM1 criteria
Key Existing Criteria Included in Modeling		
Fall outflow	• September, October, November implement the USFWS (2008) BiOp Fall X2 requirements. However, similar to spring Delta outflow and consistent with the existing RPA adaptive management process, adjustments to these outflow targets may be made using the Adaptive Management and Monitoring Program described below and the best available scientific information available regarding all factors affecting delta smelt abundance.	• Same as CM1 criteria.

[17] For example, if best available science resulting from collaborative scientific research program shows that Longfin Smelt abundance can be maintained in the absence of spring outflow, and DFW concurs, an alternative operation for spring outflow could be to follow flow constraints established under D-1641.

Parameter	Criteria	Summary of CALSIM Modeling[a]
Winter and summer outflow	• Flow constraints established under D-1641 will be followed if not superseded by criteria listed above.	• Same as CM1 criteria.
Delta Cross Channel Gates	• Operations as required by NMFS (2009) BiOp Action 4.1 and D-1641.	• Delta Cross Channel gates are closed for a certain number of days during October 1 through December 14 based on the Wilkins Slough flow, and the gates may be opened if the D-1641 Rock Slough salinity standard is violated because of the gate closure. Delta Cross Channel gates are assumed to be closed during December 15 through January 31. February 1 through June 15, Delta Cross Channel gates are operated based on D-1641 requirements.
Suisun Marsh Salinity Control Gates	• Gates would continue to be closed up to 20 days per year from October through May.	Not modeled in CALSIM II; only in DSM2.
Export to inflow ratio	• Operation criteria are the same as defined under D-1641. • The D-1641 export/inflow (E/I) ratio calculation was designed to protect fish from south Delta entrainment. For Alternative 4A, Reclamation and DWR propose that the North Delta Diversion (NDD) does not affect either Delta inflows or exports as they relate to the E/I ratio calculation. In other words, Sacramento River inflow is defined as flows downstream of the NDD and only south Delta exports are included for the export component of the criteria.	• Combined export rate is defined as the diversion rate of the Banks Pumping Plant and Jones Pumping Plant from the south Delta channels. • Delta inflow is defined as the sum of the Sacramento River flow downstream of the proposed north Delta diversion intakes, Yolo Bypass flow, Mokelumne River flow, Cosumnes River flow, Calaveras River flow, San Joaquin River flow at Vernalis, and other miscellaneous in-Delta flows.

[a] See Table C.A-1, CALSIM II Modeling Assumptions for Existing Conditions (EBC1), No Action Alternative (EBC2) and BDCP Operational Scenarios, in Section B.3.4, *Alternative 4 Decision Tree Scenarios H1, H2, H3 and H4*, in Appendix 5A, *Modeling Technical Appendix*, of the Draft EIR/EIS.

Application of Flow Criteria

Flow criteria are applied seasonally (month by month) and according to the following five water-year types. Under the observed hydrologic conditions over the 82-year period (1922–2003), the number of years of each water-year type is included below. The water-year type classification for the majority of the criteria mentioned here, unless noted differently, is based on the Sacramento Valley 40-30-30 Water Year Index defined under D-1641.

- Wet water year: the wettest 26 years of the 82-year hydrologic data record, or 32% of years.
- Above-normal water year: 12 years of 82, or 15%.
- Below-normal water year: 14 years of 82, or 17%.
- Dry water year: 18 years of 82, or 22%.
- Critical water year: 12 years of 82, or 15%.

Water operations under Alternative 4A are then constrained as shown in Table 4.1-2.

Proposed New Flow Criteria for North Delta SWP and CVP Export Facilities

Diversions from the north would be greatest in wetter years and lowest in drier years, when south Delta diversions would provide the majority of the CVP and SWP south of Delta exports. In order to avoid impacts to listed species, north Delta bypass flow requirements were developed in coordination with the fisheries agencies, and are described below. Additionally, Alternative 4A operations include a preference for south Delta pumping in July through September to avoid water quality degradation in the south Delta.

The objectives of the north Delta diversion bypass flow criteria include regulation of flows to 1) maintain fish screen sweeping velocities; 2) reduce upstream transport from downstream channels in the channels downstream of the intakes; 3) support salmonid and pelagic fish transport and migration to regions of suitable habitat; 4) reduce losses to predation downstream of the diversions; and 5) maintain or improve rearing habitat conditions in the north Delta.

To ensure that these objectives are met, diversions must be restricted at certain times of the year (mostly from December through June) when juvenile covered fish species are present. This is achieved by restricting the diversion to low level pumping (diversion of 6% of Sacramento River flow measured upstream of the intakes up to 900 cfs [300 cfs per intake]) when the juvenile fish begin their outmigration, which generally coincides with seasonal high flows triggered by fall/winter rains (called *pulse flows*); followed by a ramping up of diversion rates, while ensuring flows are adequate to be protective of aquatic species, during the remainder of the outmigration (called *post-pulse operations*). The protections allowed during these pulses are intended to achieve safe juvenile passage past the intakes to well downstream of lower Delta channels that might otherwise lead them away from their primary migration route. Additional but less restrictive requirements apply for the late spring to late fall period.

The initial pulse of juvenile fish migration is a natural occurrence caused by the first substantial runoff event of the season. This can occur as early as October or as late as February, but usually happens in December or January. During the initial pulse, flows will be minimally diminished, with diversions limited to low-level pumping to the extent allowed. If the initial pulse occurs prior to Dec 1, then an assessment will be made to decide if equivalent protection is required in the event a second pulse occurs. A flow condition will be categorized as an initial pulse based on real-time monitoring of flow at Wilkins Slough and juvenile fish movement.

At the end of the initial pulse phase, post-pulse operations will apply, with potential adjustments made based on real-time operations as described in Table 4.1-2. The conditions that trigger the transition from the initial pulse protection to post-pulse operations are described in Chapter 3 of the Draft EIR/EIS, along with bypass operating rules for the post-pulse phase, which provide maximum allowable levels of diversion for a given Sacramento River inflow measured upstream of the intakes. Additionally, as described in Table 4.1-2, there will be biologically-based triggers to allow for transitioning between and among the different diversion levels.

In July through September, the bypass rules are less restrictive, allowing for a greater proportion of the Sacramento River to be diverted, as described in Table 4.1-2. In October through November the bypass amount is increased from 5,000 cfs to 7,000 cfs, allowing a smaller proportion of the Sacramento River to be diverted.

Proposed New Flow Criteria for CVP and SWP South Delta Export Facilities

The objectives of the south Delta flow criteria are to minimize take at south Delta pumps by reducing incidence and magnitude of reverse flows during critical periods for fish species. The south Delta channel flow criteria are based on the parameters for Old and Middle River (OMR) flows as summarized below, and Head of Old River Barrier operations. Additionally, Alternative 4A operations include a preference for south Delta pumping in July through September to provide limited flushing flows to avoid water quality degradation in the south Delta.

OMR Flows

The OMR flow criteria chiefly serve to constrain the magnitude of reverse flows in the Old and Middle Rivers for entrainment protection and minimization of adverse indirect effects. The criteria are derived from fish protection triggers described in the USFWS (2008) and NMFS (2009) BiOps RPA Actions, and are described in Table 4.1-2. The proposed OMR flow criteria are used to constrain the south Delta exports, if the OMR flow requirements under current BiOps are not as constraining as the proposed criteria. These newly proposed OMR criteria (and associated Head of Old River Barrier operations) are in response to expected facility changes under the proposed project, and only applicable after the proposed north Delta diversion becomes operational.

In April, May, and June, OMR minimum allowable values would be based upon the San Joaquin River inflow relationship to OMR (Table 4.1-2). In October and November, OMR and south Delta export restrictions are based upon State Water Board D-1641 pulse trigger, as follows.[18]

- Two weeks before State Water Board D-1641 pulse trigger: no OMR restrictions.
- During State Water Board D-1641 pulse trigger: no south Delta exports.
- Two weeks following State Water Board D-1641 pulse trigger: OMR operated to be no more negative than -5,000 cfs through November.

[18] For the purposes of modeling, it was assumed that the D-1641 pulse in San Joaquin River occurs in the last 2 weeks of October.

Additionally, new criteria based on the water year type in December through March would be implemented as described in detail in Table 4.1-2. The new criteria generally provide more positive OMR flows under the wetter years compared to the requirements under the current BiOps.

Operations of the New Head of Old River Operable Barrier

Operations for the Head of Old River gate would be managed as follows.

- **October 1 – November 30**: Real Time Operation (RTO) management and HORB will be closed in order to protect the D-1641 pulse flow designed to attract upstream migrating adults.
- **January**: When salmon fry are migrating (determined based on real time monitoring), initial operating criterion will be to close the gate subject to RTO for purposes of water quality, stage, and flood control considerations.
- **February – June 15**: The gate will be closed, but subject to RTO for purposes of water quality, stage, and flood control considerations. The agencies will actively explore the implementation of reliable juvenile salmonid tracking technology which may enable shifting to a more flexible real time operating criterion based on the presence/absence of covered fishes.
- **June 16 to September 30, December**: Operable gates will be open.

Real-Time Operational Decision-Making Process

RTO Team decisions are expected to be needed during at least some part of the year at the Head of Old River gate and the north and south Delta diversion facilities. The RTO Team in making operational decisions that depart from the criteria used in the modeling will take into account upstream operational constraints, such as coldwater pool management, instream flow, and temperature requirements. The extent to which real time adjustments that may be made to each parameter related to these facilities shall be limited by the criteria and/or ranges is set out in Table 4.1-2. Any modifications to the parameters subject to real time operational adjustments or to the criteria and/or ranges set out in Table 4.1-2 shall occur only through the adaptive management, as discussed below.

Head of Old River gate. Operations for the Head of Old River gate would be managed under RTOs as set forth in Table 4.1-2.

North Delta diversions. North Delta bypass flows will be managed according to the criteria described in Table 4.1-2. Additional biologically-based triggers for adjustments between and among Levels I, II, and III, are under development through the ESA consultation process.

South Delta diversions. The south Delta diversions will be managed under RTO to achieve OMR criteria, throughout the year based on fish protection triggers (e.g., salvage density, calendar, species distribution, entrainment risk, turbidity, and flow based triggers). Increased restrictions as well as relaxations of the OMR criteria may occur as a result of observed physical and biological information. Additionally, as described above for the north Delta diversions, RTO would also be managed to distribute pumping activities amongst the three north Delta and two south Delta intake facilities to maximize both survival of covered fish species in the Delta and water supply.

Timing for Implementation of Operations

Implementation of Alternative 4A will include operations of both new and existing water conveyance facilities as described above and in Table 4.1-2, once the new north Delta facilities are constructed and become operational, thereby enabling joint operations of north and south Delta diversions. Until that time, operations will be governed by existing and applicable requirements and standards included in the NMFS (2009) and USFWS (2008) BiOps and D-1641, as may be amended, and any other regulatory and contractual obligations.

4.1.2.3 Environmental Commitments

To achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b) while also complying with NEPA and CEQA, a subset of those activities proposed in the conservation strategy for the Draft BDCP would be implemented under Alternative 4A. Specifically, portions of the actions proposed under CM3, CM4, CM6, CM7, CM8, CM9, CM10, CM11, CM12, CM15, and CM16 would be included in Alternative 4A. As preserved within Alternative 4A, however, these activities are no longer "conservation measures." The reason for not using this familiar term is to avoid creating confusion regarding the rationale for retaining these activities within Alternative 4A. The term "conservation measure" is often used in the context of Habitat Conservation Plans under Section 10(a)(2) of the ESA and Natural Community Conservation Plans under the NCCPA.

Alternative 4A contemplates ESA compliance through Section 7 of the ESA and Section 2081 of CESA, rather than through ESA Section 10 and NCCPA Section 2835. As such, different terminology has been adopted to reflect the difference in permitting strategies under state and federal endangered species laws. These repackaged and limited elements of the original BDCP Conservation Measures are instead referred to as "Environmental Commitments" (ECs). As noted, these Environmental Commitments are actions primarily intended to satisfy CEQA, CESA Section 2081, and ESA Section 7. To minimize confusion, they are numbered to track the parallel BDCP Conservation Measures: Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16, as summarized in Table 4.1-3. A summary of these commitments is presented below and consists primarily of habitat restoration, protection, enhancement, and management activities necessary to mitigate for adverse effects from construction of the proposed water conveyance facilities, along with species-specific resource restoration and protection principles to ensure that implementation of these commitments would achieve the intended mitigation of impacts (for a list of these standards, along with species-specific mitigation needs, see Table 4.1-8).[19] Where impact statements or mitigation measures refer to Conservation Measures, these statements have been changed in the analysis for Alternative 4A to refer instead to the parallel Environmental Commitments. Additionally, pertinent elements included as Avoidance and Minimization Measures (AMMs) and the proposed Adaptive Management and Monitoring Program would be implemented as applicable to the activities proposed under Alternative 4A.[20] These, too, would serve a mitigation function under CEQA. All of these components would function as *de facto* CEQA and NEPA mitigation measures for the construction and operations-related impacts of Alternative 4A. Details regarding the implementation of these activities under Alternative 4A are provided below and in Table 4.1-3.

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[19] While these are distinct from the environmental commitments described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS (as modified in this RDEIR/SDEIS, as shown in Appendix A hereto), both sets of commitments would apply to implementation of Alternative 4A.

[20] Specifically, AMMs 1–7, 10, 12–15, 18, 20–25, 30, and 37 would be carried forward under implementation of this alternative.

The RDEIR/SDEIS describes and analyzes Environmental Commitments 3, 4, 6–12, 15, and 16 at a level of detail consistent with that applied to these activities under other alternatives in the Draft EIR/EIS. (See CEQA Guidelines, § 15126.4[a][1][D] [EIRs must discuss significant effects of mitigation measures, "but in less detail than the significant effects of the project as proposed"]; see also *California Native Plant Society v. City of Rancho Cordova* (2009) 172 Cal.App.4th 603, 621-625 [lead agency did not violate CEQA by failing to identify the off-site location at which mitigation for impacts to on-site wetlands would be carried out].) Specific locations for implementing many of the activities associated with these commitments have not been identified at this time. Therefore, the analyses consider typical construction, operation, and maintenance activities that would be undertaken for implementation of the habitat restoration and enhancement and stressor reduction efforts. Where appropriate and necessary, implementation of individual projects associated with an environmental commitment would be subject to additional environmental review. (See CEQA Guidelines, §§ 15162–15164; 40 C.F.R. § 1502.9[c].)

Note that many of the actions that are part of the BDCP conservation strategy but not proposed to be implemented under Alternative 4A would continue to be pursued as part of existing but separate projects and programs associated with (1) the 2008 and 2009 USFWS and NMFS BiOps (e.g., Yolo Bypass improvements and habitat enhancements, 8,000 acres of tidal habitat restoration), (2) California EcoRestore, and (3) the 2014 California Water Action Plan. Those actions are separate from, and independent of, Alternative 4A. Therefore, for the purposes of Alternative 4A, these elements (and their associated environmental effects) are considered either as part of the No Action Alternative, as described in Section 4.2, *Impacts of No Action Alternative Early Long-Term*, or as part of the cumulative impact analysis, as described in Section 5, *Revisions to Cumulative Impact Analyses*, of this RDEIR/SDEIS.

Table 4.1-3. Environmental Commitments under Alternative 4A

Environmental Commitment 3: Natural Communities Protection and Restoration	
Valley/Foothill Riparian	103 acres
Grassland	1,060 acres
Vernal Pool Complex and Alkali Seasonal Wetland Complex	150 acres
Nontidal Marsh	119 acres
Cultivated Lands	11,870 acres
Total:	**Up to 13,302 acres**
Environmental Commitment 4: Tidal Natural Communities Restoration	Up to 59 acres
Environmental Commitment 6: Channel Margin Enhancement	Up to 4.6 levee miles
Environmental Commitment 7: Riparian Natural Community Restoration	Up to 251 acres
Environmental Commitment 8: Grassland Natural Community	Up to 1,070 acres
Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	Up to 34 acres
Environmental Commitment 10: Nontidal Marsh Restoration	Up to 832 acres
Environmental Commitment 11: Natural Communities Enhancement and Management	At sites protected or restored under Environmental Commitments 3–10
Environmental Commitment 12: Methylmercury Management	At sites restored under Environmental Commitment 4
Environmental Commitment 15: Localized Reduction of Predatory Fishes	At north Delta intakes and at Clifton Court Forebay
Environmental Commitment 16: Nonphysical Fish Barrier	At Georgiana Slough

Environmental Commitment 3: Natural Communities Protection and Restoration

This action would consist of the acquisition of lands for protection and restoration of listed species habitat in perpetuity and would be implemented in the same way as described in Conservation Measure 3 in the Draft BDCP but over less area. For the purposes of Alternative 4A, this action would entail protection of approximately 13,302 acres, of natural communities and cultivated land, as shown in Table 4.1-3. This protection and restoration would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 4: Tidal Natural Communities Restoration

This action would consist of the restoration of tidal natural communities and transitional uplands and would be implemented in the same way as described in Conservation Measure 4 in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, but over less area. For the purposes of analysis of Alternative 4A, this action would entail restoration of up to 59 acres (including transitional uplands), as shown in Table 4.1-3. This analysis assumes that none of these 59 acres of tidal restoration will be done in the Suisun Marsh area. Tidal habitat restoration would mitigate for the physical loss of aquatic habitat associated with construction of the north Delta intake facilities. The current proposed mitigation acreage is anticipated to be 59 acres. However, actual acreage may change based on further discussions with NMFS, USFWS, and DFW pertaining to the actual value of the current habitat and/or the appropriate ratio of mitigation or based on footprint changes. Based on initial discussions, the maximum ratio applied to tidal wetland mitigation is 3:1, and therefore would not exceed 177 acres for this alternative.

Environmental Commitment 6: Channel Margin Enhancement

This action would consist of the enhancement of channel margin habitat and would be implemented in the same way as described in Conservation Measure 6 in the Draft BDCP but over less linear distance. For the purposes of Alternative 4A, this action would entail enhancement of approximately 4.6 levee miles, as shown in Table 4.1-3. This would mitigate for the loss of salmonid habitat associated with construction and operations of the north Delta intake facilities.

Environmental Commitment 7: Riparian Natural Community Restoration

This action would consist of the restoration of riparian natural communities and would be implemented in the same way as described in Conservation Measure 7 in the Draft BDCP but over less area. For the purposes of Alternative 4A, this action would entail restoration of approximately 251 acres, as shown in Table 4.1-3. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 8: Grassland Natural Community

This action would consist of the restoration of grassland habitat and would be implemented in the same way as described in Conservation Measure 8 in the Draft BDCP but over less area. For the purposes of Alternative 4A, this action would entail restoration of approximately 1,070 acres as shown in Table 4.1-3. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration

This action would consist of the restoration of vernal pool and alkali seasonal wetland complex and would be implemented in the same way as described in Conservation Measure 9 in the Draft BDCP but over less area. For the purposes of Alternative 4A, this action would entail restoration of approximately 34 total acres of vernal pool complex and/or alkali seasonal wetland complex, as shown in Table 4.1-3. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 10: Nontidal Marsh Restoration

This action would consist of the restoration of nontidal marsh and would be implemented in the same way as described in Conservation Measure 10 in the Draft BDCP but over less area. For the purposes of Alternative 4A, this action would entail restoration of approximately 832 acres of nontidal marsh, as shown in Table 4.1-3. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 11: Natural Communities Enhancement and Management

This action would apply to all protected and restored habitats under Alternative 4A and would be implemented, where applicable, to manage and enhance these lands consistent with the approach described under Conservation Measure 11 in the Draft BDCP. These actions would support mitigation for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 12: Methylmercury Management

This action would minimize conditions that promote production of methylmercury in restored tidal wetland areas and its subsequent introduction to the foodweb, and to listed species in particular. Implementation of this action would be consistent with the revised description of Conservation Measure 12 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The portions of the measure applicable to effects in the Yolo Bypass would not apply because Yolo Bypass improvements would not be implemented as part of this alternative.

Environmental Commitment 15: Localized Reduction of Predatory Fishes (Predator Control)

This action would reduce populations of predatory fishes at locations of high predation risk (i.e., predation hotspots) associated with construction and operation of the proposed water conveyance facilities. Implementation of this action would be consistent with the revised description of Conservation Measure 15 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 4A, this action would be applied only to the reach of the Sacramento River adjacent to the north Delta intakes and to Clifton Court Forebay. EC15 would remove predator refuge habitat and reduce predator abundance in the construction areas. At a minimum, EC15 will target the removal of an amount of predator refuge commensurate with the amount that may be created by construction of water conveyance facilities. These measures are expected to fully mitigate any indirect effect on predation rates associated with construction and operations.

Environmental Commitment 16: Nonphysical Fish Barrier

This action would be implemented to address effects related to survival of outmigrating juvenile salmonids by installing a nonphysical barrier at Georgiana Slough to redirect fish away from channels and river reaches in which survival is lower than in alternate routes. Implementation of this action would be consistent with the revised description of Conservation Measure 16 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 4A, this action would be applied only to Georgiana Slough. This commitment would mitigate for effects on salmonid survival associated with operation of north Delta intakes and associated flows.

Avoidance and Minimization Measures

AMMs 1–7, 10–18, 20–25, 27, 30, and 37–39 would apply to all construction activities under Alternative 4A and would be implemented, where applicable, to avoid and minimize impacts on listed species, consistent with the approach described in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SDEIS. These actions would minimize the risk of impacts on species resulting from construction activities.

4.1.2.4 Collaborative Science and Adaptive Management Program

Considerable scientific uncertainty exists regarding the Delta ecosystem, including the effects of CVP and SWP operations and the related operational criteria. To address this uncertainty, DWR, Reclamation, DFW, USFWS, NMFS, and the public water agencies will establish a robust program of collaborative science, monitoring, and adaptive management. For the purposes of analysis, it is assumed that the Collaborative Science and Adaptive Management Program (AMMP) developed for Alternative 4A would not, by itself, create nor contribute to any new significant environmental effects; instead, the AMMP would influence the operation and management of facilities and protected or restored habitat associated with Alternative 4A.

Collaborative science and adaptive management will support the proposed project by helping to address scientific uncertainty where it exists, and as it relates to the benefits and impacts of the construction and operations of the new water conveyance facility and existing CVP and SWP facilities. Specifically, collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to inform and improve:

- the design of fish facilities including the intake fish screens;
- the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit; and
- habitat restoration and other mitigation measures conducted under the biological opinions and 2081b permits.

In summary, the broad purposes of the program will be to: 1) undertake collaborative science, 2) guide the development and implementation of scientific investigations and monitoring for both permit compliance and adaptive management, and 3) apply new information and insights to management decisions and actions. Each purpose is further described below.

Collaborative Science

The program will provide guidance and recommendations on relevant science related to the operations of the CVP and SWP within the Delta to inform implementation of the existing BiOps for the coordinated operations of the SWP and CVP and the 2081b permit for the SWP facilities and operations, as well as for the new biological opinion and 2081b for this proposed project. The collaborative science effort will build on the progress being made by the existing Collaborative Science and Adaptive Management Program (CSAMP) that was established to make recommendations on the science needed to inform implementation of or potential changes to the existing BiOps for the SWP and CVP operations, and proposed alternative management actions. The CSAMP process and its Collaborative Adaptive Management Team (CAMT) rely on the Delta Science Program to provide independent peer review of both science proposals and products.

Results from the collaborative science produced under the program would inform policy makers from the agencies implementing or overseeing the proposed project. These policy makers would determine whether and how to act on the information within the regulatory contexts of the biological opinions, 2081b permits, and other relevant authorizations (e.g., Corps permits, State Board authorizations).

Monitoring

Monitoring is a critical element of the adaptive management program and a required component of ESA Section 7 biological opinions and CESA 2081b permits. In addition, monitoring is a critical element of the collaborative science process that informs adaptive management decision-making. The proposed compliance and effectiveness monitoring program for the CESA 2081b permit is described in Chapter 6 of that permit application. These monitoring programs overlap but have distinct elements owing to their overlapping but distinct species lists. Collaborative science for the proposed project will have the following primary functions:

- lead active evaluation through studies, monitoring, and testing of current and new hypotheses associated with key water operating parameters, habitat restoration, and other mitigation;
- gather and synthesize relevant scientific information;
- develop new modeling or predictive tools to improve water management in the Delta; and
- inform the testing and evaluation of alternative operational strategies and other management actions to improve performance from both biological and water supply perspectives.

Monitoring is essential to carry out this collaborative science process.

Management Recommendations, Decisions, and Actions

The collaborative science effort is expected to inform operational decisions within the ranges established by the biological opinion and 2081b permit for the proposed project. However, if new science suggests that operational changes may be appropriate that fall outside of the operational ranges evaluated in the biological opinion and authorized by the 2081b permit, the appropriate agencies will determine, within their respective authorities, whether those changes should be implemented. An analysis of the biological effects of any such changes will be conducted to determine if those effects fall within the range of effects analyzed and authorized under the biological opinion and 2081b permit. If NMFS, USFWS, or DFW determine that impacts to listed species are greater than those analyzed and authorized under the biological opinion and 2081b permit, consultation may need to be reinitiated and/or the permittees may need to seek a 2081b permit amendment. Likewise, if an analysis shows that impacts to water supply are greater than those analyzed in the EIR/EIS, it may be necessary to complete additional environmental review to comply with CEQA or NEPA.

The collaborative science process will also inform the design and construction of the fish screens on the new intakes. This requires active study to maximize water supply, ensure flexibility in their design and operation, and minimize effects to covered species. The collaborative science process will similarly inform adaptive management of habitat restoration and other mitigation measures required by the existing and new biological opinions and 2081b permit.

Structure of Collaborative Science

As mentioned above, the collaborative science elements of the program will build on the experience gained in the CSAMP process. CSAMP employs a two-tiered organizational structure comprised of: 1) a Policy Group made up of agency directors and top-level executives from participating entities, and 2) the CAMT, including designated managers and scientists to serve as a working group functioning under the direction of the Policy Group. Collaborative science for the proposed project is expected to follow a similar model in which management decisions are made by the appropriate agencies within their authorities (see *Management Recommendations, Decisions, and Actions* section above) and collaborative science is undertaken by managers and scientists from participating entities, and other stakeholders as will be described in the Memorandum of Agreement (MOA, see below). In keeping with the existing CSAMP model, future members of the collaborative science process will have expertise or technical skills that would enable them to contribute to the tasks outlined above. Membership from each group will be limited to maintain the effectiveness of the group. Other senior scientists may be invited to participate by mutual consent. If useful, the group could form technical subgroups or use existing subgroups to inform its work. Decisions about what science to pursue would be made by consensus. The group will integrate the work of relevant existing groups and processes (e.g., Delta Science Program and Interagency Ecological Program) to avoid duplicating work.

Funding for Collaborative Science

Collaborative science and monitoring conducted to support the proposed project will be implemented, when feasible, using existing resources from state, federal, and other programs, and the mitigation program of the water conveyance facility. The mitigation program of the water conveyance facility has money dedicated to the monitoring necessary to support effective implementation of mitigation actions.

Proponents of the collaborative science and monitoring program will agree to provide or seek additional funding when existing resources are insufficient to complete the goals and tasks outlined above. The budget for collaborative science will be based on annual workplans that establish approved costs, identify funding sources, and serve as the basis for tracking actual performance. Contracting mechanisms would be developed to facilitate delivery of funding to meet short-term and long-term needs of the collaborative science program to the maximum extent possible while maintaining compliance with applicable contracting laws and regulations. In addition, the parties above will ensure the availability of funding for monitoring and other requirements defined in the biological opinion and 2081b permit.

Memorandum of Agreement

Commitments to adaptive management and collaborative science will be secured through a MOA between DWR, Reclamation, the public water agencies, DFW, NMFS, and USFWS. Details of the collaborative science and adaptive management process, including adaptive management decision-making, an organizational structure for adaptive management decisions, and funding for collaborative science will be developed through the MOA, as needed.

Scientific Basis for Adaptive Management

Adaptive management is a systematic process to continually improve management policies and practices by learning from our actions (Holling 1978; Walters 1986). It requires well-articulated management objectives to guide decisions about what science to try, and explicit assumptions about expected outcomes to compare against actual outcomes (Williams et al. 2009). Adaptive management uses a process to clearly articulate objectives, identify management alternatives, predict management consequences, recognize key uncertainties in advance, and monitor and evaluate outcomes. This structured and systematic process is what differentiates adaptive management from a trial and error approach (National Research Council 2004a; Williams 2011a). Learning, facilitated through deliberate design and testing, is an integral component of adaptive management (Williams et al. 2009; Allen et al. 2011; Williams 2011a).

Adaptive management is a particularly useful framework in the face of scientific uncertainty. The principles of adaptive management lend themselves to water management and ecological restoration in the Bay-Delta (CALFED Bay-Delta Program 2000; Reed et al. 2007, 2010; Healey 2008; Dahm et al. 2009; National Research Council 2011; Parker et al. 2011, 2012; Delta Stewardship Council 2013). In particular, a National Research Council (2011) panel found that despite the challenges, there often is no better option for implementing water management regimes. The adaptive management program for the proposed project will be designed and implemented with these principals and scientific guidance in mind.

4.1.3 Description of Alternative 2D

This section provides description of the components and operation of water conveyance facilities, ESA and CESA compliance process, and environmental commitments that will be implemented under Alternative 2D. Table 4.4-4 below, provides a brief summary comparison of these elements between Alternatives 4A, 2A, and 2D.

4.1.3.1 Water Conveyance Facility Construction and Maintenance

Under Alternative 2D, water conveyance facilities would be constructed and maintained similarly to those proposed and analyzed under Alternative 4 (including the modifications described in Section 3, *Conveyance Facility Modifications to Alternative 4,* of this RDEIS/SDEIS); however, this alternative would entail five intakes in the same locations as those under Alternative 2A (as shown in Figure 3-2 of the Draft EIR/EIS), rather than three. Water would primarily be conveyed from the north Delta to the south Delta through pipelines and tunnels. Water would be diverted from the Sacramento River through five fish-screened intakes on the east bank of the Sacramento River between Freeport and Courtland (Intakes 1–5) and would be conveyed to a sedimentation basin before reaching the tunnels. From the intakes, water would flow into an initial single-bore tunnel, which would lead to an intermediate forebay on Glannvale Tract. From the southern end of this forebay, water would pass through an outlet structure into a dual-bore tunnel where it would flow by gravity to the south Delta. Water would then reach pumping plants northeast of the Clifton Court Forebay, where it would be pumped from the tunnels into the north cell of the expanded Clifton Court Forebay. The forebay would be dredged and redesigned to provide an area that would isolate water flowing from the new north Delta facilities from water diverted from south Delta channels.

Table 4.1-4. Comparison of Alternatives 4, 2A, and 2D

Element of Project Description	Alternative 4 (BDCP)	Alternative 2A	Alternative 2D
ESA Compliance	Section 10 (DWR)/Section 7 (Reclamation)	Section 10 (DWR)/Section 7 (Reclamation)	Section 7
California Endangered Species law Compliance	NCCPA	NCCPA	2081(b) permit
Facilities	Modified Pipeline/Tunnel Alignment: 3 intakes, 9,000 cfs	Pipeline/Tunnel Alignment: 5 intakes, 15,000 cfs	Modified Pipeline/Tunnel Alignment: 5 intakes, 15,000 cfs
Operations	Dual Conveyance; Operational Scenarios H1–H4 with Decision Tree (see Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS); evaluated at LLT	Dual Conveyance; Operational Scenario B (see Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS); evaluated at LLT	Dual Conveyance; Operational Scenario B without Fremont Weir modifications; evaluated at ELT
Conservation Measures/ Environmental Commitments	Conservation Measures 2–21; includes Yolo Bypass Improvements and 65,000 acres of tidal wetland restoration	Conservation Measures 2–21; includes Yolo Bypass Improvements and 65,000 acres of tidal wetland restoration	Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, 16; includes up to 65 acres of tidal wetland restoration
CEQA Baseline	Existing Conditions	Existing Conditions	Existing Conditions
NEPA Baseline	No Action Alternative at LLT	No Action Alternative at LLT	No Action Alternative at ELT

A map and a schematic diagram depicting the conveyance facilities associated with the modified pipeline/tunnel alignment are provided in Mapbook Figure M3-4 in the Mapbook Volume and Figure 3-10 in Appendix A of this RDEIR/SDEIS (note, however, that these figures depict three intake locations, rather than five; all five intake locations for Alternative 2D are shown in Figure 3-2 of the Draft EIR/EIS). Each additional intake site would also require associated ancillary facilities and features, including box conduits under a widened and raised levee section, a relocated segment of State Route (SR) 160, sedimentation basins, drying lagoons, an outlet shaft, and an elevated pad hosting an electrical substation, an electrical building, and other storage buildings. During construction it is assumed that a temporary work area would surround each permanent intake site and would include a fuel station and concrete batch plant. Construction of Intake 1 would also require an additional segment of single-bore tunnel (connecting Intakes 1 and 2), as well as an expanded reusable tunnel material (RTM) area to accommodate the material associated with this tunnel. Similarly, an extension of the proposed temporary 69kV power line would be required to connect to Intake 1 during construction.

As proposed for Alternative 4, a new pumping facility would be constructed northeast of the north cell of the expanded Clifton Court Forebay, along with control structures to regulate the relative quantities of water flowing from the north Delta and the south Delta to the Banks and Jones Pumping Plants. Alternative 2D would entail the continued use of the SWP/CVP south Delta export facilities.

All other aspects of water conveyance facility design, construction, and maintenance would be similar to those described for Alternative 4 in the revised text in Chapter 3, Sections 3.4, 3.5.9, and 3.6.1 and Appendix 3C, as provided in Appendix A, *Revisions to the Draft EIR/EIS*, of this RDEIR/SDEIS.

4.1.3.2 Water Conveyance Facility Operations

Operational components of the water conveyance facilities under Alternative 2D would be similar, but not identical, to those described under Scenario B in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Operational elements associated with Fremont Weir modifications would not be incorporated as part of this alternative, because Yolo Bypass improvements contemplated for Alternative 2A (under CM2 of the Draft BDCP) would not be implemented as part of Alternative 2D; instead, they would be assumed to occur as part of the No Action Alternative because they are required by the existing BiOps. For a detailed characterization of operational criteria, please refer to Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS.[21]

Implementation of Alternative 2D would include operations of both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Operations included in this alternative for south Delta export facilities would replace the south Delta operations currently implemented in compliance with the USFWS (2008) and NMFS (2009) BiOps. The north Delta intakes and the head of Old River barrier would be new facilities for the SWP and CVP and would be operated as described in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. The design of the HORB is not yet complete, and should design change substantially from what is assumed in this RDEIR/SDEIS, such that there is a potential for new effects, additional CEQA and/or NEPA review would be required. Compliance with all other criteria included in the USFWS (2008) and NMFS (2009) BiOps and State Water Resources Control Board Water Right Decision 1641 (D-1641), including Fall X2, the E:I ratio, and operations of the Delta Cross Channel gates and the Suisun Marsh Salinity Control Gates, will continue as part of the continued operations of the CVP and SWP. As such, when compared to operations under the No Action Alternative, Alternative 2D includes modified or new operations and criteria of only the following elements.

- North Delta intake facilities.
- South Delta export operations.
- Head of Old River barrier operations.
- Rio Vista minimum flow standard in January through August.

[21] Note that these proposed operational criteria would only take effect after the proposed conveyance facilities are operational. Until that time, operations would occur as described in the USFWS 2008 and NMFS 2009 BiOps or as modified by the outcome of ongoing ESA compliance processes pertaining to operation of the existing facilities.

Alternative 2D operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times.

Real-Time Operational Decision-Making Process

RTOs are expected to be needed during at least some part of the year at the Head of Old River gate and the north and south Delta diversion facilities. In making operational decisions, the RTO Team will take into account upstream operational constraints such as coldwater pool management, instream flow, and temperature requirements. The extent to which real time adjustments that may be made to each parameter related to these facilities shall be limited by the criteria and/or ranges is set out in Table 4.1-2 of this RDEIR/SDEIS. Any modifications to the parameters subject to real time operational adjustments or to the criteria and/or ranges set out in Table 4.1-2 shall occur only through the adaptive management.

Head of Old River gate. Operations for the Head of Old River gate would be managed under RTOs as set forth in Table 4.1-2.

North Delta diversions. Operations for North Delta bypass flows will be managed according to the criteria described in Table 4.1-2.

South Delta diversions. The south Delta diversions will be managed under RTO to achieve OMR criteria, throughout the year based on fish protection triggers (e.g., salvage density, calendar, species distribution, entrainment risk, turbidity, and flow based triggers). Increased restrictions as well as relaxations of the OMR criteria may occur as a result of observed physical and biological information. Additionally, as described above for the north Delta diversions, RTO would also be managed to distribute pumping activities amongst the five north Delta and two south Delta intake facilities to maximize both survival of covered fish species in the Delta and water supply.

Timing for Implementation of Operations

Implementation of Alternative 2D would include operations of both new and existing water conveyance facilities as described above, once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Until that time, operations will be governed by existing and applicable requirements and standards included in the NMFS (2009) and USFWS (2008) BiOps and D-1641, and any regulations that supersede those requirements.

4.1.3.3 Environmental Commitments

To achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b) while also complying with NEPA and CEQA, a subset of those activities proposed in Alternative 2A would be implemented under Alternative 2D. Specifically, portions of the actions proposed under CM3, CM4, CM6, CM7, CM8, CM9, CM10, CM11, CM12, CM15, and CM16 would be included in Alternative 2D.

As described in Section 4.1.2.3 for Alternative 4A, these repackaged and limited elements of the original BDCP Conservation Measures are instead referred to as "Environmental Commitments" for the purposes of Alternative 2D: Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16, as summarized in Table 4.1-5 of this RDEIR/SDEIS. These commitments consist primarily of habitat restoration, protection, enhancement, and management activities necessary to offset—that is, mitigate for—adverse effects from construction of the proposed water conveyance facilities, along with species-specific resource restoration and protection principles to ensure that implementation of these commitments would achieve the intended mitigation of impacts (for a list of these standards, along with species-specific mitigation needs, see Table 4.1-8 of this RDEIR/SDEIS).[22] Where impact statements or mitigation measures refer to Conservation Measures, these statements have been changed in the analysis for Alternative 2D to refer instead to the parallel Environmental Commitments. Additionally, pertinent elements included as Avoidance and Minimization Measures and the proposed Adaptive Management and Monitoring Program would be implemented as applicable to the activities proposed under Alternative 2D.[23] These, too, would serve a mitigation function under CEQA. All of these components would function as *de facto* CEQA and NEPA mitigation measures for the construction and operations-related impacts of Alternative 2D. Details regarding the implementation of these activities under Alternative 2D are provided below and in Table 4.1-5 of this RDEIR/SDEIS.

The RDEIR/SDEIS describes and analyzes Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16 at a level of detail consistent with that applied to these activities under other alternatives in the Draft EIR/EIS. (See CEQA Guidelines, § 15126.4[a][1][D] [EIRs must discuss significant effects of mitigation measures, "but in less detail than the significant effects of the project as proposed"]; see also *California Native Plant Society v. City of Rancho Cordova* (2009) 172 Cal.App.4th 603, 621-625 [lead agency did not violate CEQA by failing to identify the off-site location at which mitigation for impacts to on-site wetlands would be carried out].) Specific locations for implementing many of the activities associated with these commitments have not been identified at this time. Therefore, the analyses consider typical construction, operation, and maintenance activities that would be undertaken for implementation of the habitat restoration and enhancement and stressor reduction efforts. Where appropriate and necessary, implementation of individual projects associated with an environmental commitment would be subject to additional environmental review. (See CEQA Guidelines, §§ 15162–15164; 40 C.F.R. § 1502.9[c].)

Note that many of the actions formerly part of Alternative 2A but not proposed to be implemented under Alternative 2D would continue to be pursued as part of existing but separate projects and programs associated with (1) the 2008 and 2009 USFWS and NMFS BiOps (e.g., Yolo Bypass improvements, 8,000 acres of tidal habitat restoration), (2) California EcoRestore and (3) the 2014 California Water Action Plan. Those actions are separate from, and independent of, Alternative 2D. Therefore, for the purposes of Alternative 2D, these elements (and their associated environmental effects) are considered either as part of the No Action Alternative, as described in Section 4.2, *Impacts of No Action Alternative Early Long-Term*, or as part of the cumulative impact analysis, as described in Section 5, *Revisions to Cumulative Impact Analyses*, of this RDEIR/SDEIS.

[22] While these are distinct from the environmental commitments described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS, both sets of commitments would apply to implementation of Alternative 2D.
[23] Specifically, AMMs 1–7, 10, 12–15, 18, 20–25, 30, and 37 would be carried forward under implementation of this alternative.

Table 4.1-5. Environmental Commitments under Alternative 2D

Environmental Commitment 3: Natural Communities Protection and Restoration	
Valley/Foothill Riparian	122 acres
Grassland	1,089 acres
Vernal Pool Complex and Alkali Seasonal Wetland Complex	150 acres
Nontidal Marsh	187 acres
Cultivated Lands	13,410 acres
Total:	**Up to 14,958 acres**
Environmental Commitment 4: Tidal Natural Communities Restoration	Up to 65 acres
Environmental Commitment 6: Channel Margin Enhancement	Up to 5.5 levee miles
Environmental Commitment 7: Riparian Natural Community Restoration	Up to 297 acres
Environmental Commitment 8: Grassland Natural Community	Up to 1,099 acres
Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	Up to 34 acres
Environmental Commitment 10: Nontidal Marsh Restoration	Up to 1,307 acres
Environmental Commitment 11: Natural Communities Enhancement and Management	At sites protected or restored under Environmental Commitments 3–10
Environmental Commitment 12: Methylmercury Management	At sites restored under Environmental Commitment 4
Environmental Commitment 15: Localized Reduction of Predatory Fishes	At north Delta intakes and at Clifton Court Forebay
Environmental Commitment 16: Nonphysical Fish Barrier	At Georgiana Slough

Environmental Commitment 3: Natural Communities Protection and Restoration

This action would consist of the acquisition of lands for protection and restoration of listed species habitat in perpetuity and would be implemented in the same way as described in Conservation Measure 3 in the Draft BDCP but over less area. For the purposes of Alternative 2D, this action would entail protection of approximately 14,958 acres, of natural communities and cultivated land, as shown in Table 4.1-5. This protection and restoration would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 4: Tidal Natural Communities Restoration

This action would consist of the restoration of tidal natural communities and transitional uplands and would be implemented in the same way as described in Conservation Measure 4 in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, but over less area. For the purposes of analysis of Alternative 2D, this action would entail restoration of approximately 65 acres (including transitional uplands), as shown in Table 4.1-5. This analysis assumes that none of these 65 acres of tidal restoration will be done in the Suisun Marsh area. Tidal habitat restoration would mitigate for the physical loss of aquatic habitat associated with construction of the north Delta intake facilities. The current proposed acreage is a total of 65 acres. However, actual acreage may change based on further discussions with NMFS, USFWS, and DFW pertaining to the actual value of the current habitat and/or the appropriate ratio of mitigation or based on footprint changes. Based on initial discussions, the maximum ratio applied to tidal wetland mitigation is 3:1, and therefore would not exceed 195 acres for this alternative.

Environmental Commitment 6: Channel Margin Enhancement

This action would consist of the enhancement of channel margin habitat and would be implemented in the same way as described in Conservation Measure 6 in the Draft BDCP but over less linear distance. For the purposes of Alternative 2D, this action would entail enhancement of approximately 5.5 levee miles, as shown in Table 4.1-5. This would mitigate for the loss of salmonid habitat associated with construction of the north Delta intake facilities.

Environmental Commitment 7: Riparian Natural Community Restoration

This action would consist of the restoration of riparian natural communities and would be implemented in the same way as described in Conservation Measure 7 in the Draft BDCP but over less area. For the purposes of Alternative 2D, this action would entail restoration of approximately 297 acres, as shown in Table 4.1-5. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 8: Grassland Natural Community

This action would consist of the restoration of grassland habitat and would be implemented in the same way as described in Conservation Measure 8 in the Draft BDCP but over less area. For the purposes of Alternative 2D, this action would entail restoration of approximately 1,099 acres as shown in Table 4.1-5. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration

This action would consist of the restoration of vernal pool and alkali seasonal wetland complex and would be implemented in the same way as described in Conservation Measure 9 in the Draft BDCP but over less area. For the purposes of Alternative 2D, this action would entail restoration of up to 34 total acres of vernal pool complex and/or alkali seasonal wetland complex, as shown in Table 4.1-5. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 10: Nontidal Marsh Restoration

This action would consist of the restoration of nontidal marsh and would be implemented in the same way as described in Conservation Measure 10 in the Draft BDCP but over less area. For the purposes of Alternative 2D, this action would entail restoration of up to 1,307 acres of nontidal marsh, as shown in Table 4.1-5. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 11: Natural Communities Enhancement and Management

This action would apply to all protected and restored habitats under Alternative 2D and would be implemented, where applicable, to manage and enhance these lands consistent with the approach described under Conservation Measure 11 in the Draft BDCP. These actions would support mitigation for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 12: Methylmercury Management

This action would minimize conditions that promote production of methylmercury in restored tidal wetland areas and its subsequent introduction to the foodweb, and to listed species in particular. Implementation of this action would be consistent with the revised description of Conservation Measure 12 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The portions of the measure applicable to effects in the Yolo Bypass would not apply because Yolo Bypass improvements would not be implemented as part of this alternative.

Environmental Commitment 15: Localized Reduction of Predatory Fishes (Predator Control)

This action would reduce populations of predatory fishes at locations of high predation risk (i.e., predation hotspots) associated with construction and operation of the proposed water conveyance facilities. Implementation of this action would be consistent with the revised description of Conservation Measure 15 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 2D, this action would be applied only to the reach of the Sacramento River adjacent to the north Delta intakes and to Clifton Court Forebay. This commitment would mitigate for effects on salmonid predation associated with operation of new conveyance facilities. There is also a potential for incidental benefits to other listed species as a result of this commitment.

Environmental Commitment 16: Nonphysical Fish Barrier

This action would be implemented to address effects related to survival of outmigrating juvenile salmonids by installing a nonphysical barrier at Georgiana Slough to redirect fish away from channels and river reaches in which survival is lower than in alternate routes. Implementation of this action would be consistent with the revised description of Conservation Measure 16 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 2D, this action would be applied only to Georgiana Slough. This commitment would mitigate for effects on salmonid survival associated with operation of north Delta intakes and associated flows.

Avoidance and Minimization Measures

AMMs 1–7, 10–15, 18, 20–25, 27, 30, and 37-39 would apply to all construction activities under Alternative 2D and would be implemented, where applicable, to avoid and minimize impacts on listed species, consistent with the approach described in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and in Appendix D of this RDEIR/SDEIS. These actions would minimize the risk of impacts on species resulting from construction activities.

Collaborative Science and Adaptive Management Program

Considerable scientific uncertainty exists regarding the Delta ecosystem, including the effects of CVP and SWP operations and the related operational criteria. To address this uncertainty, DWR, Reclamation, DFW, USFWS, NMFS, and the public water agencies will establish a robust program of collaborative science, monitoring, and adaptive management. For the purposes of analysis, it is assumed that the Collaborative Science and Adaptive Management Program (AMMP) developed for Alternative 2D would not, by itself, create nor contribute to any new significant environmental effects; instead, the AMMP would influence the operation and management of facilities and protected or restored habitat associated with Alternative 2D.

Collaborative science and adaptive management will support the proposed project by helping to address scientific uncertainty where it exists, and as it relates to the benefits and impacts of the construction and operations of the new water conveyance facility and existing CVP and SWP facilities. Specifically, collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to inform and improve:

- the design of fish facilities including the intake fish screens;
- the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit; and
- habitat restoration and other mitigation measures conducted under the biological opinions and 2081b permits.

In summary, the broad purposes of the program will be to: 1) undertake collaborative science, 2) guide the development and implementation of scientific investigations and monitoring for both permit compliance and adaptive management, and 3) apply new information and insights to management decisions and actions. For additional information on how the AMMP would be implemented, see Section 4.1.2.4 in this RDEIR/SDEIS.

4.1.4 Description of Alternative 5A

This section provides description of the components and operation of water conveyance facilities, ESA and CESA compliance process, and environmental commitments that will be implemented under Alternative 5A. Table 4.4-6 below, provides a brief summary comparison of these elements between Alternatives 4, 5, and 5A.

4.1.4.1 Water Conveyance Facility Construction and Maintenance

Under Alternative 5A, water conveyance facilities would be constructed and maintained similarly to those proposed and analyzed under Alternative 4 (including the modifications described in Section 3, *Alternative 4: Conveyance Facility Modifications,* of this RDEIR/SDEIS); however, this alternative would entail one intake (Intake 2), rather than three. Water would be conveyed from the north Delta to the south Delta through pipelines and tunnels. Water would be diverted from the Sacramento River through one fish-screened intake on the east bank of the Sacramento River near Clarksburg (Intake 2). Water would travel from the intake to a sedimentation basin before reaching the tunnel. From the intake water would flow into an initial single-bore tunnel, which would lead to an intermediate forebay on Glannvale Tract. From the southern end of this forebay, water would pass through an outlet structure into a dual-bore tunnel where it would flow by gravity to the south Delta. Water would then reach pumping plants northeast of the Clifton Court Forebay, where it would be pumped from the tunnels into the north cell of the expanded Clifton Court Forebay. The forebay would be dredged and redesigned to provide an area that would isolate water flowing from the new north Delta facilities from water diverted from south Delta channels.

Table 4.1-6. Comparison of Alternatives 4, 5, and 5A

Element of Project Description	Alternative 4 (BDCP)	Alternative 5	Alternative 5A
ESA Compliance	Section 10 (DWR)/Section 7 (Reclamation)	Section 10 (DWR)/Section 7 (Reclamation)	Section 7
California Endangered Species law Compliance	NCCPA	NCCPA	2081(b) permit
Facilities	Modified Pipeline/Tunnel Alignment: 3 intakes, 9,000 cfs	Pipeline/Tunnel Alignment: 1 intake, 3,000 cfs	Modified Pipeline/Tunnel Alignment: 1 intake, 3,000 cfs
Operations	Dual Conveyance; Operational Scenarios H1–H4 with Decision Tree (see Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS); evaluated at LLT	Dual Conveyance; Operational Scenario C; evaluated at LLT	Dual Conveyance; Operational Scenario C without Fremont Weir modifications; evaluated at ELT
Conservation Measures/ Environmental Commitments	Conservation Measures 2–21; includes Yolo Bypass Improvements and 65,000 acres of tidal wetland restoration	Conservation Measures 2–21; includes Yolo Bypass Improvements and 65,000 acres of tidal wetland restoration	Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16; includes up to 55 acres of tidal wetland restoration
CEQA Baseline	Existing Conditions	Existing Conditions	Existing Conditions
NEPA Baseline	No Action Alternative at LLT	No Action Alternative at LLT	No Action Alternative at ELT

A map and a schematic diagram depicting the conveyance facilities associated with the modified pipeline/tunnel alignment are provided in Mapbook Figure M3-4 in the Mapbook Volume and Figure 3-10 in Appendix A of this RDEIR/SDEIS (note, however, that these figures depict three intake locations, rather than one). Construction of a single intake site (Intake 2) would preclude the need for ancillary facilities and features associated with Intakes 3 and 5, including box conduits under widened and raised levee sections, relocated segments of SR 160, sedimentation basins, drying lagoons, outlet shafts, and elevated pads hosting an electrical substation, an electrical building, and other storage buildings. During construction, temporary work areas, fuel stations, and concrete batch plants associated with Intakes 3 and 5 would also not be required. Similarly, Alternative 5A would not require construction of a single-bore tunnel between Intake 5 and the intermediate forebay, nor temporary 69kV power line segments connecting to substations at Intakes 3 or 5. Under Alternative 5A, an operable barrier would not be constructed at the head of Old River.

As proposed for Alternative 4, a new pumping facility would be constructed northeast of the north cell of the expanded Clifton Court Forebay, along with control structures to regulate the relative quantities of water flowing from the north Delta and the south Delta to the Banks and Jones Pumping Plants. Alternative 5A would entail the continued use of the SWP/CVP south Delta export facilities.

All other aspects of water conveyance facility design, construction, and maintenance would be similar to those described for Alternative 4 in the revised text in Chapter 3, Sections 3.4, 3.5.9, and

3.6.1 and Appendix 3C, as provided in Appendix A, *Revisions to the Draft EIR/EIS*, of this RDEIR/SDEIS.

4.1.4.2 Water Conveyance Facility Operations

Operational components of the water conveyance facilities under Alternative 5A would be similar, but not identical, to those described under Scenario C in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Operational elements associated with Fremont Weir modifications would not be incorporated as part of this alternative, because Yolo Bypass improvements contemplated for Alternative 5 (under CM2) would not be implemented as part of Alternative 5A; instead, they would be assumed to occur as part of the No Action Alternative because they are required by the existing BiOps. For a detailed characterization of operational criteria, please refer to Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS.[24]

Implementation of Alternative 5A would include operations of both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. The north Delta intake would be a new facility for the SWP and CVP and would be operated as described in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Compliance with all other criteria included in the USFWS (2008) and NMFS (2009) BiOps and State Water Resources Control Board Water Right Decision 1641 (D-1641), including Fall X2, the E:I ratio, and operations of the Delta Cross Channel gates and the Suisun Marsh Salinity Control Gates, will continue as part of the operation of the CVP and SWP. As such, when compared with operations under the No Action Alternative, Alternative 5A includes modified or new operations and criteria of only the following elements.

- North Delta intake facilities.
- Rio Vista minimum flow standard in January through August.

Alternative 5A operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times.

Real-Time Operational Decision-Making Process

RTOs are expected to be needed during at least some part of the year at the north and south Delta diversion facilities. In making operational decisions, the RTO Team will take into account upstream operational constraints, such as coldwater pool management, instream flow, and temperature requirements. The extent to which real time adjustments that may be made to each parameter related to these facilities shall be limited by the criteria and/or ranges is set out in Table 4.1-2 of this RDEIR/SDEIS. Any modifications to the parameters subject to real time operational adjustments or to the criteria and/or ranges set out in Table 4.1-2 shall occur only through the adaptive management.

North Delta diversions. Operations for North Delta bypass flows will be managed according to the criteria described in Table 4.1-2.

[24] Note that these proposed operational criteria would only take effect after the proposed conveyance facilities are operational. Until that time, operations would occur as described in the USFWS 2008 and NMFS 2009 BiOps or as modified by the outcome of ongoing ESA compliance processes pertaining to operation of the existing facilities.

South Delta diversions. The south Delta diversions will be managed under RTO to achieve OMR criteria, throughout the year based on fish protection triggers (e.g., salvage density, calendar, species distribution, entrainment risk, turbidity, and flow based triggers). Increased restrictions as well as relaxations of the OMR criteria may occur as a result of observed physical and biological information. Additionally, as described above for the north Delta diversion, RTO would also be managed to distribute pumping activities among the north Delta and two south Delta intake facilities to maximize both survival of covered fish species in the Delta and water supply.

Timing for Implementation of Operations

Implementation of Alternative 5A would include operations of both new and existing water conveyance facilities as described above, once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Until that time, operations will be governed by existing and applicable requirements and standards included in the NMFS (2009) and USFWS (2008) BiOps and D-1641, and any regulations that supersede those requirements.

4.1.4.3 Environmental Commitments

To achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b) while also complying with NEPA and CEQA, a subset of those activities proposed in Alternative 5 would be implemented under Alternative 5A. Specifically, portions of the actions proposed under CM3, CM4, CM6, CM7, CM8, CM9, CM10, CM11, CM12, CM15, and CM16 would be included in Alternative 5A.

As described in Section 4.1.2.3 for Alternative 4A, these repackaged and limited elements of the original BDCP Conservation Measures are instead referred to as “Environmental Commitments” for the purposes of Alternative 5A: Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16, as summarized in Table 4.1-7. These commitments consist primarily of habitat restoration, protection, enhancement, and management activities necessary to offset—that is, mitigate for—adverse effects from construction of the proposed water conveyance facilities, along with species-specific resource restoration and protection principles to ensure that implementation of these commitments would achieve the intended mitigation of impacts (for a list of these standards, along with species-specific mitigation needs, see Table 4.1-8).[25] Where impact statements or mitigation measures refer to Conservation Measures, these statements have been changed in the analysis for Alternative 5A to refer instead to the parallel Environmental Commitments. Additionally, pertinent elements included as Avoidance and Minimization Measures and the proposed Adaptive Management and Monitoring Program would be implemented as applicable to the activities proposed under Alternative 5A.[26] These, too, would serve a mitigation function under CEQA. All of these components would function as *de facto* CEQA and NEPA mitigation measures for the construction and operations-related impacts of Alternative 5A. Details regarding the implementation of these activities under Alternative 5A are provided below and in Table 4.1-7.

The RDEIR/SDEIS describes and analyzes Environmental Commitments 3, 4, 6, 7, 8, 9, 10, 11, 12, 15, and 16 at a level of detail consistent with that applied to these activities under other alternatives in

[25] While these are distinct from the environmental commitments described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS, both sets of commitments would apply to implementation of Alternative 5A.

[26] Specifically, AMMs 1–7, 10, 12–15, 18, 20–25, 30, and 37 would be carried forward under implementation of this alternative.

the Draft EIR/EIS. (See CEQA Guidelines, § 15126.4[a][1][D] [EIRs must discuss significant effects of mitigation measures, "but in less detail than the significant effects of the project as proposed"]; see also *California Native Plant Society v. City of Rancho Cordova* (2009) 172 Cal.App.4th 603, 621-625 [lead agency did not violate CEQA by failing to identify the off-site location at which mitigation for impacts to on-site wetlands would be carried out].) Specific locations for implementing many of the activities associated with these commitments have not been identified at this time. Therefore, the analyses consider typical construction, operation, and maintenance activities that would be undertaken for implementation of the habitat restoration and enhancement and stressor reduction efforts. Where appropriate and necessary, implementation of individual projects associated with an Environmental Commitment would be subject to additional environmental review. (See CEQA Guidelines, §§ 15162–15164; 40 C.F.R. § 1502.9[c].)

Note that many of the actions formerly part of Alternative 5 but not proposed to be implemented under Alternative 5A would continue to be pursued as part of existing but separate projects and programs associated with (1) the 2008 and 2009 USFWS and NMFS BiOps (e.g., Yolo Bypass improvements, 8,000 acres of tidal habitat restoration), (2) California EcoRestore and (3) the 2014 California Water Action Plan. Those actions are separate from, and independent of, Alternative 5A. Therefore, for the purposes of Alternative 5A, these elements (and their associated environmental effects) are considered either as part of the No Action Alternative, as described in Section 4.2, *Impacts of No Action Alternative Early Long-Term*, of this RDEIR/SDEIS, or as part of the cumulative impact analysis, as described in Section 5, *Revisions to Cumulative Impact Analyses,* of this RDEIR/SDEIS.

Table 4.1-7. Environmental Commitments under Alternative 5A

Environmental Commitment 3: Natural Communities Protection and Restoration	
Valley/Foothill Riparian	91 acres
Grassland	1,034 acres
Vernal Pool Complex and Alkali Seasonal Wetland Complex	150 acres
Nontidal Marsh	118 acres
Cultivated Lands	11,330 acres
Total:	**Up to 12,724 acres**
Environmental Commitment 4: Tidal Natural Communities Restoration	Up to 55 acres
Environmental Commitment 6: Channel Margin Enhancement	Up to 3.1 levee miles
Environmental Commitment 7: Riparian Natural Community Restoration	Up to 222 acres
Environmental Commitment 8: Grassland Natural Community Restoration	Up to 1,044 acres
Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration	Up to 34 acres
Environmental Commitment 10: Nontidal Marsh Restoration	Up to 826 acres
Environmental Commitment 11: Natural Communities Enhancement and Management	At sites protected or restored under Environmental Commitments 3–10
Environmental Commitment 12: Methylmercury Management	At sites restored under Environmental Commitment 4
Environmental Commitment 15: Localized Reduction of Predatory Fishes	At north Delta intake and at Clifton Court Forebay
Environmental Commitment 16: Nonphysical Fish Barrier	At Georgiana Slough

Environmental Commitment 3: Natural Communities Protection and Restoration

This action would consist of the acquisition of lands for protection and restoration of listed species habitat in perpetuity and would be implemented in the same way as described in Conservation Measure 3 in the Draft BDCP but over less area. For the purposes of Alternative 5A, this action would entail protection of approximately 12,724 acres, of natural communities and cultivated land, as shown in Table 4.1-7. This protection and restoration would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 4: Tidal Natural Communities Restoration

This action would consist of the restoration of tidal natural communities and transitional uplands and would be implemented in the same way as described in Conservation Measure 4 in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, but over less area. For the purposes of analysis of Alternative 5A, this action would entail restoration of approximately 55 acres (including transitional uplands), as shown in Table 4.1-7. This analysis assumes that none of these 55 acres of tidal restoration will occur in the Suisun Marsh area. Tidal habitat restoration would mitigate for the physical loss of aquatic habitat associated with construction of the north Delta intake facilities. The current proposed mitigation acreage is a total of 55 acres. However, actual acreage may change based on further discussions with NMFS, USFWS, and DFW pertaining to the actual value of the current habitat and/or the appropriate ratio of mitigation or based on footprint changes. Based on initial discussions, the maximum ratio applied to tidal wetland mitigation is 3:1, and therefore would not exceed 165 acres for this alternative.

Environmental Commitment 6: Channel Margin Enhancement

This action would consist of the enhancement of channel margin habitat and would be implemented in the same way as described in Conservation Measure 6 in the Draft BDCP but over less linear distance. For the purposes of Alternative 5A, this action would entail enhancement of approximately 3.1 levee miles, as shown in Table 4.1-7. This would mitigate for the loss of salmonid habitat associated with construction of the north Delta intake facilities.

Environmental Commitment 7: Riparian Natural Community Restoration

This action would consist of the restoration of riparian natural communities and would be implemented in the same way as described in Conservation Measure 7 in the Draft BDCP but over less area. For the purposes of Alternative 5A, this action would entail restoration of approximately 222 acres, as shown in Table 4.1-7. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 8: Grassland Natural Community

This action would consist of the restoration of grassland habitat and would be implemented in the same way as described in Conservation Measure 8 in the Draft BDCP but over less area. For the purposes of Alternative 5A, this action would entail restoration of approximately 1,044 acres as shown in Table 4.1-7. This would mitigate for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration

This action would consist of the restoration of vernal pool and alkali seasonal wetland complex and would be implemented in the same way as described in Conservation Measure 9 in the Draft BDCP but over less area. For the purposes of Alternative 5A, this action would entail restoration of approximately 34 total acres of vernal pool complex and/or alkali seasonal wetland complex, as shown in Table 4.1-7. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 10: Nontidal Marsh Restoration

This action would consist of the restoration of nontidal marsh and would be implemented in the same way as described in Conservation Measure 10 in the Draft BDCP but over less area. For the purposes of Alternative 5A, this action would entail restoration of approximately 826 acres of nontidal marsh, as shown in Table 4.1-7. This would mitigate for the loss of species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 11: Natural Communities Enhancement and Management

This action would apply to all protected and restored habitats under Alternative 5A and would be implemented, where applicable, to manage and enhance these lands consistent with the approach described under Conservation Measure 11 in the Draft BDCP. These actions would support mitigation for the loss of terrestrial species habitat associated with construction of the water conveyance facilities.

Environmental Commitment 12: Methylmercury Management

This action would minimize conditions that promote production of methylmercury in restored tidal wetland areas and its subsequent introduction to the foodweb, and to listed species in particular. Implementation of this action would be consistent with the revised description of Conservation Measure 12 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The portions of the measure applicable to effects in the Yolo Bypass would not apply because Yolo Bypass improvements would not be implemented as part of this alternative.

Environmental Commitment 15: Localized Reduction of Predatory Fishes (Predator Control)

This action would reduce populations of predatory fishes at locations of high predation risk (i.e., predation hotspots) associated with construction and operation of the proposed water conveyance facilities. Implementation of this action would be consistent with the revised description of Conservation Measure 15 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 5A, this action would be applied only to the reach of the Sacramento River adjacent to the north Delta intake and to Clifton Court Forebay. This commitment would mitigate for effects on salmonid predation associated with operation of new conveyance facilities. There is also a potential for incidental benefits to other listed species as a result of this commitment.

Environmental Commitment 16: Nonphysical Fish Barrier

This action would be implemented to address effects related to survival of outmigrating juvenile salmonids by installing a nonphysical barrier at Georgiana Slough to redirect fish away from channels and river reaches in which survival is lower than in alternate routes. Implementation of this action would be consistent with the revised description of Conservation Measure 16 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); however, for the purposes of Alternative 5A, this action would be applied only to Georgiana Slough. This commitment would mitigate for effects on salmonid survival associated with operation of north Delta intakes and associated flows.

Avoidance and Minimization Measures

Actions associated with AMMs 1–7, 10–15, 18, 20–25, 27, 30, and 37–39 would apply to all construction activities under Alternative 5A and would be implemented, where applicable, to avoid and minimize impacts on listed species, consistent with the approach described in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and in Appendix D of this RDEIR/SDEIS. These actions would minimize the risk of impacts on species resulting from construction activities.

Collaborative Science and Adaptive Management Program

Considerable scientific uncertainty exists regarding the Delta ecosystem, including the effects of CVP and SWP operations and the related operational criteria. To address this uncertainty, DWR, Reclamation, DFW, USFWS, NMFS, and the public water agencies will establish a robust program of collaborative science, monitoring, and adaptive management. For the purposes of analysis, it is assumed that the Collaborative Science and Adaptive Management Program (AMMP) developed for Alternative 5A would not, by itself, create nor contribute to any new significant environmental effects; instead, the AMMP would influence the operation and management of facilities and protected or restored habitat associated with Alternative 5A.

Collaborative science and adaptive management will support the proposed project by helping to address scientific uncertainty where it exists, and as it relates to the benefits and impacts of the construction and operations of the new water conveyance facility and existing CVP and SWP facilities. Specifically, collaborative science and adaptive management will, as appropriate, develop and use new information and insight gained during the course of project construction and operation to inform and improve:

- the design of fish facilities including the intake fish screens;
- the operation of the water conveyance facilities under the Section 7 biological opinion and 2081b permit; and
- habitat restoration and other mitigation measures conducted under the biological opinions and 2081b permits.

In summary, the broad purposes of the program will be to: 1) undertake collaborative science, 2) guide the development and implementation of scientific investigations and monitoring for both permit compliance and adaptive management, and 3) apply new information and insights to management decisions and actions. For additional information on how the AMMP would be implemented, see Section 4.1.2.4 in this RDEIR/SDEIS.

4.1.5 Approach to Environmental Analysis for Alternatives 4A, 2D, and 5A

The Lead Agencies have attempted to retain as much of the methodology and terminology that was used in the analyses of other alternatives as possible for the analysis of Alternatives 4A, 2D, and 5A. This section underscores key similarities and differences in the terminology applied in the Draft BDCP, Draft EIR/EIS, and this RDEIR/SDEIS.

Under Alternatives 4A, 2D, and 5A, it is assumed that the environmental setting and area of potential impact are consistent with those analyzed under the alternatives evaluated in the Draft EIR/EIS. While there is no requirement that activities take place within a "Plan Area" under the regulatory approach that would be pursued under these alternatives, it is assumed that activities associated with these alternatives would occur within this same geographical area; therefore, the term Plan Area is still applied in the impact analysis of Alternatives 4A, 2D, and 5A (and associated figures, tables, etc.). Similarly, "Conservation Zones" and "Restoration Opportunity Areas" are still applied where applicable to indicate the areas within which Environmental Commitments would be implemented. As noted in Chapter 1, *Introduction,* Section 1.5 of the Draft EIR/EIS, the "study area" for the actions evaluated in this RDEIR/SDEIS is larger than the proposed Plan Area, because some of the effects of implementing the proposed project would extend beyond the boundaries of this region. Resource-specific study areas are defined in the introductions to the analyses in Chapters 5–30 of the Draft EIR/EIS.

As described above, various activities associated with the Draft BDCP conservation strategy would also apply to these alternatives. However, activities referred to as Conservation Measures under the BDCP (as an HCP/NCCP), are instead called Environmental Commitments for the purposes of Alternatives 4A, 2D, and 5A. However, other activities associated with the Draft BDCP conservation strategy are retained for discussion of Alternatives 4A, 2D, and 5A, including the role of avoidance and minimization measures[27] and the implementation of an adaptive management and monitoring program, with text provided as needed to clarify differences from those activities under their "parent" alternatives, as described in the Draft EIR/EIS. In some cases, resource restoration and protection principles have been added to provide additional detail regarding implementation of the Environmental Commitments (see Table 4.1-8 of this RDEIR/SDEIS). In the context of the Draft BDCP, these were often characterized as biological goals and objectives. As part of the ESA Section 7 consultation process, these elements may function (and be referred to) as "conservation measures" for mitigation purposes. However, for the purposes of the RDEIR/SDEIS, these activities are considered part of the alternative and are not defined as "mitigation measures" in order to avoid confusion with those measures proposed for the purposes of CEQA and NEPA compliance. As described in Section 1, *Introduction*, the RDEIR/SDEIS references the Draft BDCP where appropriate.

[27] In response to comments contending that DWR, as Lead Agency, had failed to "comply" with the *Lotus v. Department of Transportation* (223 Cal.App.4th 645) decision, DWR and the US Bureau of Reclamation, as Federal Lead Agency, have modified Appendix 3B, *Environmental Commitments*, as part of this RDEIR/SDEIS. Avoidance and minimization measures (AMMs) and Conservation Measures (for Alternatives 1A, 1B, 1C, 2A, 2B, 2C, 3, 4, 5, 6A, 6B, 6C, 7, 8, and 9)/Environmental Commitments (for Alternatives 4A, 2D, and 5A) that have been incorporated in this analysis as project features which will help avoid or minimize significant environmental effects (serving a similar role as environmental commitments) have been added to this appendix. In addition to other refinements, Appendix 3B now includes, after a summary of each mitigating project feature, one or more narrative discussions explaining both how it tends to reduce the severity of environmental effects and whether or not the level of impact reduction is sufficient to render the effects less-than-significant.

Any new information developed for the BDCP since the December 2013 public draft that is needed to adequately disclose environmental effects of Alternatives 4A, 2D, and 5A, or other alternatives is included in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The Section 7 and 2081(b) consultation processes address a smaller list of species than the list of BDCP covered species (Table 1-3 in the Draft BDCP). Alternatives 4A, 2D, and 5A would not include a list of "covered species;" however, this RDEIR/SDEIS retains analysis of these species, to the extent that implementation of these alternatives could result in impacts. See Section 4.3.7, *Fish and Aquatic Resources*, and 4.3.8, *Terrestrial Biological Resources*, of this RDEIR/SDEIS for impact analyses pertaining to aquatic and terrestrial species. Similarly, the concept of "covered activities" would not pertain to Alternatives 4A, 2D, and 5A. For the purposes of these alternatives, the activities considered for their potential to result in environmental impacts consist of construction and operation of proposed and existing SWP and CVP facilities in the Delta, along with implementation of Environmental Commitments designed to mitigate these effects. Operation and maintenance of the proposed North Bay Aqueduct Alternate Intake Project would not be included as a part of Alternatives 4A, 2D, and 5A; therefore, impacts from operating this proposed facility are not considered in the analysis of these alternatives.

Table 4.1-8. Terrestrial Biology Resource Restoration and Protection Principles for Implementing Environmental Commitments.

Resource[28]	Resource Restoration and Protection Principles
Landscape Level	L1 - Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands. L2 - Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area. L3 - Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species.
Natural Communities	
Valley/Foothill Riparian	VFR1 - Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. VFR2 - Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7. VFR3 - The mature riparian forest intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum patch size of 50 acres and minimum width of 330 feet.
Vernal Pool/Alkali Seasonal Wetland Complex	VP/AW1 - Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005). VP/AW2 - Restore vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acreage. VP/AW3 - Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area. VP/AW4 - Provide appropriate seasonal flooding characteristics for supporting

[28] Only species that required specific restoration guidelines were included in this table. Some of the natural community level resource guidelines benefit some species and there are also specific AMMs that address other species needs.

Resource[28]	Resource Restoration and Protection Principles
	and sustaining vernal pool and alkali seasonal wetland complex species. VP/AW5 - In grasslands surrounding protected and created vernal pools and alkali seasonal wetlands complex, increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs. VP/AW6 - In grasslands surrounding protected and created vernal pool and alkali seasonal wetlands, increase burrow availability for burrow-dependent species. VP/AW7 - In grasslands surrounding protected and restored vernal pool and alkali seasonal wetlands, increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species.
Grassland	G1 - Restore grasslands to connect fragmented patches of protected grassland and to provide upland habitat. G2 - Protect up to six acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles. G3 - Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states. G4 - Increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs. G5 - Increase burrow availability for burrow-dependent species. G6 - Increase prey abundance and accessibility, especially of small mammals and insects, for grassland-foraging species. G7 - Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species. G8 - Protect grassland on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit. G9 - Create or protect high-value upland giant garter snake habitat adjacent to the nontidal perennial aquatic habitat being restored and created. G10 - Protect 647 acres of grassland in the Byron Hills area.
Cultivated Lands	CL1 - Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands. CL2 - Target cultivated land conservation to provide connectivity between other conservation lands
Wildlife Species	
Valley Elderberry Longhorn Beetle	VELB1 - Mitigate impacts on elderberry shrubs by creating valley elderberry longhorn beetle habitat consistent with the U.S. Fish and Wildlife Service valley elderberry longhorn beetle conservation guidelines (provided in BDCP Appendix 3.F of the Draft BDCP) and planting elderberry shrubs in high-density clusters. VELB2 - Site valley elderberry longhorn beetle habitat restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle.

Resource[28]	Resource Restoration and Protection Principles
Western Pond Turtle	WPT1 - Create and protect nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will include suitable habitat characteristics for western pond turtle.
Giant Garter Snake	GGS1 - Created aquatic habitat for the giant garter snake will be connected to the protected rice land or equivalent-value habitat. GGS2 - Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands and from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development. GGS3 - Protect, restore, and/or create rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in Conservation Zones 4 and/or 5. GGS4 - Create or protect high-value upland giant garter snake habitat adjacent to the nontidal perennial aquatic habitat being restored and created. GGS5 - Create connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting 255 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 255 acres may consist of muted tidal freshwater emergent wetland and may overlap with the 160 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria.
California Black Rail	CBR1 - At the ecotone that will be created between restored tidal wetlands and transitional uplands (Environmental Commitment 4), provide for at least 22 acres of California black rail habitat (Schoenoplectus and Typha-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta) consisting of shallowly inundated emergent vegetation at the upper edge of the marsh (within 50 meters of upland refugia habitat) with adjacent riparian or other shrubs that will provide upland refugia, and other moist soil perennial vegetation. If feasible, create the 22 acres of tidal habitat in a single patch in a location that is contiguous with occupied California black rail habitat. CBR2 - Create topographic heterogeneity in restored tidal wetlands (Environmental Commitment 4).
Greater Sandhill Crane	GSC1 - Protect high- to very high-value habitat for greater sandhill crane (see Table 12-4A-28 in Section 4.3.8, *Terrestrial Biological Resources*, of this RDEIR/SDEIS for definition of habitat values), with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in Conservation Zones 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres. GSC2 - Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands. GSC3 - Create at least two 90-acre wetland complexes within the Stone Lakes

Resource[28]	Resource Restoration and Protection Principles
	National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane. GSC4 - Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss.
Swainson's Hawk	SH1 - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres. SH2 - Protect Swainson's hawk foraging habitat with at least 50% in very high-value habitat (see Table 12-4A-35 in Section 4.3.8, *Terrestrial Biological Resources*, of this RDEIR/SDEIS for a definition habitat value) production and above -1 foot above mean sea level.
Tricolored Blackbird	TB1 - Protect and manage occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence. TB2 - Protect high- to very high-value breeding-foraging habitat within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat. At least 130 acres will be within 3 miles of the 42 acres of nontidal wetland nesting habitat protected. TB3 - Protect moderate-, high-, or very high-value cultivated lands as nonbreeding foraging habitat, at least 50% of which is of high or very high value. TB4 - Nonbreeding roosting habitat mitigation needs assumed to be met through early-successional riparian (blackberry) and tidal (scirpus) restoration.
Riparian Brush Rabbit	RBR1 - Of the protected valley/foothill riparian natural community, protect and maintain 19 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat. RBR2 - Restore and maintain 19 acres of early- to mid-successional riparian brush rabbit habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat. RBR3 - Create and maintain high-water refugia in the 19 acres of restored riparian brush rabbit habitat and the 19 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 20 meters.

Resource[28]	Resource Restoration and Protection Principles
	RBR4 - In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit. RBR5 - Of the 1,060 acres of grasslands protected, protect 227 acres of grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit.
Plant Species	
Vernal Pools Species	VPS1 - Protect at least two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas.
Alkali Seasonal Wetland Species	ASWS1 - Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11.
Tidal Wetland Species	TWS1 - No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites. TWS2 - No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites.

4.1.6 Assumptions for the Purposes of Analysis

For the purposes of analyzing the environmental effects associated with Alternatives 4A, 2D, and 5A, a number of assumptions were necessary.

Environmental Baselines and Implementation Schedule

The same "Existing Conditions" baseline defined in the Draft EIR/EIS applies to Alternatives 4A, 2D, and 5A, for the purposes of CEQA impact analysis. Therefore, all CEQA conclusions associated with Alternative 4A, 2D, and 5A are made in comparison to the same Existing Conditions baseline applied for all other alternatives. However, because of the different approach for ESA compliance envisioned under Alternatives 4A, 2D, and 5A, the No Action Alternative, as applied to these new alternatives only, has been modified for the purposes of making NEPA determinations with respect to Alternatives 4A, 2D, and 5A in the RDEIR/SDEIS. Specifically, this RDEIR/SDEIS includes revisions made to the No Action Alternative required under NEPA and for the purpose of providing a logical point of comparison for the NEPA analysis of Alternatives 4A, 2D, and 5A. Because Alternatives 4A, 2D, and 5A, contemplate a shorter permit period for project implementation than the other alternatives, the new "No Action Alternative Early Long-Term" (No Action Alternative ELT) is used as the NEPA point of comparison for these alternatives. The No Action Alternative ELT is described and analyzed in Section 4.2. However, because the project would continue indefinitely, the analysis qualitatively examines impacts at the Late Long-Term timeframe for Alternatives 4A, 2D, and 5A, but does not make a CEQA or NEPA conclusion based off the No Action Alternative LLT baseline. Where impacts do not differ between the early long-term and the late long-term, this analysis is not specifically called out. For the other action alternatives in the Draft EIR/EIS, including Alternative 4, that contemplated an HCP/NCCP permit term of 50 years, the No Action Alternative, as found in the Draft EIR/EIS, remains unchanged, as it, too, had a time horizon of 50 years.

Under Alternatives 4A, 2D, and 5A, the 2009 NMFS BiOp RPAs related to Yolo Bypass improvements (Actions I.6.1, I.6.2, and I.7) and the 2008 USFWS BiOp RPA related to 8,000 acres of tidal habitat restoration (Component 4) would be considered part of the No Action Alternative. Under Alternatives 4A, 2D, and 5A, the BDCP would no longer be the vehicle to implement these actions;

instead, they would be pursued and implemented as part of existing processes, including the development of the *Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan* and the BiOps on the Coordinated Long-Term Operation of the CVP and SWP. Because a 50-year permit would not be pursued under Alternatives, 4A, 2D, and 5A, impact analyses reliant on physical modeling (primarily CALSIM II and DSM2) use "Early Long-Term" model results. However, because the project would continue indefinitely, the analysis qualitatively examines impacts at the Late Long-Term timeframe for Alternatives 4A, 2D, and 5A. Where impacts do not differ between the early long-term and the late long-term, this analysis is not specifically called out.

Physical Modeling

As described above, impact analyses reliant on physical modeling apply results consistent with an "Early Long-Term" timeframe. Based on the assumptions used for the original purposes of these model runs, these results also assume implementation of two elements, Yolo Bypass improvements and 25,000 acres of tidal wetland restoration. These two elements were included in the modeling because they were components of Alternative 4, for which the modeling was originally conducted. These two elements, however, are not proposed as part of Alternatives 4A, 2D, or 5A. Instead, these two elements would be pursued and implemented separately as part of other ongoing BiOp RPA efforts rather than as part of Alternatives 4A, 2D, and 5A. Even so, the Lead Agencies have determined that they may reasonably rely on the modeling conducted for Alternative 4 to accurately predict the environmental effects of Alternative 4A. At the time the Lead Agencies developed Alternative 4 in concept and wanted to test it as a potentially viable new subalternative, the Lead Agencies already possessed ELT modeling outputs for Alternative 4, which included the two elements. The Lead Agencies conducted additional sensitivity modeling to assess whether or not the existing ELT modeling for Alternative 4 accurately predicted the environmental effects of Alternative 4A. The new assessment concluded in the affirmative on that question. Their conclusions from this sensitivity analysis comparison are provided in Appendix B, *Supplemental Modeling for Alternative 4A*, of this RDEIR/SDEIS. Additionally, as described in Table 4.1-2 in this RDEIR/SDEIS, the operations for Alternative 4A include a new criterion for spring outflow longfin smelt. For the purposes of impact analysis under Alternative 4A, applicable analyses evaluate a range of impacts, bounded by the early long-term modeling results generated for Alternative 4, Scenarios H3 and Scenario H4.

4.1.7 References

National Marine Fisheries Service. 2009. *Biological and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project*. June 4. Long Beach, CA. Available: <http://www.swr.noaa.gov/ocap/NMFS_Biological_and_Conference_Opinion_on_the_Long-Term_Operations_of_the _CVP_and_SWP.pdf>. Accessed: June 12, 2013.

U.S. Fish and Wildlife Service. 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*. Region 1, Portland, OR.

U.S. Fish and Wildlife Service. 2008. Biological Opinion on the Effects of Long Term Coordinated Operations of the Central Valley (CVP) and State Water Project (SWP) on Delta Smelt and its Designated Critical Habitat. December.

4.2 Impacts of No Action Alternative Early Long-Term

The addition of Alternatives 4A, 2D, and 5A, as described above in Section 4.1, *Introduction*, requires a new No Action Alternative to be defined that matches the time horizon for the new alternatives and provides a baseline or point of comparison for NEPA purposes. This section provides a brief overview of the No Action Alternative Early Long Term (ELT) assumptions and provides analysis of the No Action Alternative (ELT) impacts compared against existing conditions.

The No Action Alternative (ELT) includes most of the assumptions used for the No Action Alternative Late Long Term (LLT) as described in Appendix 3D of the Draft EIR/EIS including continued SWP/CVP operational assumptions used in CALSIM II modeling and on-going programs, projects and polices that would continue in the absence of action alternatives. Two exceptions include planned Yolo Bypass improvements and habitat restoration required by the USFWS BiOp. Because Alternatives 4A, 2D, and 5A do not include these Yolo Bypass and habitat restoration actions they are now assumed for the No Action Alternative (ELT); they are actions that would be required to occur with or without implementation of Alternatives 4A, 2D, or 5A.

Other programs, projects, and policies assumed for the No Acton Alternative (LLT) are also assumed for the No Action Alternative (ELT) but the ELT period assumes a shorter time horizon of approximately 15 years following project approval. These programs, projects and policies are presented in Draft EIR/EIS Tables 3D-1 and 3D-2 in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions* and include those with clearly defined management and/or operational plans, including facilities under construction as of February 13, 2009. In general, these actions are consistent with the continuation of existing management direction or level of management for plans, policies, and operations by the NEPA Lead Agencies and other agencies, and are summarized in Table 3D-4 of the Draft EIR/EIS, Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*. The No Action Alternative (ELT) assumptions also include facilities and programs that have received approvals and permits or foreseeably will be approved and permitted during the ELT time period because those programs were consistent with existing management direction as of the Notice of Preparation, as summarized in Table 3D-4 (Draft EIR/EIS, Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*). The effects of climate change and sea level rise will foreseeably have some effect on the Delta environment during the ELT time period[1] and are included in the No Action Alternative (ELT) CALSIM modeling and analysis.

Inclusion of future projects or actions in the No Action Alternative does not represent a decision by any agency to pursue those project or actions. Reclamation has included in the No Action Alternative future projects or actions that Reclamation believes are reasonably foreseeable to occur. To the extent such future projects or actions require approval by another federal agency, Reclamation's decision to include these future action projects or actions in the No Action Alternative should not be interpreted as approval by any federal agency.

[1] ELT is modeled at 2025. Late-long term timeframe is modeled at 2060.

4.2.1 No Action Alternative (ELT) Assumptions for State Water Project and Central Valley Project

No Action Alternative (ELT) includes continuation of operations of the SWP and CVP as described in the Biological Assessment (BA) on the Continued Long-term Operations of the Central Valley Project and the State Water Project (August 2008) with operational assumptions modified by the 2009 NMFS BiOp and 2008 USFWS BiOp. The operational assumptions for the No Action Alternative (ELT) are identical to those assumed for the No Action Alternative (LLT) for a shorter time period and do not include "Near Term Future Projects" or "Other Future Projects" included in the 2008 BA that are not actionable enough to assume in CALSIM II modeling of SWP/CVP operations. The Sacramento River Reliability Project is not included in the No Action Alternative (ELT) because the environmental documentation is not complete, and therefore, specific construction and operational criteria are not defined. The South Delta Improvement Program is not included in the No Action Alternative (ELT) because DWR is developing alternative plans at this time. Detailed assumptions for the CVP and SWP operations are also represented in hydrological and water quality analytical models, as described in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

4.2.2 No Action Alternative (ELT) Assumptions for Ongoing Programs and Policies

The No Action Alternative (ELT) assumes continued implementation of operations, maintenance, enforcement, and protection programs by federal, state, and local agencies and non-profit groups in areas relevant to the action alternatives, as summarized in Table 3D-2 and 3D-4 of the Draft EIR/EIS. Many of the ongoing programs include development of future projects that would require separate environmental documentation. The future projects are not included in the No Action Alternative (ELT) assumptions unless they meet the definition of No Action Alternative or are defined well enough to be assumed in the No Action Alternative (ELT).

4.2.3 No Action Alternative (ELT) Assumptions for Biological Opinions

The same NMFS and USFWS BiOp actions assumed for the No Action Alternative (LLT) are assumed for the No Action Alternative (ELT), as described above and presented in Table 3D-5 of the Draft EIR/EIS and include the Lower Putah Creek enhancements, Lisbon Weir improvements, changes in Delta Cross Channel operations, San Joaquin River inflow to export ratio requirements, Old and Middle River flow management, and Tracy Fish Collection and Skinner Fish Collection Facility improvements, among other related actions. In general, actions required under the 2008 and 2009 NMFS and USFWS BiOps were included in the No Action Alternative (ELT) analysis if they were found to be well-defined enough to allow for a meaningful analysis and are likely to be implemented in the absence of the action alternatives.

The future actions not included in the modeling of No Action Alternative (ELT) include facilities or changes in operations under implementation of the NMFS BiOp and the USFWS BiOp that would require further study and subsequent implementation as well as future actions required by the Biological Opinions which cannot be analyzed (such as convening a working group to make certain findings). As noted above, the No Action Alternative (ELT) includes Yolo Bypass improvements and

8,000 acres of habitat enhancements. These actions were subsumed by the BDCP action alternatives and thus, were not included in the No Action Alternative (LLT) assumptions. Because Alternatives 4A, 2D, and 5A do not include these actions they are now included in the No Action Alternative (ELT) assumptions and evaluated qualitatively.

4.2.4 Water Supply

Under the No Action Alternative, the facilities and operations of the SWP and CVP would continue to be similar to Existing Conditions with the following changes.

- Effects of sea level rise and climate change on system operations as discussed in Section 5.3.1.1 of the Draft EIR/EIS.
- An increase in demands and the buildout of facilities associated with water rights and CVP and SWP contracts of about 443 TAF per year, north of Delta at the future level of development. This is an increase in CVP Municipal and Industrial (M&I) service contracts (253 TAF per year) and water rights (184 TAF per year) related primarily to urban M&I use, especially in the communities in El Dorado, Placer, and Sacramento Counties.
- An increase in demands associated with SWP contracts, up to full contract amounts, south of Delta at the future level of development. SWP M&I demands, which under the existing level of development vary on hydrologic conditions between 3.0 and 4.1 MAF per year, under the future condition are at maximum contract amounts in all hydrologic conditions. This represents a potential 25% increase on average in south of Delta demands under SWP M&I contracts between existing and future levels of development due to assumed additional development and demographics.
- New urban intake/Delta export facilities:
    - Freeport Regional Water Project (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS for information on additional EBMUD demand of about 26 TAF/YR on average with increased demand in dry years)
    - 30 million-gallon-per-day City of Stockton Delta Water Supply Project
    - Delta-Mendota Canal–California Aqueduct Intertie
    - Contra Costa Water District Alternative Intake and 55 TAF/YR increased demand
    - South Bay Aqueduct rehabilitation, to 430 cfs capacity, from the junction with California Aqueduct to Alameda County Flood Control and Water Conservation District Zone 7.
- An increase in supplies for wildlife refuges including Firm Level 2 supplies of about 8 TAF per year at the future level of development. In addition, there is a shift in refuge demands from south to north (24 TAF per year reduction in south of Delta and 32 TAF per year increase in north of Delta).
- Implementation of the Fall X2 RPA action (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS), which requires maintenance of X2 at specific locations in wet and above normal years in September and October, plus releases in November to augment Delta outflow dependent on hydrology.

- Increased demands for cross-Delta water transfers, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years, and average annual transfer volume increasing from 146,000 acre-feet to 280,000 acre-feet compared to existing conditions.

A detailed description of the modeling assumptions associated with the No Action Alternative is included in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

Ongoing Plans, Policies, and Programs

The programs, plans, and projects included under the No Action Alternative (ELT) are summarized in the Draft EIR/EIS Chapter 3, *Description of Alternatives*. Most of the projects would not affect SWP/CVP water supply availability under the No Action Alternative (ELT) as compared to Existing Conditions. The projects that could affect SWP/CVP water supply availability are summarized in Table 5-3 in the Draft EIR/EIS, along with their anticipated effects on water supply.

Model simulation results for the No Action Alternative (ELT) compared to Existing Conditions are discussed in the following sections and summarized in Tables B.1-1 through B.1-3.

Change in Delta Outflow

Average annual Delta outflow would increase by 625 TAF (4%) at Year 2025 (ELT) as compared to Existing Conditions. Changes in Delta outflow would result from the seasonal changes in the timing of precipitation and runoff due to climate change, with higher outflows in December through March and lower outflows in April through June, as shown in Figure 4.3.1-1. The increase in Delta outflow in September and October in wet and above normal years would be due to increased outflow to meet Fall X2 and because higher outflows are needed to meet Fall X2 requirements as a result of sea level rise and salinity intrusion into the Delta under future 2025 climate conditions. The changes in the timing of seasonal outflows are more prominent in wet years as compared to dry years, as shown in Figures 4.3.1-2 and 4.3.1-3.

Change in SWP and CVP Reservoir Storage

In comparison to Existing Conditions under the No Action Alternative (ELT), there would be a decrease in carryover storage at the end of September for Lake Oroville, Trinity Lake, Shasta Lake, and Folsom Lake in all years. Lake Oroville storage would decrease by 430 TAF (21%) in September average end of month storage. Trinity, Shasta, and Folsom lakes September carryover would decrease by 119 TAF (9%), 249 TAF (9%), and 80 TAF (15%), respectively under No Action Alternative at ELT as compared to Existing Conditions.

These changes in storage would reduce the ability of the CVP and SWP to meet system water demands and environmental water needs. Adaption measures would need to be implemented on upstream operations to manage coldwater pool storage levels under future sea level rise and climate change conditions. As described in the methods section of Chapter 5, *Water Supply*, in the Draft EIR/EIS, model results when storages are at or near dead pool may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

Potential for Abrupt Disruptions of South of Delta Water Supplies

The levee system in the Delta is composed of approximately 1,115 miles of levees in the Delta and another 230 miles of levees in the Suisun Marsh area (California Department of Water Resources 2005). Some of these are project levees that are part of the State Plan of Flood Control (SPFC) and subject to state and federal oversight and regulation. The majority of Delta Levees are non-project levees, built and improved by local interests, primarily to drain islands and tracts in the Delta so they could be put into agricultural use (California Department of Water Resources 2005); they also serve other purposes, including preservation of water quality and conveyance for export water flows. These levees were built without State and/or federal assistance but have status under California Water Code. The non-project levees are under the jurisdiction of public agencies (reclamation districts) and eligible for State assistance due to their acknowledged special benefits to State interests. There are also other levees that may be owned by private or public entities that do not have the same eligibility status as the Delta's non-project levees.

A breach of one or more levees and the associated island flooding could affect Delta water quality and SWP and CVP operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, salt water may be pulled into the interior Delta from Suisun and San Pablo bays. When certain islands are flooded, Delta exports may need to drastically decrease or even cease to avoid drawing saline water toward the Banks and Jones Pumping Plants.

Although the condition of the Delta levees is improving due to the investment of State funds, the failure of an individual levee could happen at any time because the Delta islands are below sea level. Such a sunny day failure occurred in 2004 on Middle River, which flooded Upper and Lower Jones Tract, inundating 12,000 acres of farmland with about 160,000 af of water. Following the levee break, Delta export pumping was curtailed for several days to prevent the intrusion of saline water into the Delta. Water shipments down the California Aqueduct were continued through unscheduled releases from San Luis Reservoir Also, Shasta and Oroville reservoir releases were increased to provide for salinity control in the Delta.

According to the Delta Risk Management Strategy (DRMS), Phase 1: Risk Analysis (California Department of Water Resources 2007), the risk of levee failure in the Delta is significant. Since 1900, 158 levee failures have occurred (California Department of Water Resources 2008b). Some islands have been flooded and recovered multiple times. A few islands, such as Franks Tract, have never been recovered.

Levee failures may be isolated events that affect only a single island, or they may involve multiple islands at the same time. The potential for a single-island event to affect conveyance depends on the location of the island, the conditions in the Delta, and timing of the event. The failure of an island located along current conveyance routes (e.g., Old and Middle rivers) could have a much greater effect on Delta water exports than a failure at some other locations. In addition, because the operation of the export pumps varies over the course of a year, the effects of a single-island levee failure event on conveyance would vary from no effect to disruption of pumping for several days or weeks, according to the time of year at which it occurred.

As discussed in the No Action Alternative discussion in Chapter 5, *Water Supply* of the Draft EIR/EIS, sea-level rise could result in an increased risk of levee failure if the levees are not maintained and improved to accommodate the additional load. However, the State has programs and partners in the local agencies to support necessary levee improvements to minimize any increase in risk. It will be important to continue supporting these programs and to provide funds for the improvement of the levees in order to minimize the potential for inundation of the Delta islands. Without the programs and funding, the potential effects on Delta water supplies could be very significant.

Seismically Induced Levee Failure

The Delta is in an area of moderate seismic risk. A moderate to strong earthquake could cause simultaneous levee failures on several Delta islands, with resultant flooding. The potential for levee failure to result from a seismic event was the subject of analyses conducted by the CALFED program and Phase I of the DRMS. In 2002, the Working Group on California Earthquake Probabilities estimated that an earthquake of magnitude 6.7 or greater has a 62 percent probability of occurring in the San Francisco Bay Area before 2032, and could cause 20 or more islands to flood at the same time (URS Corporation and Benjamin & Associates 2009).

As discussed in the DRMS analysis, a major earthquake could flood many islands simultaneously, which would result in the influx of saline water into the Delta and could require the immediate cessation of water exports. The subsequent repair of levee breaches after the earthquake could require several months, after which the Delta would have to be restored to a fresh condition. Freshening the Delta could involve releases from upstream reservoirs to flush saline water from the Delta. Emergency provisions of existing laws may be used in order to provide the ability to pump water for SWP and CVP to avoid or minimize adverse health and safety effects resulting from the reduced water supply conditions related to a seismic event.

Flood-Related Failures

The potential for a flood event to result in damage to levees, structures, and result in the loss of life has been evaluated in several studies, including DRMS and the Central Valley Flood Protection Plan (California Department of Water Resources 2011b). Generally, these studies have focused on characterizing the potential flood risk, estimating the extent of flood damage, and describing options to mitigate flood risks and reduce flood damage. Storm-related flooding tends to fill the Delta and Suisun Marsh with fresh water, thereby making disruption of the export supply less likely. The 2009 SWP Reliability Report (California Department of Water Resources 2010a) acknowledges the potential for disruption of Delta exports from a flood event would depend on the number of flooded islands, the timing and size of the flood flows, and the water quality in the Delta and Suisun Bay at the time of the flood.

Funding from the Delta Levees Subventions and Delta Special Flood Control Projects Programs have assisted reclamation districts with system maintenance, levee repairs, and levee improvements, which have improved overall levee performance in the Delta. The annual funding has ranged from 2 million to 50 million dollars. Continued funding of those programs would likely result in additional improvements to levee performance. However, the cost of a comprehensive program to manage risk across the Delta has been estimated at between $10.5 and $17.5 billion (California Department of Water Resources 2011c). Costs of this magnitude likely exceed the funding ability of local reclamation districts and may not be available from the State or federal governments. Thus, the ability to implement widespread levee improvements in advance of anticipated increases in flood peaks or sea-level rise or due to climate change is uncertain.

As noted above, the potential consequences for water exports as a result of a levee failure during flood conditions would depend on the specific levee reach and its relation to export conveyance. Since the Delta and Suisun Marsh will contain significantly more fresh water, the potential for salt contamination and any need to curtail exports for water quality reasons is reduced. However, once flood flows subside, saline water would be expected to re-enter the Delta system. The levee breaches remaining after the flood could have altered flow patterns in the Delta and would have to be evaluated for their effects on exports and in-Delta water quality. Where adverse effects remain, closure of the breaches would restore the function of the levee system in preserving water quality and conveyance. It is unlikely that a single-island failure during flood conditions could result in a reduction or disruption to Delta water exports, although it is possible that multiple-island levee failure events, unless repaired, could affect water exports for a longer period.

Potential Effects on the Export of Delta Water Supplies from Levee Failure

In the past several years, DWR USACE the Delta Protection Commission, and local agencies have worked to improve the response to an in-Delta flood emergency, such as a levee failure. As a result, DWR and local agencies are better prepared to respond effectively through improved planning and coordination and the stockpiling of materials. Thus, in the event of a threatened levee breach, local agencies will respond immediately and will notify the County Office of Emergency Services and DWR Flood Center of an event. If needed, additional supplies and support are available. If a levee breach were to occur on a single island (such as occurred at Jones Tract), a unified response effort would be pursued. As part of the implementation of that response, planning teams consider impacts on systems, including the export water system. If the export water system were compromised, restoration of its full function would be incorporated into the response plan so that repairs could be completed in a relatively short timeframe (e.g., a few weeks or months). Thus, for most single-island events, the effect on Delta water exports would generally be limited to a relatively short interruption, until it is confirmed that the resumption of exports would not draw saline water into the Delta.

Various analyses have been undertaken to understand the risk and probability of a more widespread levee failure event, and to determine the potential impact to conveyance of water across the Delta. This included DRMS, an action envisioned by the CALFED ROD in 2000, which provided data to meet the requirements of Assembly Bill (AB) 1200 (California Department of Water Resources and California Department of Fish and Game 2008). Adopted by the legislature in 2005, AB 1200 amended the California Water Code[2] to require that DWR conduct an analysis of the potential for potential impacts on Delta water supplies from subsidence, earthquakes, floods, and changes in precipitation, temperature, and ocean levels. For further discussion of impacts of seismic risks and climate change see Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS.

Appendix 5B, *Responses to Reduced South of Delta Water Supplies*, of the Draft EIR/EIS discusses the potential responses of urban and agricultural water users to abrupt disruptions in Delta water supplies. As discussed more fully therein, urban water user responses could include increased reliance on reservoir storage, expanded groundwater reliance, increased water transfers from agricultural uses to urban uses, increased use on recycled water, and water use restrictions. Responses from agricultural water users could include increased reliance on reservoir storage, expanded groundwater reliance, and water conservation measures.

[2] California Water Code § 139.2: The department shall evaluate the potential impacts on water supplies derived from the Sacramento-San Joaquin Delta based on 50-, 100-, and 200-year projections for each of the following possible impacts on the delta: (1) Subsidence; (2) Earthquakes; (3) Floods; (4) Changes in precipitation, temperature, and ocean levels; (5) A combination of the impacts specified in paragraphs (1) to (4), inclusive.

Indirect effects of changes in Delta exports due to abrupt reductions in Delta water supply are further addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects,* and other sections of this RDEIR/SDEIS addressing specific resources.

Change in Delta Exports

Average annual Delta exports (SWP and CVP exports through Banks and Jones Pumping Plants) under the No Action Alternative (ELT) would be reduced by about 416 TAF (8%) as compared to Existing Conditions (Table B.1-2 in Appendix B of this RDEIR/SDEIS) because of sea level rise and climate change, increased outflows to meet Fall X2 in wet and above normal years, increased projected urban water demands, and other changes explained previously in this section, as shown in Figures 4.3.1-15 through 4.3.1-17. Figure 4.3.1-18 shows that annual Delta exports would be reduced in almost all years under the No Action Alternative (ELT) as compared to Existing Conditions. Increased system inflow during January through March due to climate change would not result in increased exports during this period generally because of limited demands and limited conveyance and storage capacity in these months. Average monthly total SWP and CVP exports, as shown in Figures 4.3.1-19 through 4.3.1-21, exhibit reductions in the fall months because of increased Delta outflow for Fall X2. Export reductions that begin in June and continue through Fall under the No Action Alternative (ELT) as compared to Existing Conditions are due to reduced carryover storage and increased urban demands.

Overall, SWP and CVP water exports would decrease under the No Action Alternative (ELT) as compared to Existing Conditions and could result in reductions in CVP and SWP deliveries. The following summarizes the types of responses to the reductions in water supply that are anticipated to occur. Monthly Delta export patterns are presented in Figures 4.3.1-19 through 4.3.1-21.

Urban Responses

Exports of Delta water supplies have been reduced as a result of legislative and regulatory actions. Additional regulatory actions could result in further reductions, although a specific estimate would be difficult to quantify. Prior responses from urban water agencies in periods of drought provide useful examples of how those agencies could respond to further reductions of Delta water supplies. Reductions that occur as a result of regulatory or policy decisions are likely to remain in place for some time (unless and until some alternative program or projects can address the underlying issues which were the impetus for the regulatory action). Thus, it is likely that any such reductions would at a minimum remain in place for a period of years, or could essentially be permanent.

The effect on individual water agencies would vary considerably, as some are almost entirely reliant on exports of Delta water supplies, while for others these sources provide only a portion of their water supply portfolios, and other water sources could remain available. For example, in 2010, supplies exported from, or diverted in, the Delta comprised approximately 89 percent of the total water supplies for the Zone 7 Water Agency (Zone 7 Water Agency 2010), while the SWP provides less than 30 percent of water supplies for Metropolitan.

The responses of urban water users of reduced exports of Delta water supplies are discussed further in Appendix 5B, *Responses to Reduced South of Delta Water Supplies*, of the Draft EIR/EIS. As described therein, responses could include voluntary conservation measures, increased reliance on reservoir storage, increased reliance on groundwater, implementation of contingency planning efforts, increased use of recycled water, increased water transfers, increased reliance on desalination as a water supply, and water use restrictions.

Agricultural Responses

The San Joaquin Valley is among the most productive agricultural regions in the world, each year generating more than $23 billion in farm output and supporting more than 200,000 jobs. This success can largely be attributed to the availability of water supplies through the Delta and delivered by the SWP and CVP.

As noted above, exports of Delta water supplies have been reduced as a result of legislative and regulatory actions. Responses from individual agricultural water agencies and agriculture overall, to previous reductions and during periods of drought provide useful examples of how those agencies would respond. Reductions that occur as a result of a regulatory or policy decision are assumed to remain in place for some time. Thus, it is likely that any such reductions would remain for several years or could be permanent.

The responses of water agencies to extended droughts provide good insights into the effects of further reductions in exports of Delta water supplies. The 1987–1992 drought had severe impacts on water agencies. Many purchased water from alternative sources to offset reduced Delta supplies, often at very high costs that some clients were unable to afford. Farmers responded to the resultant higher costs by increasing their own groundwater pumping and reducing their purchases from water agencies, but also fallowed large acreages of both annual and permanent crop land. The financial viability of some water agencies themselves suffered and was reflected in increased credit risks and downgrades by credit rating agencies because of these reduced supplies (Moody's Investors Service 1994).

The effect on individual agricultural agencies would vary considerably, as some are almost entirely reliant on exports of Delta water supplies, while for others these sources provide only a portion of their water supply portfolios, and those other water sources could remain available. For example, during the period of 1978 to 2006, Westlands Water District relied on CVP deliveries for an average of 73 percent of its total supplies (Westlands Water District 2007).

The responses of agricultural water users of reduced exports of Delta water supplies are discussed further in Appendix 5B, *Responses to Reduced South of Delta Water Supplies*, of the Draft EIR/EIS. As described therein, responses could include increased reliance on reservoir storage, increased reliance on groundwater, and water conservation programs.

Increased Transfer Demand

Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase. Demand for cross-Delta water transfers will increase, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years compared to existing conditions. The demand increases by project are: from about 23 percent of years to 39 percent of years for the SWP, and from about 51 percent of years to 67 percent of years for the CVP. The average annual transfer demand volume could increase from about 146,000 acre-feet to about 280,000 acre-feet, assuming an estimated maximum cross-Delta transfer supply of 600,000 acre-feet in any one year. Cross-Delta Transfer capacity would restrict the actually realized increase in transfer volumes to less than the amounts stated by an unknown degree, but the increase in the frequency of Cross-Delta transfers would likely occur as predicted as a result of the predicted 14 percent reduction in Delta exports for SWP and CVP Project deliveries.

As noted elsewhere, the decreases in project deliveries (and consequential increase in transfer demand) are caused by (1) an increase in demands associated with water rights, the buildout of planned facilities, and greater use of existing CVP and SWP contracts which cumulatively result in about 443 TAF per year additional consumptive use per year north of Delta at the future level of development; (2) climate change and sea level rise; and (3) depending on alternative, assumption of certain added Delta outflows to benefit fish.

Indirect effects of changes in Delta exports are further addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects*, and other sections of this RDEIR/SDEIS addressing specific resources.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP CVP Water Deliveries during Construction

No construction or modification to SWP or CVP facilities would occur under the No Action Alternative (ELT).

***CEQA Conclusion*: ** No construction or modification to SWP or CVP facilities would occur under the No Action Alternative (ELT).

Impact WS-2: Change in SWP and CVP Deliveries

The effects of sea level rise and climate change, increase in north of Delta urban demands and implementation of Fall X2 in wet and above normal years under the No Action Alternative (ELT) would cause changes in SWP and CVP deliveries as compared to Existing Conditions.

Under No Action Alternative (ELT) average annual total CVP deliveries would be similar with a slight increase of 9 TAF (0%) and average annual total south of the Delta CVP deliveries would decrease by about 150 TAF (7%) as compared to deliveries under Existing Conditions. Average annual CVP north of Delta agricultural deliveries would be reduced by 47 TAF (20%) and exhibit reductions in about 75% of years under the No Action Alternative at Year 2025 (ELT) as compared to Existing Conditions, as shown in Figure 4.3.1-22. Average annual CVP south of Delta agricultural deliveries would be reduced by 120 TAF (12%) and exhibit reductions in about 85% of the years, as shown in Figure 4.3.1-23. Average annual CVP north of Delta M&I deliveries would increase by 181 TAF (86%) due to the increase in urban demand. Deliveries would increase in all years, as shown in Figure 4.3.1-24. Average annual CVP south of Delta M&I deliveries would be reduced by 6 TAF (5%) in about 75% of the years, as shown in Figure 4.3.1-25.

Under No Action Alternative (ELT), model results show a 18 TAF (1%) decrease in CVP Settlement Contract deliveries and a 8 TAF (2%) decrease in CVP Level 2 Refuge Water Supplies during dry and critical years compared to the Existing Conditions. This is because Shasta Lake storage would decline to dead pool more frequently due to the shift in runoff patterns from climate change, sea level rise, increased releases for Fall X2, and increased demands as explained above. Results show no changes in deliveries to CVP Exchange Contractors. As described in the methods section in Chapter 5, *Water Supply*, of the Draft EIR/EIS, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

Under No Action Alternative (ELT), average annual total SWP deliveries would decline by 236 TAF (6%). Average annual total SWP south of Delta deliveries (including Article 56[3] and Article 21) would be reduced by about 219 TAF (8%) and exhibit reductions in about 90% of the years under No Action Alternative at 2025 (ELT) as compared to Existing Conditions, as shown in Figure 4.3.1-26. Average annual SWP Table A deliveries would reduce by 114 TAF (4%) and average annual SWP south of Delta Table A deliveries (including Article 56) would be reduced by about 129 TAF (5%). Table A deliveries would be reduced in about 80% of the years, as shown in Figure 4.3.1-27. Average annual SWP south of Delta Article 21 deliveries would be reduced by about 106 TAF (67%) and would decrease in almost all years, as shown in Figure 4.3.1-28. There would be an average annual decrease of 44 TAF (5%) in SWP Feather River Service Area deliveries during dry and critical years compared to the Existing Conditions.

Overall, SWP and CVP water deliveries would decrease under the No Action Alternative (ELT) as compared to Existing Conditions.

For a discussion of the potential responses of SWP and CVP water users to reduced SWP and CVP deliveries, please refer to Appendix 5B, *Responses to Reduced South of Delta Water Supplies*, of the Draft EIR/EIS. As explained therein, responses of urban water users could include voluntary conservation measures, increased reliance on reservoir storage, increased reliance on groundwater, implementation of contingency planning efforts, increased use of recycled water, increased water transfers, increased reliance on desalination as a water supply, and water use restrictions. Responses of agricultural water users could include increased reliance on reservoir storage, increased reliance on groundwater, and water conservation programs.

Indirect effects of changes in water deliveries are further addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects,* and other sections of this RDEIR/SDEIS addressing specific resources.

CEQA Conclusion: The reductions in SWP and CVP water deliveries under the No Action Alternative (ELT) as compared to Existing Conditions would be mainly due to a combination of effects of sea level rise and climate change, increased future upstream and in-delta water demand (having priority over SWP and CVP rights) and implementation of Fall X2. Indirect effects of changes in water deliveries are addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects,* and other sections of this RDEIR/SDEIS addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase. Demand for cross-Delta water transfers will increase, with the frequency of such transfers increasing from about 52 percent of years to 68 percent of years, increasing from about 23 percent of years to 39 percent of years for the SWP, and from about 51 percent of years to 67 percent of years for the CVP. The average annual transfer demand volume could increase from about 146,000

[3] In accordance with Monterey Agreement Article 56, SWP contractors may choose to keep a portion of their allocated water in a certain year in project surface conservation facilities and request it in a subsequent year. Article 56 deliveries in this document refers to water that was previously stored in project storage facilities delivered to contractors in a certain year.

acre-feet to about 280,000 acre-feet, assuming an estimated maximum cross-Delta transfer supply of 600,000 acre-feet in any one year. Cross-Delta transfer capacity would restrict the actually realized increase in transfer volumes to less than the amounts stated by an unknown degree, but the increase in the frequency of Cross-Delta transfers would likely occur as predicted as a result of the predicted 14 percent reduction in Delta exports for project deliveries.

CEQA Conclusion: Demands for supplemental water supplies to offset declines in SWP and CVP allocations will increase, and demand for cross-Delta water transfers will increase, due to reductions in SWP and CVP water deliveries. The reductions in SWP and CVP water deliveries under the No Action Alternative as compared to Existing Conditions would be mainly due to a combination of effects of sea level rise and climate change, increased future upstream and in-Delta water demand or in-basin consumptive use (having priority over SWP and CVP rights) and implementation of Fall X2.

4.2.5 Surface Water

The No Action Alternative (ELT) would include continued implementation of existing maintenance, enforcement, and protection programs by federal, state, and local agencies, as well as projects that are permitted or under construction. Under the No Action Alternative (ELT), operations of the SWP CVP facilities would be similar to those under Existing Conditions with the following changes.

- Effects of sea level rise and climate change on system operations as discussed in Section 6.3.1.1, *Quantitative Analysis of Surface Water Resources*, of the Draft EIR/EIS.
- An increase in demands and the buildout of facilities associated with water rights and CVP and SWP contracts of about 443 TAF per year, north of Delta at the future level of development. This is an increase in CVP M&I service contracts (253 TAF per year) and water rights (184 TAF per year) related primarily to urban M&I use, especially in the communities in El Dorado, Placer, and Sacramento Counties.
- An increase in demands associated with SWP contracts, up to full contract amounts, south of Delta at the future level of development. SWP M&I demands, which under the existing level of development vary on hydrologic conditions between 3.0 and 4.1 MAF per year, under the future condition are at maximum contract amounts in all hydrologic conditions. This represents a potential 25% increase on average in south of Delta demands under SWP M&I contracts between existing and future levels of development due to assumed additional development and demographics.
- New urban intake/Delta export facilities:
    - Freeport Regional Water Project (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS for information on additional EBMUD demand of about 26 TAF/YR on the average with increased demand in dry years)
    - 30 million-gallon-per-day City of Stockton Delta Water Supply Project
    - Delta-Mendota Canal–California Aqueduct Intertie
    - Contra Costa Water District Alternative Intake and 55 TAF/YR increased demand
    - South Bay Aqueduct rehabilitation, to 430 cfs capacity, from the junction with California Aqueduct to Alameda County Flood Control and Water Conservation District Zone 7.

- An increase in supplies for wildlife refuges including Firm Level 2 supplies of about 8 TAF per year at the future level of development. In addition, there is a shift in refuge demands from south to north (24 TAF per year reduction in south of Delta and 32 TAF per year increase in north of Delta).
- Implementation of the Fall X2 RPA action (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS), which requires maintenance of X2 at specific locations in wet and above normal years in September and October, plus releases in November to augment Delta outflow depending on hydrology.

A detailed description of the modeling assumptions associated with the No Action Alternative is included in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS. Impacts on surface water conditions related to climate change and sea level rise are further described in Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS.

Model results discussed for this alternative are summarized in Tables B.2-1 through B.2-6.

Section 6.3.2, *Determination of Effects*, of the Draft EIR/EIS includes the criteria used to determine an adverse effect under NEPA or a significant impact under CEQA for the Surface Water Impacts.

SWP CVP Reservoir Storage and Related Changes to Flood Potential

Impact SW-1: Changes in SWP or CVP Reservoir Flood Storage Capacity

Reservoir storage in Shasta Lake, Folsom Lake, and Lake Oroville during the October through June period is compared to the flood storage capacity of each reservoir to identify the number of months when the reservoir storage is close to the flood storage capacity.

Under the No Action Alternative (ELT), the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be fewer than under Existing Conditions, as shown in Tables B.2-1 through B.2-6. The changes in flood storage capacity are due to water releases to meet increased demands under the No Action Alternative (ELT) compared to Existing Conditions, and changes due to sea level rise and climate change. The changes in reservoir flood storage capacity would provide additional flexibility for flood management.

***CEQA Conclusion*:** Under No Action Alternative (ELT) the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be less than under Existing Conditions because of the changes due to higher releases for increased demands under the No Action Alternative, implementation of Fall X2, and changes due to sea level rise and climate change. No Action Alternative (ELT) would not cause consistently higher storages in the upper Sacramento River watershed during the October through June period. Accordingly, No Action Alternative (ELT) would result in a less-than-significant impact on flood management.

Highest Monthly Flows in Sacramento and San Joaquin Rivers and Related Changes to Flood Potential

Impact SW-2: Changes in Sacramento and San Joaquin River Flood Flows

Analysis of monthly flows in high flow conditions could be indicative of the potential for changes in flood management in the Sacramento River at Freeport, San Joaquin River at Vernalis, Sacramento

River upstream of Walnut Grove (downstream of proposed north Delta intake locations), Trinity River downstream of Lewiston Dam, American River downstream of Nimbus Dam, Feather River downstream of Thermalito Dam, and Yolo Bypass at Fremont Weir.

Sacramento River at Bend Bridge

Highest monthly flows that occur in Sacramento River at Bend Bridge are shown in Figures 4.3.2-1 and 4.3.2-2 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by 1% of the channel capacity (100,000 cfs) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3 in Appendix B of this RDEIR/SDEIS. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Sacramento River at Freeport

Highest monthly flows that occur in Sacramento River at Freeport are shown in Figures 4.3.2-3 and 4.3.2-4 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 1% of the channel capacity (110,000 cfs) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

San Joaquin River at Vernalis

Highest monthly flows that occur in San Joaquin River at Vernalis are shown in Figures 4.3.2-5 and 4.3.2-6 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) would increase by no more than 1% of channel capacity under the No Action Alternative (ELT) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3. The changes primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Sacramento River at Locations Upstream of Walnut Grove (downstream of north Delta intakes)

Highest monthly flows that occur in the n the Sacramento River upstream of Walnut Grove are shown in Figures 4.3.2-7 and 4.3.2-8 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 1% of the channel capacity (110,000 cfs) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3 of the Draft EIR/EIS. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Trinity River Downstream of Lewiston Dam

Highest monthly flows that occur in the Trinity River downstream of Lewiston Dam are shown in Figures 4.3.2-9 and 4.3.2-10 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 3% of the channel capacity (6,000 cfs), as shown in Tables B.2-1 through B.2-3. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

American River Downstream of Nimbus Dam

Highest monthly flows that occur in the American River downstream of Nimbus Dam are shown in Figures 4.3.2-11 and 4.3.2-12 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 1% of channel capacity (152,000 cfs), as shown in Tables B.2-1 through B.2-3 of the Draft EIR/EIS. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Feather River Downstream of Thermalito Dam

Highest monthly flows that occur in the Feather River downstream of Thermalito Dam are shown in Figures 4.3.2-13 and 4.3.2-14 during wet years and over the long-term average.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 1% of the channel capacity (210,000 cfs) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Yolo Bypass at Fremont Weir

Water generally spills into Yolo Bypass at Fremont Weir when the combined flows in the Sacramento River and Feather River upstream of Fremont Weir and flows from Sutter Bypass exceed 56,000 cfs. The Yolo Bypass floodplain capacity can accommodate a flow at Fremont Weir up to 343,000 cfs. Highest monthly spills into the Yolo Bypass at Fremont Weir during wet years is shown in Figure 4.3.2-15.

Average of highest spills simulated (flows with probability of exceedance of 10% or less) under the No Action Alternative (ELT) would increase by no more than 1% of the channel capacity (343,000 cfs) as compared to the flows under Existing Conditions, as shown in Tables B.2-1 through B.2-3. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

Overall, the peak flows simulated in CALSIM show increases from 0% to 3% in certain locations under the No Action Alternative (ELT). However, these changes are primarily due to the change in flow patterns due to sea level rise and climate change. As described in Section 6.3.1.2, *Methods for Analysis of Flood Management along Major Rivers*, in Appendix A of this RDEIR/SDEIS, the flood management criteria for maintaining adequate flood storage space in the reservoirs (as defined by the USACE and DWR for flood control release criteria) were not modified to adapt to the changes in runoff due to climate change. No changes in monthly allowable storage values related to CALSIM II model assumptions were included because these changes were not defined under the alternatives to achieve the project objectives or purpose and need for Alternative 4A. If USACE and DWR modify allowable storage values in the future in response to climate change, it is anticipated that the surface water flows and related water supply and water quality conditions would change.

CEQA Conclusion: No Action Alternative (ELT) could result in an increase in potential risk for flood management compared to Existing Conditions because of the changes due to sea level rise and climate change. It is expected that flood management criteria would be modified in the future to reduce risks due to sea level rise and climate change. This potential impact is considered significant.

Reverse Flows in Old and Middle River

Impact SW-3: Change in Reverse Flow Conditions in Old and Middle Rivers

Reverse flow conditions for Old and Middle River flows in all months on a long-term average basis under the No Action Alternative (ELT) are more positive as compared to Existing Conditions, except in April and May. In these months, Old and Middle River flows are less negative due to reduced south Delta exports because of the sea level rise and climate change, increased demands in north of the Delta, and operations to comply with Fall X2 (Figure 4.3.2-16).

CEQA Conclusion: There would be less reverse flows in Old and Middle Rivers under the No Action Alternative (ELT) compared to Existing Conditions in June through March, due to reduced south Delta exports because of sea level rise and climate change, increased demands north of the Delta, and operations to comply with Fall X2. Reverse flows would become more negative in April and May under the No Action Alternative (ELT) compared to Existing Conditions.

Ongoing Plans, Policies, and Programs

The programs, plans, and projects included under the No Action Alternative ELT are summarized in Chapter 3, *Description of Alternatives*, of the Draft EIR/EIS. Most of the projects would not affect surface water resources under the No Action Alternative compared to Existing Conditions. The projects that could potentially affect SWP/ CVP surface water conditions are summarized in Table 6-8 of the Draft EIR/EIS.

CEQA Conclusion: In total, the ongoing programs and plans under the No Action Alternative (ELT) would not result in significant impacts on surface water resources based upon information presented in related environmental documentation.

4.2.6 Groundwater

Delta Region

The effects of the No Action Alternative (ELT) as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 7, *Groundwater*, Section 7.3.3.1 of the Draft EIR/EIS.

Groundwater resources are not anticipated to be substantially affected in the Delta Region under the No Action Alternative (ELT) because surface water inflows to this area are sufficient to satisfy most of the agricultural, industrial, and municipal water supply needs.

Changes in Delta Groundwater Levels. Groundwater levels in the Delta for the No Action Alternative (ELT) would be strongly influenced by surface water flows in the Sacramento River that fluctuate due to moderate sea level rise, climate change and due to surface water operations. Sea level rise under the No Action Alternative (ELT) would be less than that described under the No Action Alternative (LLT), therefore, impacts on the Suisun Marsh area groundwater levels would be less than under the No Action Alternative (LLT). In most other areas of the Delta, groundwater levels under the No Action Alternative (ELT) would be similar to Existing Conditions.

Changes in Delta Groundwater Quality. As described above, groundwater levels would be similar under Existing Conditions and the No Action Alternative (ELT) except for a localized area around Suisun Marsh. Therefore, changes in groundwater conditions under the No Action Alternative (ELT) are not anticipated to alter regional patterns of groundwater flow or quality, compared with Existing Conditions.

Changes in Delta Agricultural Drainage. Changes in agricultural drainage are anticipated to be similar or less under the No Action Alternative (ELT) as compared to the No Action Alternative (LLT). As described in Section 7.3.3.1 of the Draft EIR/EIS, due to fluctuations in groundwater levels that occur with moderate sea level rise and climate change, some areas of the Delta might experience rises in groundwater levels in the vicinity of rivers and in the Suisun Marsh area under the No Action Alternative (ELT) compared to Existing Conditions. This could affect agricultural drainage. However, changes are anticipated to be minor and these areas would be surrounded by larger regional flow patterns that would remain largely unchanged under the No Action Alternative (ELT).

CEQA Conclusion: Groundwater resources are not anticipated to be substantially affected in the Delta Region under the No Action Alternative (ELT) because surface water inflows to this area are sufficient to satisfy most of the agricultural, industrial, and municipal water supply needs. Therefore the No Action Alternative (ELT) would have less than significant impacts on Delta groundwater levels, groundwater quality, and agricultural drainage because changes in groundwater flows and groundwater use are not anticipated to occur due to the abundant surface water in the Delta.

SWP CVP Export Service Areas

Under the No Action Alternative (ELT), surface water supplies to the Export Service Areas would continue to decline based on water modeling and operational assumptions described in Chapters 5 and 6 in the Draft EIR/EIS which project reductions in SWP/CVP water supply availability, compared to Existing Conditions. In addition, decreases in SWP/CVP surface water deliveries in the Export Service Areas for the No Action Alternative (ELT) compared to Existing Conditions also occur due to sea level rise and climate change, as described in Chapter 5, *Water Supply*, in the Draft EIR/EIS.

CVHM simulation assumptions for the No Action Alternative (ELT) are similar to those for the No Action Alternative (LLT).

Groundwater conditions under the No Action Alternative (ELT) (with future projected sea level rise and climate change at approximately year 2025) compared to Existing Conditions are provided in the descriptions that follow. The comparison is made through a review of simulated groundwater resources conditions in the San Joaquin and Tulare Basins.

CEQA Conclusion:

San Joaquin Basin

Forecasted groundwater flow in the San Joaquin Basin under the No Action Alternative (ELT) is generally toward the San Joaquin River from the margins of the basin and to the northwest toward the Delta. As compared to Existing Conditions, groundwater levels would decline by up to 10 feet beneath the Corcoran Clay in portions of the San Joaquin Basin (see Figure 4.2.3-1) under the No Action Alternative (ELT). This reduction in groundwater levels could substantially affect groundwater resources in the San Joaquin Basin by reducing well yields of nearby agricultural and municipal wells. Therefore, the No Action Alternative (ELT).would result in a significant impact on groundwater resources.

Tulare Basin

Forecasted groundwater flow in the Tulare Basin under the No Action Alternative (ELT) is complex because of the spatially variable water use over such a large area. Forecasted groundwater flow in the Tulare Basin is generally away from the margins of the basin toward areas of substantial groundwater production. As compared to Existing Conditions, groundwater levels would decline up to 100 feet with a small area that could see water level declines of as much as 250 feet beneath the Corcoran Clay in dry years in portions of the Tulare Basin irrigated areas, notably the Westside and Northern Pleasant Valley basins (WBS 14) in the western portion (see Figure 4.2.3-1) under the No Action Alternative (ELT). The forecasted maximum groundwater level changes occur in August because agricultural groundwater pumping is typically highest during this month.

The anticipated reduction in groundwater levels could substantially affect groundwater resources in the Tulare Basin in terms of affecting well yields of nearby agricultural and municipal wells, groundwater supplies, and groundwater recharge and therefore, the No Action Alternative (ELT) would result in a significant impact on groundwater resources.

The increase in groundwater pumping that could occur under the No Action Alternative (ELT) compared to Existing Conditions in portions of the Export Service Areas in response to reduced SWP/CVP water supply availability could induce the local migration of poor-quality groundwater into areas of good-quality groundwater. However, it is not anticipated to alter regional groundwater flow patterns and would not be considered a significant impact on groundwater quality.

Other Portions of the Export Service Areas

The total long-term average annual water deliveries to the CVP and SWP Export Service Areas in portions outside of the Central Valley under the No Action Alternative (ELT) would be slightly less than under Existing Conditions, but more than under No Action Alternative (LLT). The reduction in surface water deliveries could result in an increase in groundwater pumping and the associated decrease in groundwater levels. The anticipated reduction in groundwater levels could substantially affect groundwater resources in the in terms of affecting well yields of nearby agricultural and municipal wells, groundwater supplies, and groundwater recharge. Therefore, the No Action Alternative (ELT) would have a significant impact on groundwater resources.

However, in the Central Coast and Southern California, overdrafted basins have, for the most part, been adjudicated to control the amount of pumping, thus reducing the amount of groundwater resource availability. In addition, many groundwater basins in the San Francisco Bay Area, Central Coast, and Southern California rely on SWP CVP surface water to recharge groundwater basins.

4.2.7 Water Quality

The analysis of effects of the No Action Alternative (ELT) on boron, bromide, chloride, DOC, EC, and nitrate in the Delta and SWP/CVP Export Service Areas is based on modeling conducted for the No Action Alternative in the ELT, which assumed no implementation of Yolo Bypass improvements or tidal habitat restoration. However, as described in Section 4.1.6, *Assumptions for Purpose of Analysis*, of the RDEIR/SDEIS, enhancements to the Yolo Bypass and 8,000 acres of tidal habitat restoration areas would be developed under the No Action Alternative (ELT). In general, the significance of this difference is the assessment of bromide, chloride and EC for the No Action Alternative (ELT), relative to Existing Conditions, likely underestimates increases in bromide, EC, and chloride that could occur, particularly in the west Delta. Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of the No Action Alternative (ELT).

Impact WQ-1: Effects on Ammonia Concentrations Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on ammonia levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT) discussed in Chapter 8, *Water Quality*, Section 8.3.3.1, in the Draft EIR/EIS. This is because factors which affect ammonia levels in these areas would be similar at the ELT and LLT timeframes. The Sacramento Regional County Sanitation District will have completed modifications to the Sacramento Regional Wastewater Treatment Plant (SRWTP) in the ELT that will substantially reduce ammonia in the treated wastewater discharge and thus substantially lower concentrations of ammonia in the Sacramento River downstream of the SRWTP relative to Existing Conditions. A substantial decrease in Sacramento River ammonia concentrations is expected to decrease ammonia concentrations for all areas that are influenced by Sacramento River water, which includes various locations in the Delta and at Jones and Banks Pumping Plants where Delta water is exported to the SWP/CVP Export Service Areas. At locations which are not influenced notably by Sacramento River water, concentrations are expected to remain relatively unchanged relative to Existing Conditions. Based on these factors and for the reasons described for the No Action Alternative (LLT) in Section 8.3.3.1 in the Draft EIR/EIS, the effects on ammonia from implementing the No Action Alternative (ELT) would not be adverse.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on ammonia levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT). This is because factors that would directly affect ammonia levels in the surface waters of these areas are expected to be similar in the ELT and LLT. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because ammonia concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant.

Impact WQ-3: Effects on Boron Concentrations Resulting from Existing Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on boron concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. There would be no expected change to the sources of boron in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases and river flows upstream of the Delta would have negligible, if any, effect on the concentration of boron in the rivers and reservoirs of these watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly compared to Existing Conditions in association with climate change and increased water demands. The reduced flow would result in possible increases in long-term average boron concentrations of up to about 0.5% relative to the Existing Conditions (Table Bo-1 in Appendix B of this RDEIR/SDEIS). Consequently, the increases in lower San Joaquin River boron levels under the No Action Alternative (ELT), relative to Existing Conditions, would be small and not adversely affect any beneficial uses of the lower San Joaquin River.

Delta

Relative to Existing Conditions, the No Action Alternative (ELT) would result in similar or decreased long-term annual average boron concentrations at all of the Delta assessment locations for the 16-year period modeled (i.e., 1976–1991) (Table Bo-2 in Appendix B of this RDEIR/SDEIS). For the drought year period modeled (i.e., 1987–1991), the No Action Alternative (ELT) would result in increased annual average concentrations only at the Sacramento River at Emmaton (i.e., up to a maximum 3% increase) relative to Existing Conditions.

With respect to the 2,000 µg/L EPA drinking water human health advisory objective (i.e., for children) and agricultural objective of 500 µg/L contained in the San Francisco Bay RWQCB (Region 2) Basin Plan, the long-term annual average boron concentrations, for either the 16-year period or drought period modeled, are low and would not exceed these objectives at any of the eleven Delta assessment locations (Table Bo-3 in Appendix B of this RDEIR/SDEIS). The maximum long-term average concentration of about 417 µg/L in the Sacramento River at Mallard Island under the No Action Alternative (ELT) represents a slight decrease from the Existing Conditions. Accordingly, the long-term assimilative capacity with respect to both objectives would not change substantially, thus boron levels that may occur under the No Action Alternative (ELT), relative to Existing Conditions, would not be expected to adversely affect municipal water supply beneficial uses of the Delta.

SWP/CVP Export Service Areas

Under the No Action Alternative (ELT), a relatively small increase would occur in the long-term average boron concentration at the Jones Pumping Plant, relative to the Existing Conditions (i.e., up to 1% for both the 16-year and drought period modeled) and a small decrease would occur at the Banks Pumping Plant (i.e., reduced 1%) (Table Bo-2 in Appendix B of this RDEIR/SDEIS). The small change in boron concentrations exported from the Delta would not be expected to measurably affect boron levels in the lower San Joaquin River at Vernalis or the existing CWA Section 303(d) impairment in the lower San Joaquin River and associated TMDL actions for reducing boron loading.

In summary, the effects of additional future climate change/sea level rise under the No Action Alternative (ELT) condition would result in relatively small changes in long-term average boron concentrations in the lower San Joaquin River and several Delta locations. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality. The changes to long-term and monthly average boron concentrations at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service areas under the No Action Alternative (ELT) would be similar or lower in magnitude relative to effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 in the Draft EIR/EIS.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on boron levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT). This is because factors that would directly affect boron levels in the surface waters of these areas are expected to be similar at the ELT and LLT timeframes. As such, the No Action Alternative (ELT) is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because boron concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Additionally, the changes in long-term average boron concentrations in exported water would not result in further degradation or the existing impairment and CWA Section 303(d) listing of boron in the lower San Joaquin River for the agricultural water supply beneficial use to be discernibly worse. Boron is not a bioaccumulative constituent, thus any increased concentrations under the No Action Alternative (ELT) would not result in adverse boron bioaccumulation effects to aquatic life or humans. Based on these findings, this impact is determined to be less than significant.

Impact WQ-5: Effects on Bromide Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on bromide concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, because factors affecting bromide concentrations in these water bodies would be the same in the ELT. There would be no expected change to the sources of bromide in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of bromide in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions in association with climate change and increased water demands, but the associated change would less in the LLT, and any associated bromide increase would not be substantial, as described for the LLT. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, the No Action Alternative (ELT) would not be expected to adversely affect the MUN beneficial use, or any other beneficial uses, of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta due to changes in bromide concentrations.

Delta

Estimates of bromide concentrations at Delta assessment locations were generated using a mass balance approach, and using relationships between EC and chloride and between chloride and bromide and DSM2 EC output. See Chapter 8, *Water Quality*, Section 8.3.1.3 in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in bromide at Delta assessment locations based on both approaches.

Relative to Existing Conditions, the No Action Alternative (ELT) would result in small decreases in long-term average bromide concentrations at all modeled Delta assessment locations except the Sacramento River at Emmaton (Table Br-1 in Appendix B of this RDEIR/SDEIS). For the entire period modeled (1976–1991) the long-term average increase in bromide concentration at Emmaton would be <1%. Long-term average concentrations of seawater-derived constituents generally decrease under the No Action Alternative (ELT) relative to Existing Conditions because the No Action Alternative (ELT) includes Fall X2 operations, while Existing Conditions does not (Appendices 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Condition*, and 5A, *BDCP/EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS). Therefore, even though sea level rise is included in the No Action Alternative (ELT), and not in Existing Conditions, the effect of Fall X2 on bromide is generally greater than sea level rise.

The modeled frequency with which bromide concentrations would exceed bromide thresholds would change only slightly at Delta assessment locations (Table Br-1 in Appendix B of this RDEIR/SDEIS). Small increases in exceedance of 100 μg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts, would occur at some Delta interior and western Delta assessment locations. In the Delta interior at Rock Slough and Franks Tract, the frequency of exceeding 100 μg/L would increase by up to 2%. In the western Delta, the frequency of exceeding 100 μg/L would increase by up to 5% at Emmaton. As described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, the resulting bromide concentrations would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, particularly when considering the relatively small change in long-term annual average concentration.

Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent with the discussion above, and assessment of bromide using these data results in the same conclusions as are presented above for the mass-balance approach (Table Br-2 in Appendix B of this RDEIR/SDEIS).

SWP/CVP Export Service Areas

Under the No Action Alternative (ELT), long-term average bromide concentrations at the Banks and Jones Pumping Plants would decrease by as much as 6% relative to Existing Conditions (Table Br-1 in Appendix B of this RDEIR/SDEIS), based on the mass balance modeling results. The frequency with which bromide would exceed bromide concentration thresholds at the Banks and Jones Pumping Plants, relative to Existing Conditions, would remain unchanged (Table Br-1 in Appendix B of this RDEIR/SDEIS). Consequently water exported into the SWP/CVP Export Service Areas through these south Delta pumps would be of similar or slightly better quality with regard to bromide under the No Action Alternative (ELT), relative to Existing Conditions. Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent these results, and assessment of bromide using these modeling results leads to the same conclusions as presented for the mass balance approach (Table Br-2 in Appendix B of this RDEIR/SDEIS).

In summary, the effects of additional future climate change/sea level rise under the No Action Alternative (ELT) condition would result in relatively small changes in long-term average bromide concentrations in the lower San Joaquin River and several Delta locations. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality. The changes to long-term and monthly average boron concentrations at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service areas under the No Action Alternative (ELT) would be similar or lower in magnitude relative to effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS.

Maintenance of SWP and CVP facilities under the No Action Alternative (ELT) would not be expected to create new sources of bromide or contribute towards a substantial change in existing sources of bromide in the affected environment. Maintenance activities would not be expected to cause any substantial change in bromide such that MUN beneficial uses, or any other beneficial use, would be adversely affected anywhere in the affected environment.

CEQA Conclusion: While greater water demands under the No Action Alternative (ELT) would alter the magnitude and timing of reservoir releases north and east of the Delta, these activities would have negligible, if any, effect on the sources of bromide, and ultimately the concentration of bromide in the Sacramento River, the San Joaquin River, the eastside tributaries, and the various reservoirs of the related watersheds, as described for the No Action Alternative (LLT).

Relative to Existing Conditions, the No Action Alternative (ELT) would result in small decreases in average bromide concentrations at all modeled Delta assessment locations except the Sacramento River at Emmaton, where the bromide concentration would increase, though by <1%. Small increases in bromide threshold exceedances would occur at some Delta interior and western Delta assessment locations, including Rock Slough, Franks Tract, and Emmaton, but the resulting conditions would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

The assessment of effects on bromide in the SWP/CVP Export Service Areas is based on assessment of changes in bromide concentrations at Banks and Jones Pumping Plants Average bromide concentrations at the Banks and Jones Pumping Plants are predicted to decrease by as much as 6% relative to Existing Conditions while exceedance of bromide concentration thresholds at the Banks and Jones Pumping Plants would remain unchanged.

Based on the above, the No Action Alternative (ELT) would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide. The No Action Alternative (ELT) would not result in any substantial change in long-term average bromide concentration or exceed 50 and 100 µg/L assessment threshold concentrations by frequency, magnitude, and geographic extent that would result in adverse effects on any beneficial uses within affected water bodies. Bromide is not a bioaccumulative constituent and thus concentrations under this alternative would not result in bromide bioaccumulating in aquatic organisms. Increases in exceedances of the 100 µg/L assessment threshold concentration would be 5% or less at all locations assessed, which is considered to be less-than substantial long-term degradation of water quality. The levels of bromide degradation that may occur under the No Action Alternative (ELT) would not be of sufficient magnitude to cause substantially increased risk for adverse effects on any beneficial uses of water bodies within the affected environment. Bromide is not CWA Section 303(d) listed and thus the minor increases in long-term average bromide concentrations would not affect existing beneficial use impairment because no such use impairment currently exists for bromide. Based on these findings, this impact is less than significant.

Impact WQ-7: Effects on Chloride Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on chloride concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, because factors affecting chloride concentrations in these water bodies would be the same in the early long-term timeframe. There would be no expected change to the sources of chloride in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of chloride in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions in association with climate change and increased water demands, but the associated change would less than under the LLT, and any associated chloride increase would be less than substantial, as described for the LLT. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, the No Action Alternative (ELT) would not be expected to cause exceedance of chloride objectives or substantially degrade water quality with respect to chloride and thus would not adversely affect any beneficial uses of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta.

Delta

Estimates of chloride concentrations at Delta assessment locations were generated using a mass balance approach and EC chloride relationships and DSM2 EC output. See Chapter 8, *Water Quality*, Section 8.3.1.3, of the Draft EIR/EIS for more information regarding these modeling approaches. The assessment below identifies changes in chloride at Delta assessment locations based on both approaches.

Relative to Existing Conditions, the mass balance modeling predicts that the No Action Alternative (ELT) would result in similar, or in small decreases in, long-term average chloride concentrations for the 16-year period modeled (i.e., 1976–1991) at all Delta assessment locations except the Sacramento River at Emmaton and the San Joaquin River at Antioch (in Appendix B of this RDEIR/SDEIS Table Cl-4 in Appendix B of this RDEIR/SDEIS). In the Sacramento River at Emmaton, there would be a 1 mg/L (<1%) increase in the long-term average chloride concentration, and 49 mg/L (10%) increase in the drought period modeled (i.e., 1987–1991) chloride concentration. This increase is less than the increase that would occur under Alternative 4 (LLT). At Antioch, the long-term average chloride concentration would decrease, but the drought period concentration would increase by 4 mg/L (<1%). Long-term average concentrations of seawater-derived constituents would generally decrease under the No Action Alternative (ELT) relative to Existing Conditions because the No Action Alternative (ELT) includes Fall X2, while Existing Conditions does not (Appendices 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and*

Cumulative Impact Condition, and 5A, *BDCP/EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS). Therefore, even though sea level rise is included in the No Action Alternative (ELT), and not in Existing Conditions, the effect of Fall X2 on chloride is generally greater than sea level rise.

The comparison to Existing Conditions reflects changes in chloride due to both increased demands and changed hydrology and Delta hydrodynamic conditions associated with climate change and sea level rise. The following outlines the modeled chloride changes relative to the applicable objectives and effects on beneficial uses in Delta waters.

Municipal and Industrial Beneficial Uses Relative to Existing Conditions

Estimates of chloride concentrations generated using EC chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses on a basis of the percent of years the chloride objective would be exceeded for the 16-year period modeled. The objective is exceeded if chloride concentrations exceed 150 mg/L for a specified number of days in a given water year at Antioch or Contra Costa Pumping Plant #1. For the No Action Alternative (ELT), the frequency of objective exceedance would decrease relative to Existing Conditions. The frequency of exceedance of the 150 mg/L objective is predicted to be 6.7% of years under Existing Conditions and 0% under the No Action Alternative (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Evaluation of the 250 mg/L Bay-Delta WQCP objective for chloride utilized results from both the mass balance approach and EC chloride relationships. The basis for the evaluation was the predicted number of days the objective would be exceeded for the modeled 16-year period.

Based on the mass-balance approach, there would be an increased frequency of exceedance of the 250 mg/L objective under the No Action Alternative (ELT), relative to Existing Conditions, in the Sacramento River at Emmaton, the San Joaquin River at Antioch, and the Sacramento River at Mallard Island. At Emmaton, the frequency of objective exceedance would increase from 55% under Existing Conditions to 60% under the alternative during the drought period; when the entire modeled period is considered, there would be a decrease in the frequency of objective exceedance. At Antioch, the frequency of objective exceedance would increase from 66% to 70% for the entire period modeled, and from 82% to 85% during the drought period modeled. In the Sacramento River at Mallard Island, the frequency of objective exceedance would increase from 85% to 86% for the entire period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS).

The mass balance results also indicate reduced assimilative capacity with respect to the 250 mg/L objective during certain months and locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in March and April of up to 20% for the 16-year period modeled, and a 52% reduction during the drought period modeled (Table Cl-10 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced, in February and March, by up to 11%.

When utilizing the EC-chloride relationship to model chloride concentrations for the 16-year period, trends in frequency of exceedance of the 250 mg/L objective and use of assimilative capacity are similar to that discussed above for the mass balance modeling approach (Tables Cl-3 and Cl-11 in Appendix B of this RDEIR/SDEIS).

Based on the additional predicted seasonal and annual exceedances of Bay Delta WQCP objectives for chloride, and the associated long-term water quality degradation and use of assimilative capacity, the potential exists for adverse effects on the municipal and industrial beneficial uses in the western Delta, particularly at Antioch, through reduced opportunity for diversion of water with acceptable chloride levels.

CWA Section 303(d) Listed Water Bodies–Relative to Existing Conditions

Tom Paine Slough in the southern Delta is on the state's CWA Section 303(d) list for chloride with respect to the secondary MCL of 250 mg/L. Monthly average chloride concentrations at the Old River at Tracy Road for the 16-year period modeled, which represents the nearest DSM2-modeled location to Tom Paine Slough, would be well below the MCL and generally would be similar to Existing Conditions (Figure Cl-1 in Appendix B of this RDEIR/SDEIS).

Suisun Marsh also is on the state's CWA Section 303(d) list for chloride in association with the Bay-Delta WQCP objectives for maximum allowable salinity during the months of October through May, which establish appropriate seasonal salinity conditions for fish and wildlife beneficial uses. The Sacramento River at Mallard Island, Sacramento River at Collinsville, and Montezuma Slough at Beldon's Landing within the marsh are DSM2-modeled locations representative of source water quality conditions for the marsh that is supported by inflowing flood tide waters from the west, and ebb tide flows of Sacramento River water into Montezuma Slough through the Suisun Marsh Salinity Control Gates located near Collinsville. Long-term average chloride concentrations at the Sacramento River at the Mallard Island for the 16-year period modeled would decrease by 93 mg/L (-4%) relative to Existing Conditions (Table Cl-4 in Appendix B of this RDEIR/SDEIS). The plots of monthly average chloride concentrations for the Sacramento River at Collinsville (Figure Cl-3 in Appendix B of this RDEIR/SDEIS) and Montezuma Slough at Beldon's Landing (Figure Cl-4 in Appendix B of this RDEIR/SDEIS) for the 16-year period modeled indicate that, relative to Existing Conditions, chloride concentrations would be similar or lower during the months of October through May. Consequently, chloride concentrations at Tom Paine Slough and Suisun Marsh would not be further degraded on a long-term basis or adversely affect necessary actions to reduce chloride loading for any TMDLs developed.

SWP/CVP Export Service Areas

Under the No Action Alternative (ELT), long-term average chloride concentrations at the Banks and Jones Pumping Plants would decrease by 6% and 5%, respectively, relative to Existing Conditions for the 16-year period modeled, based on mass-balance modeling results (Table Cl-4 in Appendix B of this RDEIR/SDEIS). However, the frequency of objective exceedance would increase at both pumping plants, relative to Existing Conditions, for both the 16-year period and the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). Results of the modeling approach which utilized a EC chloride relationship are consistent these results, and assessment of chloride using these modeling output results in the same conclusions as for the mass-balance approach (Table Cl-3 and Table Cl-5 in Appendix B of this RDEIR/SDEIS).

Maintenance of SWP and CVP facilities under the No Action Alternative (ELT) would not be expected to create new sources of chloride or contribute towards a substantial change in existing sources of chloride in the affected environment. Maintenance activities would not be expected to cause any substantial change in chloride such that any beneficial uses would be adversely affected anywhere in the affected environment.

CEQA Conclusion**:** Chloride is not a constituent of concern in the Sacramento River watershed upstream of the Delta, thus river flow rate and reservoir storage reductions that would occur under the No Action Alternative (ELT), relative to Existing Conditions, would not be expected to result in a substantial adverse change in chloride levels. Additionally, relative to Existing Conditions, the No Action Alternative (ELT) would not result in reductions in river flow rates (i.e., less dilution) or increased chloride loading such that there would be any substantial increase in chloride concentrations upstream of the Delta in the San Joaquin River watershed.

It is expected there would be changes in Delta chloride levels in response to a shift in the Delta source water percentages under this alternative or some degradation of these water bodies. Relative to Existing Conditions, the No Action Alternative (ELT) would result in increased chloride concentrations such that frequency of exceedance of the 250 mg/L Bay-Delta WQCP objective would increase in the San Joaquin River at Antioch (by 4%) and in the Sacramento River at Mallard Island (by 1%), and long-term degradation may occur, that may result in adverse effects on the municipal and industrial water supply beneficial use. With respect to CWA Section 303(d) listings, the similar average chloride concentrations would not cause further degradation on a long-term basis that would adversely affect necessary actions to reduce chloride loading for any TMDLs developed for Tom Paine Slough and Suisun Marsh.

Long-term average chloride concentrations would be reduced in water exported from the Delta to the CVP/SWP Export Service Areas thus reflecting a potential improvement to chloride loading in the lower San Joaquin River.

Chloride is not a bioaccumulative constituent, thus any increased concentrations under the No Action Alternative (ELT) would not result in adverse chloride bioaccumulation effects to aquatic life or humans.

Based on these findings, this impact is determined to be significant due to increased chloride concentrations and objective exceedances, and additional long-term degradation, in the western Delta and associated effects on the municipal and industrial water supply beneficial uses.

Impact WQ-9: Effects on Dissolved Oxygen Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because the factors that would affect DO levels in the surface waters of these areas would be the same in the ELT as in the LLT. For the reasons described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, the effects on DO from implementing the No Action Alternative (ELT) is determined to not be adverse.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT). This is because the factors that would affect DO levels in the surface waters of these areas would be similar in the ELT and LLT. There would be no substantial, and likely no measurable, long-term change in DO levels Upstream of the Delta, in the Plan Area, or the SWP/CVP Export Service Areas under the No Action Alternative relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would adversely affect beneficial uses. Because no substantial changes in DO levels are expected, long-term water quality degradation would not be expected, and, thus, beneficial uses would not be expected to be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels are expected, greater degradation and impairment of these areas is not expected to occur. Based on these findings, this impact is considered less than significant.

Impact WQ-11: Effects on Electrical Conductivity Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on EC levels in reservoirs and rivers upstream of the Delta would be similar to those effects described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. The extent of new urban growth would be less in the early long-term, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further loading of EC-related parameters to tributaries. Based on these considerations, and those described in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, EC levels (highs, lows, typical conditions) in the Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under the No Action Alternative (ELT) could occur, but would be slightly less than those described for No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because the effects of climate change and increase water demands on flows, which could effect dilution of high EC discharges, would be less in the early long-term. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

Similar to the No Action Alternative (LLT), the No Action Alternative (ELT) would result in a fewer number of days when interior and southern Bay-Delta WQCP compliance locations would exceed EC objectives or be out of compliance with the EC objectives (Table EC-1 in Appendix B of this RDEIR/SDEIS). However, western Delta locations—Sacramento River at Emmaton and San Joaquin River at Jersey Point (fish and wildlife objective)—would experience an increased frequency of exceedance of EC objectives, where sea level rise and increased water demands would combine to cause increases in EC, relative to Existing Conditions (Table EC-1 in Appendix B of this RDEIR/SDEIS). The number of days the EC levels would exceed objectives and be out of compliance at these locations would be less at the ELT than the LLT. Further, average EC levels at western, interior, and southern Delta compliance locations, other than the Sacramento River at Emmaton, would decrease relative to Existing Conditions. The increase in exceedances at Jersey Point would be from 0% under Existing Conditions to 3% under No Action Alternative (ELT), which represents a very small increase for this objective. Further discussion of EC increases relative to this objective can be found in Appendix 8H, *Electrical Conductivity* Attachment 2 in Appendix A of this

RDEIR/SDEIS. Average EC at Emmaton would increase by 1% for the entire modeled period (1976–1991) and 11% for the drought period modeled (1987–1991), relative to Existing Conditions (Table EC-2 in Appendix B of this RDEIR/SDEIS), similar to increases that would occur in the LLT. Given that the western Delta is CWA Section 303(d) listed as impaired due to elevated EC the increase in the incidence of exceedance of EC objectives and average EC levels at Emmaton has the potential to contribute to additional impairment and adversely affect beneficial uses.

Also similar to the No Action Alternative (LLT), relative to Existing Conditions, the No Action Alternative (ELT) would result in increased average EC in Suisun Marsh during the months of January through May. The average EC increases would be lower in magnitude than in the LLT, ranging from 0.1–0.4 mS/cm, depending on the location and month (Tables EC-3 through EC-7 in Appendix B of this RDEIR/SDEIS). For the reasons described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, the small increase in EC relative to Existing Conditions would not be expected to adversely affect beneficial uses of Suisun Marsh under the No Action Alternative (ELT). While Suisun Marsh is CWA Section 303(d) listed as impaired because of elevated EC, the potential increases in long-term average EC concentrations, relative to Existing Conditions, would not be expected to contribute to additional impairment, because the increase would be so small (<1 mS/cm) as to not be measurable and beneficial uses would not be adversely affected.

SWP/CVP Export Service Areas

The frequency of exceedance of EC objectives at the Banks and Jones Pumping Plants under the No Action Alternative (ELT) would be slightly higher than that described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS (Table EC-2 in Appendix B of this RDEIR/SDEIS). The frequency of exceedance of the Bay-Delta WQCP 1,000 μmhos/cm objective would increase from 1% to 3% at Banks Pumping Plant and from 0% to 1% at Jones Pumping Plant. However, similar to the No Action Alternative (LLT), average EC levels for the entire period modeled would decrease at the Banks and Jones Pumping Plants relative to Existing Conditions in the ELT time period (Table EC-2 in Appendix B of this RDEIR/SDEIS). For the reasons described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1, the slight increase in frequency of exceedance of the EC objective under the No Action Alternative (ELT) would not be expected to adversely affect agricultural beneficial uses of this water. Further, the No Action Alternative (ELT) would not cause long-term degradation of EC levels in the SWP/CVP Export Service Areas, relative to Existing Conditions or contribute to additional CWA Section 303(d) impairment related to elevated EC in the SWP CVP Export Service Areas waters, because long-term average EC levels would be lower in the exported water. The lower average EC in the exported water would be expected to result in an improvement in lower San Joaquin River EC levels, as these levels are related, in part, by the irrigation deliveries from the Delta.

In summary, the increased frequency of exceedance of EC objectives and increased drought period average EC levels that would occur in the western Delta under the No Action Alternative (ELT) would contribute to adverse effects on the agricultural beneficial uses. Given that the western Delta is Clean Water Act Section 303(d) listed as impaired due to elevated EC, the increase in the incidence of exceedance of EC objectives and increases in drought period average EC in the western Delta under the No Action Alternative has the potential to contribute to additional beneficial use impairment. These increases in EC constitute an adverse effect on water quality.

***CEQA Conclusion*:** River flow rate and reservoir storage reductions that would occur under the No Action Alternative (ELT), relative to Existing Conditions, would not be expected to result in a substantial adverse change in EC levels in the reservoirs and rivers upstream of the Delta, given that: changes in the quality of watershed runoff and reservoir inflows would not be expected to occur in the future; the state's aggressive regulation of point-source discharge effects on Delta salinity-elevating parameters and the expected further regulation as salt management plans are developed; the salt-related TMDLs adopted and being developed for the San Joaquin River; and the expected improvement in lower San Joaquin River average EC levels commensurate with the lower EC of the irrigation water deliveries from the Delta.

Relative to Existing Conditions, the No Action Alternative (ELT) would not result in any substantial increases in long-term average EC levels in the SWP CVP Export Service Areas At the Jones and Banks Pumping Plants there would be only a, respective, 1–2% increase in exceedance of the EC objective when the entire period modeled is considered. Average EC levels for the entire period modeled would decrease at both plants. Because the EC objective is for agricultural beneficial use protection, for which longer-term crop exposure to elevated EC waters is a concern, the minimal increase in the frequency of exceedance of the EC objective at the pumping plants for the entire period modeled coupled with the long-term average decrease in EC levels at the pumping plants would not adversely affect this beneficial use.

In the Plan Area, the No Action Alternative (ELT) would result in an increase in the frequency with which Bay-Delta WQCP EC objectives are exceeded in the Sacramento River at Emmaton. Further, long-term average EC levels would increase by 1% for the entire period modeled and 11% during the drought period modeled at Emmaton. The increases in drought period average EC levels that would occur in the Sacramento River at Emmaton would further degrade existing EC levels and thus contribute additionally to adverse effects on the agricultural beneficial use. Because EC is not bioaccumulative, the increases in long-term average EC levels would not directly cause bioaccumulative problems in aquatic life or humans. The western Delta is CWA Section 303(d) listed for elevated EC and the increases in long-term average EC and increased frequency of exceedance of EC objectives that would occur in the Sacramento River at Emmaton could make beneficial use impairment measurably worse. This impact is considered significant.

Impact WQ-13: Effects on Mercury Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on mercury levels in surface waters upstream of the Delta relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 in the Draft EIR/EIS. This is because factors which affect mercury concentrations in surface waters upstream of the Delta are similar in the ELT and LLT under the No Action Alternative. For the reasons stated for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, any modified reservoir operations and subsequent changes in river flows at the ELT, relative to Existing Conditions, are expected to have negligible, if any, effects on average reservoir and river mercury concentrations in the Sacramento River watershed upstream of the Delta. Any negligible changes in mercury concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to mercury. Both waterborne methylmercury concentrations and largemouth bass fillet mercury concentrations are expected to remain above guidance levels at upstream of Delta locations, but will not change substantially relative to Existing Conditions due to changes in flows under the No Action Alternative (ELT).

Delta

Similar to the No Action Alternative (LLT), the No Action Alternative (ELT) would have very little effect on mercury or methylmercury concentrations in the Delta (Tables Hg-1 and Hg-2 in Appendix B of this RDEIR/SDEIS), to the extent that these changes would likely not be measurable. Because of this, use of assimilative capacity for mercury would be negligible. Any small changes would not be expected to result in adverse effects to beneficial uses.

Similarly, estimates of fish tissue mercury concentrations and exceedance quotients show almost no differences would occur among sites for the No Action Alternative (ELT) as compared to Existing Conditions for the Delta sites (Tables Hg-3 and Hg-4 in Appendix B of this RDEIR/SDEIS). Peak exceedance quotients for drought conditions are all at the San Joaquin River at Buckley Cove (4.3 for Existing Conditions; 4.6 for the No Action Alternative (ELT); Eq2 model, Table Hg-4 in Appendix B of this RDEIR/SDEIS). These small differences of less than 10% are not expected to further degrade water quality, with regards to mercury, by measurable levels, and thus beneficial use impairment would not be made discernibly worse. Similar to waterborne concentrations of methylmercury, the fish tissue concentrations and exceedance quotients would be highest at the San Joaquin River, Buckley Cove site during drought years (Tables Hg-3 and Hg-4 in Appendix B of this RDEIR/SDEIS). All modeled fish tissue mercury concentrations exceed tissue guidelines, with exceedance quotients greater than 1 (Tables Hg-3 and Hg-4 in Appendix B of this RDEIR/SDEIS). Because the increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I, *Mercury*, in Appendix A of this RDEIR/SDEIS, for a complete discussion of the uncertainty associated with the fish tissue estimates.

The bioaccumulation models contain multiple sources of uncertainty associated with their development. These are related to: analytical variability; temporal and/or seasonal variability in Delta source water concentrations of methylmercury; interconversion of mercury species (i.e., the non-conservative nature of methylmercury as a modeled constituent); and limited sample size (both in number of fish and time span over which the measurements were made), among others. Although there is considerable uncertainty in the models used, the results serve as a reasonable approximations of a very complex process. Considering the uncertainty, small (i.e., <20–25%) increases or decreases in modeled fish tissue mercury concentrations at a low number of Delta locations (i.e., 2–3) should be interpreted to be within the uncertainty of the overall approach, and not predictive of actual adverse effects. Larger increases, or increases evident throughout the Delta, can be interpreted as more reliable indicators of potential adverse effects.

SWP/CVP Export Service Areas

The analysis of mercury and methylmercury in the SWP/CVP Export Service Areas was based on concentrations estimated at the Banks and Jones Pumping Plants. Concentrations changes at these locations are expected to be very small, and likely not measurable. Thus, any change in use of assimilative capacity is also expected to be small and not measurable. Any increases in mercury concentrations that may occur in water exported via Banks and Jones Pumping Plants are not expected to result in adverse effects to beneficial uses or substantially degrade the quality of exported water, with regards to mercury.

Relative to Existing Conditions, the No Action Alternative (ELT) would result in small changes (less than 3%) in estimated methylmercury concentrations in largemouth bass. All modeled methylmercury concentrations in largemouth bass exceed fish tissue guidelines (Tables Hg-5 through Hg-8 in Appendix B of this RDEIR/SDEIS).

CEQA Conclusion**:** Under the No Action Alternative (ELT), greater water demands and climate change would alter the magnitude and timing of reservoir releases and river flows upstream of the Delta in the Sacramento River watershed and east-side tributaries, relative to Existing Conditions. Concentrations of mercury and methylmercury upstream of the Delta will not be substantially different relative to Existing Conditions due to the lack of important relationships between mercury/methylmercury concentrations and flow for the major rivers.

Methylmercury concentrations exceed criteria at all locations in the Delta for Existing Conditions and no assimilative capacity exists. However, monthly average waterborne concentrations of total and methylmercury, over the period of record, are very similar to each other among Alternatives. Similarly, estimates of fish tissue mercury concentrations show almost no differences would occur among sites for the No Action Alternative (ELT) as compared to Existing Conditions for Delta sites.

Assessment of effects of mercury in the SWP and CVP Export Service Areas were based on effects on mercury concentrations and fish tissue mercury concentrations at the Banks and Jones Pumping Plants. The Banks and Jones Pumping Plants are expected to show very small concentration changes or changes in fish tissue concentration of mercury for the No Action Alternative (ELT) as compared to Existing Conditions.

As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, the No Action Alternative (ELT) would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, this impact is considered less than significant.

Impact WQ-15: Effects on Nitrate Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on nitrate levels in surface waters upstream of the Delta relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because factors which affect nitrate concentrations in surface waters upstream of the Delta are similar in the

ELT and LLT under the No Action Alternative. For the reasons stated for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, any modified reservoir operations and subsequent changes in river flows at the ELT, relative to Existing Conditions, are expected to have negligible, if any, effects on average reservoir and river nitrate concentrations in the Sacramento River watershed upstream of the Delta. In the San Joaquin River watershed, nitrate concentrations are higher than in the Sacramento watershed, owing to use of nitrate-based fertilizers throughout the lower watershed. The correlation between historical water year average nitrate concentrations and water year average flow in the San Joaquin River at Vernalis is a weak inverse relationship—that is, generally higher flows result in lower nitrate concentrations, while low flows result in higher nitrate concentrations (linear regression r^2=0.49; Figure 2, Appendix 8J, *Nitrate*, of the Draft EIR/EIS). Under the No Action Alternative (ELT), average flows at Vernalis would decrease an estimated 1% relative to Existing Conditions, which is less than the 6% decrease in average flows estimated to occur at the LLT. Given these relatively small decreases in flows and the weak correlation between nitrate and flows in the San Joaquin River, it is expected that nitrate concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT).

Delta

Results of the mass balance calculations indicate that under the No Action Alternative (ELT), relative to Existing Conditions, nitrate concentrations throughout the Delta would remain low (<1.4 mg/L-N) relative to adopted objectives (Table N-1 in Appendix B, of this RDEIR/SDEIS). Although changes at specific Delta locations and for specific months may be substantial on a relative basis (Table N-2, in Appendix B of this RDEIR/SDEIS), the absolute concentration of nitrate in Delta waters would remain low (<1.4 mg/L-N) in relation to the drinking water MCL of 10 mg/L-N, as well as all other relevant nitrate thresholds (see Chapter 8, *Water Quality*, Section 8.3.17 in the Draft EIR/EIS). Long-term average nitrate concentrations are anticipated to remain below 1 mg/L-N at all 11 Delta assessment locations except the San Joaquin River at Buckley Cove, where early long-term average concentrations would be somewhat above 1 mg/L-N. Nevertheless, at this location, early long-term average nitrate concentration would be somewhat reduced under the No Action Alternative (ELT), relative to Existing Conditions. No additional exceedances of the MCL are anticipated at any location (Table N-1, in Appendix B of this RDEIR/SDEIS). On a monthly average basis and a long-term annual average basis, for all modeled years (1976–1991) and for the drought period (1987–1991) only, use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <1%) for all locations and months (Table N-3, in Appendix B of this RDEIR/SDEIS). Nitrate concentrations, change in nitrate concentrations relative to existing conditions, and use of assimilative capacity with regard to nitrate at various locations throughout the Delta under the No Action Alternative (ELT) would be approximately the same as would occur in the LLT.

As described in for the No Action Alternative for the LLT in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, actual nitrate on concentrations would likely be higher than the modeling results indicate at certain locations under the No Action Alternative (ELT). This is because the mass balance modeling does not account for contributions from the SRWTP, which would be implementing nitrification/partial denitrification, or Delta wastewater treatment plant dischargers that practice nitrification, but not denitrification. However, for the reasons described for the No Action Alternative (LLT), additional nitrate contributions and resulting concentrations that may occur at certain locations within the Delta at the ELT would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to nitrate.

SWP/CVP Export Service Areas

Assessment of effects of the No Action Alternative (ELT) on nitrate in the SWP/ CVP Export Service Areas is based on effects on nitrate at the Banks and Jones Pumping Plants.

Results of the mass balance calculations indicate that under the No Action Alternative (ELT), relative to Existing Conditions, early long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly (Table N-1, in Appendix B of this RDEIR/SDEIS), as is also expected for the LLT (see Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS). No exceedances of the 10 mg/L MCL would occur (Table N-1, in Appendix B of this RDEIR/SDEIS). On a monthly average basis and on a long-term annual average basis, for all modeled years and for the drought period only, use of assimilative capacity available under Existing Conditions relative to the MCL would be negligible (i.e., <1%) for both Banks and Jones Pumping Plants (Table N-3, in Appendix B of this RDEIR/SDEIS). As discussed above, in the Delta region, nitrate concentrations would be higher than indicated in the modeling results for areas receiving Sacramento River water, including Banks and Jones pumping plants. However, long-term average nitrate concentrations would be expected to decrease under the No Action Alternative (ELT), relative to Existing Conditions. Resultant nitrate concentrations in water exported via Banks and Jones pumping plants under the No Action Alternative (ELT) are not expected to result in adverse effects to beneficial uses of exported water or substantially degrade the quality of exported water, with regard to nitrate.

In summary, based on the discussion above, effects on nitrate of facilities operation and maintenance are considered not adverse.

CEQA Conclusion: For the same reasons described for the LLT in Chapter 8, *Water Quality*, Section 8.3.3.1 in the Draft EIR/EIS, any modified reservoir operations and subsequent changes in river flows under the No Action Alternative (ELT), relative to Existing Conditions, are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed.

In the Delta, results of the mass balance calculations indicate that under the No Action Alternative (ELT), relative to Existing Conditions, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L MCL are anticipated at any location, and use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <1%) for all locations and months.

Results of the mass balance calculations indicate that under the No Action Alternative (ELT), relative to Existing Conditions, average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly. No additional exceedances of the MCL are anticipated, and use of assimilative capacity available under Existing Conditions, relative to the MCL would be negligible (i.e., <1%) for both Banks and Jones pumping plants for all months.

Based on the above, there would be no substantial, long-term increase in nitrate concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the waters exported to the SWP/CVP Export Service Areas under the No Action Alternative (ELT), relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment from nitrate. Because nitrate concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant.

Impact WQ-17: Effects on Dissolved Organic Carbon Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

While increased water demands and climate change under the No Action Alternative (ELT) would alter the magnitude and timing of reservoir releases north, south and east of the Delta, these activities would have no substantial effect on the various watershed sources of DOC. Moreover, long-term average flow and DOC at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in DOC concentrations upstream of the Delta. Consequently, long-term average DOC concentrations under the No Action Alternative (ELT) would not be expected to change by frequency, magnitude and geographic extent, relative to Existing Conditions and, and thus, would not adversely affect the MUN beneficial use, or any other beneficial uses, in water bodies of the affected environment located upstream of the Delta.

Delta

Relative to the Existing Conditions, the No Action Alternative (ELT) would result in no changes, or a 0.1 mg/L decrease, in the long-term average DOC concentrations at the 11 assessment locations for the modeled 16-year period. However, the average DOC concentrations would increase slightly (i.e., up to 0.1 mg/L) in the modeled drought period (1987–1991) only at the Jones pumping plant location (Appendix B, *Supplemental Modeling for Alternative 4A*, Table DOC-1, of this RDEIR/SDEIS). At all 11 assessment locations, the range of frequency with which average DOC concentrations would exceed the 2 mg/L threshold concentration under the No Action Alternative (ELT) would be similar to Existing Conditions (i.e., 93–100%) for the modeled 16-year period and the drought period. The frequency with which DOC concentration would exceed the 3 mg/L and 4 mg/L thresholds also would be similar at most of the assessment locations, with exception of predicted changes at both the Banks and Jones pumping plants.

At the Banks pumping plant, the frequency with which DOC concentration would exceed 3 mg/L would increase from 64% under Existing Conditions to 69% under the No Action Alternative (ELT) for the 16-year period (and increase from 57% to 68% during the drought year period) (Appendix B, *Supplemental Modeling for Alternative 4A*, Table DOC-1, of this RDEIR/SDEIS). The relative frequencies of exceedance of 3 mg/L at the Jones pumping plant would be similar to the Banks pumping plant for the modeled 16-year and drought periods. The relative increase in the frequency with which DOC concentrations would exceed 4 mg/L at both the Banks and Jones pumping plants would be minimal (i.e., up to a 3% increased frequency at the Jones pumping plant). While the No

Action Alternative (ELT) would generally lead to similar or slightly higher long-term average DOC concentration in the western and interior Delta locations, the predicted changes would not be expected to be of magnitude that would adversely affect MUN beneficial uses, or any other beneficial use, particularly when considering the relatively small change in long-term annual average concentration (i.e., ≤0.1 mg/L).

SWP/CVP Export Service Areas

With respect to the potential for effects of the No Action Alternative (ELT), the long-term average DOC concentrations in water exported at the Banks and Jones pumping plants would not change measurably relative to Existing Conditions (i.e., up to 0.1 mg/L at Jones pumping plant for the modeled drought period) (Appendix B, *Supplemental Modeling for Alternative 4A*, Table DOC-1, of this RDEIR/SDEIS). Relatively small increases in the frequency of average DOC concentrations in exports exceeding the 3 and 4 mg/L thresholds would be predicted to occur at both Banks and Jones pumping plants. However, the predicted changes in long-term average DOC concentrations would not be expected to be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial use, within the SWP/CVP Export Service Areas. Long-term average DOC concentrations, and frequency of exceedance of threshold concentrations, would decrease slightly at Barker Slough under the No Action Alternative (ELT) relative to Existing Conditions.

In summary, the potential operations- and maintenance-related changes to DOC concentrations under the No Action Alternative (ELT) at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service areas would generally be similar to, or of lower magnitude, than the effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because less changes in water demands and climate change would occur in the ELT compared to the LLT, and thus factors affecting DOC concentrations, would be lower in these water bodies in the ELT.

Maintenance of SWP and CVP facilities under the No Action Alternative (ELT) would not be expected to create new sources of DOC or contribute towards a substantial change in existing sources of DOC in the affected environment.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on DOC concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar, or of lower magnitude, than the effects described for the No Action Alternative (LLT). While greater water demands and climate change under the No Action Alternative (ELT) would alter the magnitude and timing of reservoir releases north, south and east of the Delta, these activities would have no substantial effect on the various watershed sources of DOC. Based on the above, the No Action Alternative (ELT) would not result in any substantial increase in the frequency with which long-term average DOC concentrations exceed the 2, 3, or 4 mg/L levels at any of the 11 assessment locations relative to Existing Conditions.

The predicted change in long-term average DOC concentrations relative to Existing Conditions would not be expected to be of sufficient magnitude to adversely affect MUN beneficial uses, nor would there be any long-term water quality degradation with respect to DOC. DOC is not bioaccumulative and thus would not directly cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations would not be expected to increase substantially, no significant impacts on beneficial uses would occur. Based on these findings, this impact would be less than significant.

Impact WQ-19: Effects on Pathogens Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1. of the Draft EIR/EIS. This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar in the ELT and LLT. The difference in reservoir storage, river flows, and associated changes in Delta source water fractions due to climate change and water demands would not alter the pathogen sources in these waters. Thus, for the reasons described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1of the Draft EIR/EIS, the effects on pathogens from implementing the No Action Alternative (ELT) is determined to not be adverse.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative. This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar in the ELT and LLT. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is Clean Water Act Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. This impact is considered less than significant.

Impact WQ-21: Effects on Pesticide Concentrations Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on pesticide levels in surface waters upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or less than those expected to occur at the LLT, described in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because at the ELT, the primary factor that will influence pesticide concentrations in surface waters upstream of the Delta, the effect of timing and magnitude of reservoir releases on dilution capacity, is expected to change to a similar or less degree than under the No Action Alternative (LLT). As shown in Tables P-1 throughP-4, in Appendix B of this RDEIR/SDEIS, changes in average winter and summer flow rates at the ELT relative to Existing Conditions are expected to be similar to or less than changes in flow rates expected at the LLT (Appendix 8L, *Pesticides* Tables 1–4, of the Draft EIR/EIS) in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis (shown in Tables 1-4 in Appendix 8L, *Pesticides*, of the Draft EIR/EIS). Similarly, at the ELT, the primary factor that will influence pesticide concentrations in surface waters of the Delta and in the SWP/CVP Export Service areas (i.e., changes in San Joaquin River, Sacramento River and Delta agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar or less degree than at the LLT. The percent change in monthly average source water fractions at the ELT are similar to or less than changes expected at the LLT (Appendix 8D *Source Water Fingerprinting Results* Figures 1–22, of the Draft EIR/EIS).

Development of 8,000 acres of tidal habitat under the No Action Alternative (ELT) could result in a limited reduction in pesticide use throughout the Delta through the potential repurposing of active or fallow agricultural land for natural habitat purposes. In the short-term, the repurposing of agricultural land associated with these measures may expose water used for habitat restoration to pesticide residues. Moreover, the fisheries enhancements to the Yolo Bypass that would occur under the No Action Alternative (ELT) could be managed alongside continuing agriculture, where pesticides may be used on a seasonal basis and where water during flood events may come in contact with residues of these pesticides. However, rapid dissipation would be expected, particularly in the large volumes of water involved in flooding, such that aquatic life toxicity objectives would not be exceeded by frequency, magnitude, and geographic extent whereby adverse effects on beneficial uses would be expected.

***CEQA Conclusion*:** As discussed above, the effects of the No Action Alternative (ELT) on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1. of the Draft EIR/EIS. As such, the No Action Alternative (ELT) would not result in any substantial change in long-term average pesticide concentration or result in substantial increase in the anticipated frequency with which long-term average pesticide concentrations would exceed aquatic life toxicity thresholds or other beneficial use effect thresholds upstream of the Delta, at the 11 assessment locations analyzed for the Delta, or the SWP CVP Export Service Areas. Numerous pesticides are currently used throughout the affected environment, and while some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence for their presence in waters affected by SWP and CVP operations (i.e., diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative, and thus changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, while there are numerous CWA Section 303(d) listings throughout the affected environment that name pesticides as the cause for beneficial use impairment, the modeled changes in upstream river flows and Delta source water fractions would not be expected to make any of these beneficial use impairments measurably worse. Because long-term average pesticide concentrations are not expected to increase substantially, no long-term water quality degradation with respect to pesticides is expected to occur and, thus, no adverse effects on beneficial uses would occur. This impact is considered less than significant.

Impact WQ-23: Effects on Phosphorus Concentrations Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or less than those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because factors which affect phosphorus levels in surface waters of these areas would be similar at the ELT and LLT under the No Action Alternative. Phosphorus concentrations may increase during January through March at locations in the Delta where the source fraction of San Joaquin River water increases, due to the higher concentration of phosphorus in the San Joaquin River during these months compared to Sacramento

River water or San Francisco Bay water. However, based on the DSM2 fingerprinting results (see Figures B.4-1 through B.4-22 in Appendix B of this RDEIR/SDEIS), together with source water concentrations (presented in Chapter 8, *Water Quality*, Figure 8-56, of the Draft EIR/EIS), the magnitude of increases during these months is expected to be negligible (i.e., <0.01 mg/L) at all Delta locations. Thus, phosphorus levels in the Delta and waters exported from Banks and Jones pumping plants to the SWP/CVP Export Service Areas are expected to change less at the ELT compared to the LLT. For the reasons described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS and those described above, the effects on phosphorus from implementing the No Action Alternative (ELT) is determined to not be adverse.

***CEQA Conclusion*:** The effects of the No Action Alternative (ELT) on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1.of the Draft EIR/EIS. This is because factors that would directly affect phosphorus levels in the surface waters of these areas are expected to be the same or change to a lesser degree than at the LLT. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because phosphorus concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. This impact is considered less than significant.

Impact WQ-25: Effects on Selenium Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on selenium concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1. of the Draft EIR/EIS. There would be no expected change to the sources of selenium in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases and river flows upstream of the Delta would have negligible, if any, effect on the concentration of selenium in the rivers and reservoirs of these watersheds.

Selenium concentrations in the San Joaquin River upstream of the Delta comply with NTR criteria and Basin Plan objectives at Vernalis under Existing Conditions, and they are expected to do so under the No Action Alternative (ELT). This is because a TMDL has been developed by the Central Valley Water Board (2001), the Grassland Bypass Project has established limits that will result in reduced inputs of selenium to the Delta, and the Central Valley Water Board (2010a) and State Water Board (2010d, 2010e) have established Basin Plan objectives that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta, Further, modeling of flows for the San Joaquin River at Vernalis indicates that average annual flows under the No Action Alternative (ELT) will vary by less than 10% from Existing Conditions (Appendix 5A, *BDCP EIR/EIS*

Modeling Technical Appendix, of the Draft EIR/EIS). Given these relatively small decreases in flows and the considerable variability in the relationship between selenium concentrations and flows in the San Joaquin River, it is expected that selenium concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT).

In summary, any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Delta

Relative to Existing Conditions, the No Action Alternative (ELT) would result in little to no change in average selenium concentrations in water at all modeled Delta assessment locations. Long-term average concentrations would be the same or lower, with the exception of Old River at Rock Slough during the drought (1987–1991) period modeled and Jones pumping plant for the entire (1976–1991) period modeled (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-1, of this RDEIR/SDEIS). Long-term average concentrations at these locations would increase negligibly (by 0.01µg/L). The long-term average selenium concentrations in water under the No Action Alternative (ELT) would range from 0.09–0.39 µg/L (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-1, of this RDEIR/SDEIS), which would be well below the EPA draft water quality criterion of 1.3 µg/L. Thus, the No Action Alternative (ELT) would not result in selenium concentration increases in water that would substantially degrade water quality.

Relative to Existing Conditions, the No Action Alternative (ELT) would result in little to no change in estimated selenium concentrations in most biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets), with the largest increase being 0.01 mg/kg dry weight (dw) (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-2a, of this RDEIR/SDEIS). During the drought period, concentrations of selenium in sturgeon in the western Delta would increase slightly, with about a 0.05 mg/kg dw (<1 percent) increase for the San Joaquin River at Antioch (Appendix B, *Supplemental Modeling for Alternative 4A*, Tables Se-5 and Se-6, of this RDEIR/SDEIS).

All Toxicity Level Exceedance Quotients for whole fish, bird eggs, and fish fillets are less than 1.0, indicating low probability of adverse effects (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-3, of this RDEIR/SDEIS). Low Toxicity Threshold Exceedance Quotients for selenium concentrations in sturgeon from the western Delta exceed 1.0 for the drought period, indicating a higher probability for adverse effects for drought years (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-7, of this RDEIR/SDEIS). Relative to Existing Conditions, Exceedance Quotients would increase by 0.00–0.01, indicating that there would essentially be no increased risk of toxicity associated with selenium concentrations under the No Action Alternative (ELT).

In summary, relative to Existing Conditions, the No Action Alternative (ELT) would result in essentially no change in selenium concentrations throughout the Delta. The No Action Alternative (ELT) would not be expected to substantially increase the frequency with which applicable water quality criteria, or toxicity or level of concern thresholds would be exceeded in the Delta or substantially degrade the quality of water in the Delta, with regard to selenium.

SWP/CVP Export Service Areas

Relative to Existing Conditions, the No Action Alternative (ELT) would result in little to no change in average selenium concentrations in water at the south Delta pumping plants. At the Banks pumping plant, there would be no change in long-term average concentrations for the entire period modeled or the drought period modeled (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-1, of this RDEIR/SDEIS). At the Jones pumping plant, selenium concentrations would increase by 0.01 μg/L for the entire period modeled (Appendix B, Table Se-1). Furthermore, the modeled selenium concentrations in water for the No Action Alternative (ELT) would range from 0.21–0.29 μg/L, well below the USEPA water quality criterion of 1.3 μg/L (Appendix B, *Supplemental Modeling for Alternative 4A*, Table Se-1, of this RDEIR/SDEIS).

Similarly, the No Action Alternative (ELT) would result in little to no change in estimated selenium concentrations in biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets), and concentrations of selenium in biota would not be expected to exceed any toxicity or level of concern benchmarks for biota (Appendix B, *Supplemental Modeling for Alternative 4A*, Tables Se-2a and Se-3, of this RDEIR/SDEIS).

Residence time of water in the Delta is not expected to change substantially under the No Action Alternative (ELT) relative to Existing Conditions. Thus, any minor residence time changes would not be expected to affect selenium bioaccumulation or fish tissue and bird egg concentrations of selenium.

In summary, relative to Existing Conditions, the No Action Alternative (ELT) would result in essentially no change in selenium concentrations in the SWP/CVP Export Service Areas, because there would essentially be no change in selenium concentrations at the Bank and Jones pumping plants. Thus, the No Action Alternative (ELT) would not be expected to substantially increase the frequency with which applicable water quality criteria, or toxicity and level of concern benchmarks would be exceeded in the Export Service Areas or substantially degrade the quality of water in the Export Service Areas, with regard to selenium.

CEQA Conclusion: There are no substantial point sources of selenium in watersheds upstream of the Delta, and no substantial nonpoint sources of selenium in the watersheds of the Sacramento River and the eastern tributaries. Nonpoint sources in the San Joaquin Valley that contribute selenium to the Delta will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board 2010d and State Water Board 2010d, 2010e) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta. Consequently, any modified reservoir operations and subsequent changes in river flows under the No Action Alternative (ELT), relative to Existing Conditions, are expected to cause negligible changes in selenium concentrations in water. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Relative to Existing Conditions, modeling estimates indicate that the No Action Alternative (ELT) would result in essentially no change in selenium concentrations throughout the Delta, with all changes on the order of 0.01 μg/L or less. Furthermore, there would not be an increased risk of exceeding toxicity and level of concern benchmarks for biota.

Assessment of effects of selenium in the SWP/CVP Export Service Areas is based on effects on selenium concentrations at the Banks and Jones pumping plants. Relative to Existing Conditions, the No Action Alternative (ELT) would result in no change in long-term average selenium concentrations at the Bank pumping plant, and very little increase (0.01 µg/L) at the Jones pumping plant.

Based on the above, selenium concentrations that would occur in water under this alternative would not cause additional exceedances of applicable state or federal numeric or narrative water quality objectives/criteria, or other relevant water quality effects thresholds identified for this assessment by frequency, magnitude, and geographic extent that would result in adverse effects to one or more beneficial uses within affected water bodies. In comparison to Existing Conditions, water quality conditions under this alternative would not increase levels of selenium by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of selenium in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Water quality conditions under this alternative with respect to selenium would not cause long-term degradation of water quality in the affected environment, and therefore would not result in use of available assimilative capacity such that exceedances of water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. This alternative would not further degrade water quality by measurable levels, on a long-term basis, for selenium and, thus, cause the CWA Section 303(d)-listed impairment of beneficial use to be made discernibly worse. This impact is considered less than significant.

Impact WQ-27: Effects on Trace Metal Concentrations Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on trace metal concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because the factors that would affect trace metal concentrations in the surface waters of these areas would be the same in the ELT as in the LLT. For the reasons described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, the effects on trace metal concentrations from implementing the No Action Alternative (ELT) is determined to not be adverse.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on trace metal concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative. This is because the factors that would affect trace metal concentrations in the surface waters of these areas would be similar in the ELT and LLT. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, negligible change in long-term trace metal concentrations throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. This impact is considered less than significant.

Impact WQ-29: Effects on TSS and Turbidity Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be the same in the ELT as in the LLT. For the reasons described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, the effects on TSS and turbidity from implementing the No Action Alternative (ELT) is determined to not be adverse.

CEQA Conclusion: The effects of the No Action Alternative (ELT) on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the No Action Alternative. This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be similar in the ELT and LLT. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels are not expected to be substantially different from Existing Conditions, long-term water quality degradation is not expected, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor Clean Water Act section 303(d) listed constituents. This impact is considered less than significant.

Impact WQ-31: Water Quality Effects Resulting from Construction-Related Activities

The effects of construction-related activities and potential water quality effects that would occur under the No Action Alternative (ELT) in association with projects other than Alternative 4A would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because many construction-related activities that could affect the surface waters in the project area are ongoing (e.g., urban development), or recurring (e.g., maintenance activities for channels and levees, sediment dredging), and thus are expected to result in generally similar effects in the ELT and LLT. While the timing of construction of planned projects, described under the No Action Alternative (ELT) (e.g., restoration projects), is uncertain relative to the Existing Conditions, the potential construction-related contaminant discharges that may occur under the No Action Alternative (ELT) would be avoided and minimized upon implementation of BMPs and adherence to permit terms and conditions. Consequently, construction-related activities would not be expected to cause constituent discharges of sufficient magnitude to result in a substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas.

CEQA Conclusion: Alternative 4A construction-related contaminant discharges under the No Action Alternative (ELT) would not occur. Other reasonably foreseeable projects that are independent from Alternative 4A would result in construction-related impacts that are temporary and intermittent in nature and would involve negligible, if any, discharges of bioaccumulative or CWA Section 303(d) listed constituents to water bodies of the affected environment. As such, construction activities would therefore not contribute to bioaccumulation of contaminants in organisms or humans or cause Section 303(d) impairments to be discernibly worse. Relative to Existing Conditions, the construction-related effects of other projects in the Delta would not be expected to cause or contribute to a substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality on a long-term average basis with respect to the constituents of concern, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. Based on these findings, this impact is determined to be less than significant.

Impact WQ-32: Effects on *Microcystis* Bloom Formation Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the No Action Alternative (ELT) on *Microcystis* levels, and thus microcystin concentrations, in surface waters upstream of the Delta relative to Existing Conditions would be similar to those described for the No Action Alternative in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is because factors that would affect *Microcystis* levels in these areas would be the same in the ELT and the LLT. In the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, under Existing Conditions, bloom development is limited by high water velocity and low residence times. These conditions are not expected to change under the No Action Alternative (ELT).

Delta

In the Delta, enhancements to the Yolo Bypass and 8,000 acres of tidal habitat would be developed under the No Action Alternative (ELT). The hydrodynamic effects of these actions could lead to increased residence times in the affected Delta sub-regions relative to Existing Conditions. As described in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS, climate change and sea level rise are also expected to cause slight increases in water residence times throughout the Delta at the LLT. At the ELT the incremental contribution of climate change and sea level rise to increased water residence times would be less than that at the LLT.

Due to the assumed effects of climate change, Delta water temperatures are expected to increase relative to Existing Conditions under the No Action Alternative (ELT), although the magnitude of increase would be less at the ELT (1.3–2.5°F) compared to the LLT (2.9–4.9°F). Increasing water temperatures could lead to earlier attainment of the water temperature threshold of 19°C required to initiate *Microcystis* bloom formation, and thus earlier occurrences of *Microcystis* blooms in the Delta, relative to Existing Conditions. Elevated ambient water temperatures in the Delta, and thus an increase in *Microcystis* bloom duration and magnitude, are expected under the No Action Alternative (ELT), relative to Existing Conditions. However, the effects of elevated ambient water temperatures on *Microcystis* at the ELT are expected to be less than would occur at the LLT.

The combination of increased water residence times in the Delta, due to assumed restoration activities, and increased water temperatures, due to climate change, could lead to measurable increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms throughout the

Delta at the ELT, relative to Existing Conditions. It is not expected that the effects on *Microcystis* in the Delta that could occur at the ELT would be significantly different than those that could occur at LLT.

SWP/CVP Export Service Area

The effects of the No Action Alternative (ELT) on *Microcystis* levels, and thus microcystin concentrations, in SWP/CVP Export Service Areas, relative to Existing Conditions, would be similar to or slightly less than those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. This is for two reasons. First, the assessment of effects on *Microcystis* in the SWP/CVP Export Service Areas is based on the assessment of *Microcystis* production in source waters to Banks and Jones pumping plants, and the effects on *Microcystis* at Banks and Jones pumping plants is not expected to be different at the ELT and LLT for the reason discussed for the "Delta" above. Second, changes in ambient air temperatures due to climate change are expected to be less at the ELT compared to the LLT, as described for the "Delta" above. Thus, effects of climate change on the potential for environmental conditions in the SWP/CVP Export Service Areas to become more conducive for *Microcystis* growth, relative to Existing Conditions, are expected to be less at the ELT than at the LLT.

CEQA Conclusion: For the reasons described above, the effects of the No Action Alternative (ELT) on Microcystis levels, and thus microcystin concentrations, in surface waters upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or less than those described for the No Action Alternative (LLT) in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. As such, the No Action Alternative (ELT) would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Microcystis and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing Microcystis impairment measurably worse because no such impairments currently exist. Because Microcystis and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, because it is possible that under the No Action Alternative (ELT) increases in the frequency, magnitude, and geographic extent of Microcystis blooms in the Delta would occur due to both increased water temperatures from climate change, as well as increased water residence times related to restoration activities, long-term water quality degradation may occur in the Delta and water exported from the Delta to the SWP/CVP Export Service Areas. Thus, impacts on beneficial uses could occur. This impact is considered significant.

Impact WQ-33: Effects on San Francisco Bay Water Quality Resulting from Facilities Operations and Maintenance

The effects of the No Action Alternative (ELT) on San Francisco Bay water quality would be similar to or slightly less than those described for the No Action Alternative (LLT), in Chapter 8, *Water Quality*, Section 8.3.3.1 of the Draft EIR/EIS. The primary difference in the ELT is that the effects of climate change on upstream hydrology and sea level rise in the Delta and Bay would be less, and there would be less water demand. However, for the same reasons described for the LLT, upstream constituent concentrations and Delta outflow would not be altered sufficiently by these differences to cause substantial water degradation or contribute to adverse effects to beneficial uses in San Francisco Bay.

CEQA Conclusion: The No Action Alternative (ELT) would not be expected to cause long-term degradation of water quality in San Francisco Bay resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. Further, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria in the San Francisco Bay by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Any changes in boron, bromide, chloride, and DOC in the San Francisco Bay would not adversely affect beneficial uses, because the uses most affected by changes in these parameters, MUN and AGR, are not beneficial uses of the Bay. Further, no substantial changes in dissolved oxygen, pathogens, pesticides, trace metals or turbidity or TSS are anticipated in the Delta, relative to Existing Conditions, therefore, no substantial changes in these constituents levels in the Bay are anticipated. Changes in Delta salinity would not contribute to measurable changes in Bay salinity, as the change in Delta outflow would be two to three orders of magnitude lower than (and thus minimal compared to) the Bay's tidal flow and thus, have minimal influence on salinity changes. Adverse changes in *Microcystis* levels that could occur in the Delta would not cause adverse *Microcystis* blooms in the Bay, because *Microcystis* are intolerant of the Bay's high salinity and, thus have not been detected downstream of Suisun Bay. The reduction in total nitrogen load (associated with the SRWTP improvements) and changes in phosphorus load, relative to Existing Conditions, are expected to have minimal effect on water quality degradation, primary productivity, or phytoplankton community composition. As with the LLT, the change in mercury and methylmercury load (which is based on source water and Delta outflow), relative to Existing Conditions, would be within the level of uncertainty in the mass load estimate and not expected to contribute to water quality degradation, make the CWA section 303(d) mercury impairment measurably worse or cause mercury/methylmercury to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Similarly, based on LLT estimates, the increase in selenium load would be minimal, and total and dissolved selenium concentrations would be expected to be the same as Existing Conditions, and less than the target associated with white sturgeon whole-body fish tissue levels for the North Bay. Thus, the change in selenium load is not expected to contribute to water quality degradation, or make the CWA section 303(d) selenium impairment measurably worse or cause selenium to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. This impact is considered less than significant.

4.2.8 Geology and Seismicity

The effects of the No Action Alternative (ELT) as considered for the purposes of Alternative 4A, 2D, and 5A would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 9, *Geology and Seismicity*, Section 9.3.3.1 of the Draft EIR/EIS. The No Action Alternative (ELT) considers changes in risk from geology and seismicity that would take place as a result of the continuation of existing plans, policies, and operations, as described in Chapter 3, *Description of Alternatives*, of the Draft EIR/EIS. Due to the shorter time frame, the magnitude of total geologic and seismic impacts on construction associated with development and habitat restoration activities within the Plan Area would be less under the ELT timeframe than that considered in 2060 due to less development in the region.

4.2.8.1 Earthquake Induced Ground Shaking, Liquefaction and Slope Instability

Under the No Action Alternative (ELT) it is anticipated that the current hazard resulting from earthquake-induced ground shaking from regional and local faults would be similar to that under the No Action Alternative (LLT) presented in the Draft EIR/EIS. This would continue to present a risk of levee failure and subsequent flooding of Delta islands, with a concomitant influx of seawater into the Delta, thereby adversely affecting water quality and water supply. It is also anticipated that the current hazard of earthquake-induced liquefaction triggered by regional and local faults would persist. Liquefaction would continue to present a risk of levee failure and subsequent flooding of Delta islands, with concomitant water quality and water supply effects from seawater intrusion as described in Appendix 3E, *Potential Seismicity and Climate Change Risks to SWP/CVP Water Supplies*.

Ongoing and reasonably foreseeable future projects in parts of the Delta are expected to upgrade the levees to a “flood-safe” condition under the 100-year return flood elevation. Given the shorter timeframe, fewer projects would be implemented in the No Action Alternative (ELT). Regardless, these projects would provide very little levee foundation strengthening and improvements directed at improving the stability of the levees to better withstand ground shaking, liquefaction, and slope instability.

4.2.8.2 Tsunami and Seiche

Under the No Action Alternative (ELT) it is anticipated that the current hazard resulting from tsunami and seismically induced seiche on Delta and Suisun Marsh levees would be similar to that under the No Action Alternative (LLT). The geometry of existing water bodies in the Delta and Suisun Marsh and distance to seismic sources generally are not conducive to the occurrence of a substantial seismically induced seiche, as described in Section 9.1.1.3 of the Draft EIR/EIS. However, because of its proximity to the potentially active West Tracy fault, there is a potential hazard for a seiche to occur in the Clifton Court Forebay (Fugro Consultants 2011).

4.2.8.3 Ongoing Plans, Policies, and Programs

The programs, plans, and projects included in Table 9-13 of the Draft EIR/EIS would apply to the No Action Alternative (ELT). Although not specifically directed at mitigating potential damage to levees caused by a tsunami and seiche, the ongoing and reasonably foreseeable future projects directed to upgrade levees to a “flood-safe” condition under the 100-year return flood elevation or projects involving other similar levee improvements may provide some benefit to withstanding the potential effect of a tsunami and seiche.

Given the shorter timeframe, fewer projects would be implemented in the No Action Alternative (ELT), but there would be an indirect and beneficial effect upon the potential hazard of tsunami and seiche in the Delta due to improvements in levee infrastructure as a part of implementation of these projects or programs.

4.2.8.4 Climate Change and Catastrophic Seismic Risks

The Delta and vicinity is within a highly active seismic area, with a generally high potential for major future earthquake events along nearby and/or regional faults, and with the probability for such events increasing over time. Under the No Action Alternative (ELT), it is anticipated that the potential for significant damage to, or failure of, these structures during a major local seismic event would be identical to that under the No Action Alternative (LLT) presented in the Draft EIR/EIS. In the instance of a large seismic event, levees constructed on liquefiable foundations are expected to experience large deformations (in excess of 10 feet) under a moderate to large earthquake in the region. There would potentially be loss, injury or death resulting from ground rupture, ground shaking and liquefaction.

***CEQA Conclusion*:** In total, the plans and programs under the No Action Alternative ELT would result in a beneficial effect on an undetermined extent of levees in the Delta. Under the No Action Alternative ELT, these plans, policies, and programs would have an indirect and beneficial effect upon the potential hazard of tsunami and seiche in the Delta. These plans and programs, however, would not decrease the risks associated with climate change or a catastrophic seismic event, as discussed above and more thoroughly in Appendix 3E, *Seismic and Climate Change Risks to SWP/CVP Water Supplies.* The impact of the No Action Alternative (ELT) related to geology and seismicity would be less than significant.

4.2.9 Soils

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 10, *Soils*, Section 10.3.3.1 of the Draft EIR/EIS. The No Action Alternative (ELT) includes projects and programs with defined management or operational plans, including facilities under construction because those actions would be consistent with the continuation of existing management direction or level of management for plans, policies, and operations by the project proponents and other agencies. Under the No Action Alternative (ELT), the condition of soils would continue largely as they have under Existing Conditions. Due to the shorter time frame compared to the No Action Alternative (LLT), the magnitude of total impacts to soils resulting from construction associated with development and habitat restoration activities within the Plan Area would be less under the ELT timeframe than that considered in 2060 due to less development in the region.

Accelerated Soil Erosion

As with the No Action Alternative (LLT), current rates of water and wind erosion would continue under the No Action Alternative (ELT) as a result of agricultural practices as well as levee stabilization, dredge spoil disposal, and habitat restoration projects. There would be less erosion than under the No Action Alternative (LLT) due to a smaller scale of farming and project construction that would be completed during this timeframe. Federal, state, and local regulations, codes, and permitting programs would continue to require implementation of measures to prevent nonagricultural accelerated erosion and sediment transport associated with construction.

The loss of topsoil as a result of excavation, overcovering, and inundation would continue in the Delta and statewide under the No Action Alternative ELT as a result of numerous land development and habitat restoration projects. However, it would be less than under the No Action Alternative (LLT) described in Chapter 10, *Soils*, Section 10.3.3.1 of the Draft EIR/EIS, due to the shorter timeframe.

Land subsidence in the Delta and the Suisun Marsh would continue to varying degrees under the No Action Alternative (ELT). It is anticipated that the current rate of subsidence would continue. Several projects are now underway that would have a beneficial effect on subsidence, some with the explicit goal of controlling or reversing subsidence. While fewer projects would be implemented during the ELT, the level of subsidence would also be less than under the No Action Alternative (LLT).

Ongoing and reasonably foreseeable future projects in the Plan Area are likely to encounter expansive, corrosive, and compressible soils. However, federal and state design guidelines and building codes would continue to require that the facilities constructed as part of these projects incorporate design measures to avoid the adverse effects of such soils.

Plans and programs that would occur in the No Action Alternative (ELT) would result in the loss of at least 3,618 acres of topsoil from overcovering or inundation. Because of the amount of topsoil that would be lost under the No Action alternative (ELT), these plans, policies, and programs would be deemed to have direct and adverse effects on topsoil loss in the Delta.

Subsidence would be controlled or reversed on approximately 308 acres, resulting in a beneficial effect.

CEQA Conclusion: In total, the plans and programs under the No Action Alternative (ELT) would result in the loss of at least 3,618 acres of topsoil from overcovering or inundation between the present and 2025. This would constitute a significant impact. Subsidence would be controlled or reversed on approximately 308 acres, resulting in a beneficial impact.

4.2.10 Fish and Aquatic Resources

Covered Fish Species

Many of the projects and programs that would occur under the No Action Alternative (ELT) would be similar to those included in the alternatives and would have similar potential effects. These effects would also be similar between the different covered species. Therefore, the following assessment addresses all the covered species as a group for some potential effects (e.g., water quality effects), but addresses individual species for other mechanisms where the effects could be measurably different among species (e.g., entrainment).

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-NAA1: Effects of Construction of Facilities on Covered Fish Species

The construction effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Construction of future projects would continue largely as it has under Existing Conditions and would include continued implementation of SWP and CVP operations, maintenance, enforcement, and protection programs by federal, state, and local agencies and non-profit groups, as well as projects that are permitted or assumed to be constructed in the early long-term period. However, due to the shorter time frame, the magnitude of in-water construction projects including water supply and habitat restoration activities within the Plan Area would be less than that considered under the No Action Alternative (LLT) in 2060. Similarly, aquatic impacts associated with climate change (including temperature and water quality) would be anticipated to be lower than consideration of the No Action Alternative (LLT).

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic*

Resources, Section 11.3.4.1 of the Draft EIR/EIS. Overall, the potential impact mechanisms on covered fish species from construction of other projects under the No Action Alternative (ELT) would include effects from increased turbidity, accidental spills, disturbance of contaminated sediment, underwater noise, fish stranding, in-water work activities, loss of spawning, rearing or migration habitat, and predation. However, these effects would be less than significant because of the limited extent, intensity, and duration of expected construction and maintenance projects in the Plan Area. In addition, any such construction projects would be subject to a separate environmental compliance process, with permit stipulations that would include the implementation of project-specific AMMs, BMPs, environmental commitments and/or mitigation measures. This would include project-specific erosion and sediment control plans; hazardous materials management plans; SWPPPs; spill prevention and control plans; and limiting in-water activities to periods of low flow and/or to times when covered fish species are not likely to be present. Therefore, the construction-related effects under the No Action Alternative (ELT) would be less than significant.

Impact AQUA-NAA2: Effects of Maintenance of Facilities on Covered Fish Species

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Construction of future projects would continue largely as it has under Existing Conditions and would include continued implementation of SWP CVP operations, maintenance, enforcement, and protection programs by federal, state, and local agencies and non-profit groups, as well as projects that are permitted or assumed to be constructed by in the early long-term period. However, due to the shorter time frame, the magnitude of the maintenance of in-water construction projects including water supply and habitat restoration activities within the Plan Area would be less than that considered in 2060. Similarly, aquatic impacts associated with climate change (including temperature and water quality) would be anticipated to be lower than consideration of the No Action Alternative (LLT).

CEQA Conclusion: The conclusion provided in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS and above for the construction activity effects (Impact AQUA-NAA1), would typically be very similar to those expected to occur during maintenance activities, and therefore this impact would be less than significant.

Water Operations of Water Conveyance Facilities

Impact AQUA-NAA3: Effects of Water Operations on Entrainment of Covered Fish Species

Numerous methods were used to estimate entrainment losses under No Action Alternative (LLT), and a complete analysis can be found in the Draft BDCP Appendix 5B, *Entrainment*, Section B.5, *Methods of Biological Analysis*, and Section B.6, *Results* (hereby incorporated by reference).

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1, of the Draft EIR/EIS. However, due to the earlier time frame, the magnitude of operational effects within the Plan Area generally would be slightly greater than that considered in 2060, i.e., slightly greater entrainment at the early long-term timeframe than at the late long-term time frame because of slightly greater south Delta exports (see, for example, Figure 5.B.4-2 in Draft BDCP Appendix 5B, *Entrainment*, Section 5.B.4.2, *Difference in Exports from the South Delta Pumps under the BDCP [*hereby incorporated by reference]). Aquatic impacts associated with climate change (including temperature and water quality) would be anticipated to be lower than under the No Action Alternative (LLT).

Delta Smelt

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Despite modeled increases in entrainment in the No Action (ELT) compared to the Existing Condition, the differences are not expected to reach the level of adverse effects on delta smelt populations (less than 5% of the population). Entrainment of delta smelt is regulated by the USFWS 2008 BiOp, which includes operational criteria and continued improvements in water export processes, fish screens, and fish salvage operations at the south Delta facilities. These activities are expected to occur in the ELT and LLT time periods and therefore, there would be little difference between the previously modeled No Action Alternative (LLT) and the No Action Alternative (ELT). Along with other improvements in SWP/CVP facilities and operations expected to occur in the future, the effect would be less than significant.

Longfin Smelt

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Operational activities associated with water exports from SWP/CVP south Delta facilities during the No Action Alternative (ELT) period would not result in an overall substantial increase in entrainment for longfin smelt under most circumstances. Improvements in water export and fish salvage operations as a result of on-going studies, and the implementation of the SWP California Department of Fish and Wildlife longfin smelt Incidental Take Permit No. 2081-2009-001-03 (California Department of Fish and Game 2009) are expected to result in a less-than-significant impact.

Chinook Salmon

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. General on-going improvements implemented under Existing Conditions during the NAA timeframe are expected to reduce entrainment losses of Chinook salmon through the implementation of the NMFS and USFWS BiOp requirements (National Marine Fisheries Service 2009a; U.S. Fish and Wildlife Service 2008). Additionally, Implementation of RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) in the No Action Alternative (ELT) would reduce loss of Chinook salmon at the Fremont Weir and other structures in the Yolo Bypass. Yolo Bypass Restoration would provide improved connectivity and passage for Central Valley spring-run Chinook and an increase in Chinook salmon within the project area. This may result in an increase in salmon entrainment; however, the overall number of Chinook salmon will increase. Therefore, the overall effects for the No Action Alternative (ELT) are expected to be less than significant, and likely to be generally beneficial.

Steelhead

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic*

Resources, Section 11.3.4. of the Draft EIR/EIS 1. Implementation of RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) in the No Action Alternative (ELT) would reduce loss of steelhead at the Fremont Weir and other structures in the Yolo Bypass. Yolo Bypass Restoration would provide improved connectivity and passage for Central Valley steelhead and an increase in steelhead within the project area. This may result in an increase in steelhead entrainment; however, the overall number of steelhead would increase. Additionally, on-going and future operational improvements at the SWP and CVP south Delta facilities would likely result in a general decrease in entrainment for juvenile steelhead under the No Action Alternative (ELT). Potential impacts of the No Action Alternative (ELT) on entrainment of steelhead could be slightly beneficial.

Sacramento Splittail

The methods used to estimate juvenile splittail entrainment are detailed in Appendix 5B *Entrainment,* Section B.5.4.5 of the Draft BDCP.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Structural and operational changes associated with water exports from SWP/CVP south Delta facilities are not expected to result in an overall increase in per capita entrainment for Sacramento splittail under the No Action Alternative (ELT), and could be somewhat beneficial. Therefore, impacts of the No Action Alternative on entrainment are considered less than significant.

Sturgeon

Available information on the distribution and abundance of sturgeon in the Plan Area is provided in Appendix 11A, *Covered Fish Species Descriptions*, of the Draft BDCP.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. Implementation of RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) in the No Action Alternative (ELT) would reduce loss of sturgeon at the Fremont Weir and other structures in the Yolo Bypass. Yolo Bypass Restoration would provide improved connectivity and passage for green sturgeon and an increase in sturgeon within the project area. This may result in an increase in sturgeon entrainment; however, the overall number of sturgeon will increase. Structural and operational changes associated with water exports from south SWP/CVP facilities are not expected to substantially change the entrainment of sturgeon under the No Action Alternative (ELT), based on continued improvements implemented under the 2009 NMFS and 2008 USFWS BiOps. Overall, impacts of water operations on sturgeon entrainment would be less than significant.

Lamprey

Although somewhat limited, the available information on the distribution and abundance of lamprey in the Plan Area is provided in Appendix 11A, *Covered Fish Species Descriptions*, of the Draft BDCP.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic*

Resources, Section 11.3.4.1 of the Draft EIR/EIS. Structural and operational activities associated with water exports from south Delta SWP/CVP facilities are not expected to substantially change entrainment of lamprey under the No Action Alternative (ELT). Overall, the entrainment impacts of water operations to Pacific and river lamprey are considered less than significant.

Impact AQUA-NAA4: Effects of Water Operations on Spawning and Egg Incubation Habitat for Covered Fish Species

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. However, due to the earlier time frame, the magnitude of operational effects within the Plan Area would be slightly greater than that considered in 2060 as there would be less operational constraints resulting from climate change and sea level rise. Aquatic impacts associated with climate change (including temperature and water quality) would be anticipated to be lower than those assumed for the No Action Alternative (LLT) and therefore the overall effect would be similar or slightly lower in the early long-term timeframe than the late long-term timeframe.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. The effect of the NAA operations on delta smelt, longfin smelt, and Sacramento splittail spawning habitat is not adverse, because there would be little change in spawning conditions attributable to continued operations. Longfin smelt spawning flows would be slightly reduced (less than 2%) relative to Existing Conditions when climate change effects are accounted for under No Action Alternative (ELT) conditions, but not to an adverse level. However, Shasta Reservoir storage volume at the end of May would be lower than storage volume under Existing Conditions in below normal, dry, and critical water years due to climate change effects, indicating a small–to-moderate impact from summer water flows and temperatures. Decreased summer flows in the upstream tributaries as a result of climate change could adversely affect spawning habitat and egg survival for some covered fish species, such as spring-run and winter-run Chinook salmon, although no major or consistent effects were identified. The No Action Alternative (ELT) modeling also does not account for changes that may occur upstream to mitigate climate change effects, such as habitat restoration and improvements in passage that are included in the NMFS BiOp as RPAs. Because the changes in modeled flows were not substantial and because improvements are a required component in the NMFS BiOp, the effect is less than significant.

Impact AQUA-NAA5: Effects of Water Operations on Rearing Habitat for Covered Fish Species

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. However, due to the earlier time frame, the magnitude of operational effects within the Plan Area generally would be slightly greater than that considered in 2060 as there would be less operational constraints resulting from climate change and sea level rise. Aquatic impacts associated with climate change (including temperature and water quality) would be anticipated to be lower than those described for the No Action Alternative (LLT). Aquatic impacts associated with climate change would be anticipated to be lower than those assumed for the No Action Alternative (LLT) and the overall effect would be similar or slightly less in the early long-term timeframe than the late long-term timeframe.

An additional project not considered in Chapter 11 for the No Action Alternative (LLT) and included in this analysis are the actions covered by the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Bureau of Reclamation and California Department of Water Resources 2012). These actions are intended to address two of the Reasonable and Prudent Alternative (RPA) actions outlined in the NMFS (2009) BiOp: RPA Action I.6.1 and RPA Action 1.7. RPA Action I.6.1 (Restoration of Floodplain Rearing Habitat) requires increased seasonal inundation in the lower Sacramento River Basin, and RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) requires multispecies fish passage improvements and assessment of their performance.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. However, implementation of RPA Action 1.6.1 would result in improved rearing conditions for Sacramento splittail, salmonids, and green and white sturgeon. The overall effects of the No Action Alternative (ELT) would be less than significant for the other covered fish species.

Impact AQUA-NAA6: Effects of Water Operations on Migration Habitat for Covered Fish Species

The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. However, due to the earlier time frame, the magnitude of operational effects alone within the Plan Area generally would be slightly greater than that considered in 2060 as there would be less operational constraints resulting from climate change and sea level rise. Aquatic impacts associated with climate change would be anticipated to be lower than those assumed for the No Action Alternative (LLT) and the overall effect would be similar or slightly less in the early long-term timeframe than the late long-term timeframe.

An additional project not considered in Chapter 11 of the Draft EIR/EIS for the No Action LLT and included in this analysis of the actions covered by the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Bureau of Reclamation and California Department of Water Resources 2012). These actions are intended to address two of the Reasonable and Prudent Alternative (RPA) actions outlined in the NMFS (2009) BiOp: RPA Action I.6.1 and RPA Action 1.7. RPA Action I.6.1 (Restoration of Floodplain Rearing Habitat) requires increased seasonal inundation in the lower Sacramento River Basin, and RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) requires multispecies fish passage improvements and assessment of their performance.

CEQA Conclusion: The effects of the No Action Alternative (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 11, *Fish and Aquatic Resources*, Section 11.3.4.1 of the Draft EIR/EIS. However, implementation of RPA Action I.7 (Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon at Fremont Weir and Other Structures in the Yolo Bypass) under the No Action Alternative (ELT) would provide improved connectivity and migration for Sacramento splittail, salmonids, and green and white sturgeon. Average Delta outflow would be similar to Existing Conditions, which would have limited effects on migration and survival of covered fish species migrating downstream in the spring. There would be a beneficial effect to these species in the No Action Alternative (ELT) as a result. There would be little effect on delta smelt and longfin smelt migration conditions, and therefore any impacts would be less than significant.

4.2.11 Terrestrial Biological Resources

Effects of the No Action Alternative (ELT) as considered for the purposes of Alternative 4A, 2D, and 5A would be similar to the effects described for the No Action Alternative (LLT), except that the shorter time frame would reduce the effects of many projects and programs listed in Table 12-7 in Chapter 12, *Terrestrial Biological Resources*, of the Draft EIR/EIS. The reduced time frame would also lessen the potential effects of sea level rise and would reduce, but not eliminate, the risks to biological resources from flood- or seismic-related failure of Delta levees.

Implementation of the on-going habitat expansion projects are likely to show significant progress in the ELT time period as efforts are made to counteract the terrestrial habitat losses associated with land conversion (primarily agricultural) and urban and infrastructure development in a timely fashion. These expansions would be expected to counteract any transportation- or water-related infrastructure development or urban development in the study area because of the tight controls on these developments in the Delta. Management of the state and federal wildlife areas and the private wetlands would continue to emphasize a balance of protection for sensitive plant and wildlife species and the need for recreation opportunities and long-term agricultural viability. The number of habitat enhancement projects and the acreage of natural habitats restored and protected would likely be lower than what would be expected over a 50-year time frame. Ongoing water management activities under the No Action Alternative (ELT) would not be likely to substantially modify the natural communities of the study area during the ELT time period. Most water management strategies being developed by state and federal water management agencies are designed to improve the conditions for special-status fish, wildlife and plants in the study area.

The potential for adverse effects on biological resources from gradual sea level rise and from levee system failures due to major flooding episodes or seismic activity would be significantly reduced under No Action Alternative (ELT), compared to the 50-year time frame under No Action Alternative (LLT). The extent of marsh habitat conversion would be lessened on the periphery of Suisun Marsh and the Yolo Basin, and along the Delta waterways with a lower rise in sea level. The long-term risk of habitat destruction from levee failure and subsequent flooding of riparian and cropland areas on Delta islands due to major flood events or seismic shaking would be reduced. However, the risk would remain that major areas of cropland and adjacent natural habitats could be lost due to the poor condition of many Delta levees.

Even though the No Action Alternative (ELT) time period is significantly reduced from the No Action Alternative (LLT) time period, the overall direction of existing and ongoing programs and policies that influence land conversion and land management in the study area would continue to be toward maintaining the mix of agricultural, recreational, water management, and wildlife uses in the Delta, Yolo Bypass and Suisun Marsh. Some actions that will occur under the No Action Alternative (ELT) will expand natural and manmade terrestrial and wetland habitats that will benefit the special-status and common plants and wildlife with expanded and enhanced habitat in the study area. The potential will remain, however, for long-term trends in levee deterioration, global climate change, and seismic activity that could damage levees and result in significant changes in natural communities and cultivated lands. Major reductions in tidal and nontidal wetland, riparian, and managed wetland sensitive natural communities and cultivated land habitats and their associated special-status plant and animal species would be an adverse effect on terrestrial biological resources.

CEQA Conclusion: Under the No Action Alternative (ELT) existing plans, programs and policies would affect terrestrial biological resources in the study area in a positive way. Many plans and programs call for expanded development and management of wetland and riparian habitats and increased management of cultivated lands for joint benefit to the farmer and wildlife. There would be a beneficial impact on terrestrial biological resources.

Risks associated with natural processes that could damage or destroy Delta levees that protect both natural habitats and agricultural lands will continue, only over a shorter time period. The risks include flood-related levee deterioration, potential for seismically induced levee collapse, and to a lesser extent, sea level rise associated with climate change. These risks, even over the shorter time period, if unchecked, could result in a net reduction in sensitive natural communities and special-status species, causing a significant impact on the terrestrial biological resources of the study area.

4.2.12 Land Use

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 13, *Land Use*, Section 13.3.3.1 of the Draft EIR/EIS. Statewide and federal programs to preserve open space and agricultural lands would continue to be implemented. Additionally, projects and programs related to land development, habitat restoration, and flood control are also considered part of the No Action Alternative (ELT). As is the case in the late long-term timeframe, the land uses in the Delta in the early long-term would be anticipated to be generally similar to those of today because only limited types of development are allowed in the Primary Zone of the Delta. However, land use patterns and agricultural uses may experience change related to continued development pressure in areas outside the primary zone. Due to the shorter time frame, the magnitude of agricultural conversion and other changes in land use associated with development and habitat restoration activities within the Delta would be less than that considered in 2060. Similarly, risks associated with other factors that may affect land use conditions in the study area, including subsidence, levee instability, and sea level rise would be anticipated to be lower than the risks associated with those factors when considered in the late long-term.

Land use changes under the No Action Alternative (ELT) would not be anticipated to result in the physical division of any existing communities within the study area. While habitat restoration and urban development projects may result in localized conflicts with existing land uses and incompatibilities with policies and plans (depending on their locations and other characteristics), overall, the effects of plans, policies, programs, and other reasonably foreseeable circumstances included as part of the No Action Alternative (ELT) would not be anticipated to result in adverse effects on land use within the study area.

CEQA Conclusion: Under the No Action Alternative (ELT), existing land use designations, goals, and policies would guide land use in the Delta in a similar way as it exists today. Physical impacts on land use are anticipated to be less than significant under this alternative.

4.2.13 Agricultural Resources

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 14, *Agricultural Resources*, Section 14.3.3.1 of the Draft EIR/EIS. Agricultural production would continue largely as it has under Existing Conditions and would include continued implementation of SWP/CVP operations, maintenance, enforcement, and protection programs by federal, state, and local agencies and non-profit groups, as well as projects that are permitted or assumed to be constructed by in the early long-term period. However, due to the shorter time frame, the magnitude of agricultural conversion including development and habitat restoration activities within the Plan Area would be less than that considered in 2060. Similarly, agricultural effects associated with climate change (including water quality and flooding risks) would be anticipated to be lower than consideration of the No Action Alternative (LLT). Continuing activities related to operation of SWP and CVP facilities, changes in water quality, and other indirect effects are not changes in the existing environment that would result in the conversion of substantial amounts of Important Farmland to nonagricultural use. However, because Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones in the study area would be converted to nonagricultural uses under existing plans and programs, direct and adverse effects upon agricultural resources in the study area would occur under the No Action Alternative.

CEQA Conclusion: Continuing activities related to operation of SWP and CVP facilities, changes in water quality, and other indirect effects are not changes in the existing environment that would result in the conversion of substantial amounts of Important Farmland to nonagricultural use. However, because Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones would be converted to nonagricultural uses under existing plans and programs, the No Action Alternative considered in the early long-term would have significant impacts upon agricultural resources in the study area.

4.2.14 Recreation

The effects of the No Action Alternative (ELT) considered for the purposes of Alternatives 4A, 2D, and 5A would be expected to be similar to the effects described for the No Action Alternative (LLT) in Chapter 15, *Recreation,* of the Draft EIR/EIS 15.3.3.1 of the Draft EIR/EIS. Recreation opportunities occurring under the No Action Alternative (ELT) would continue largely as described for Existing Conditions and would include continued implementation of SWP and CVP operations, maintenance, enforcement, and protection programs by federal, state, and local agencies and non-profit groups, as well as projects that are permitted or assumed to be constructed by in the early long-term period. This includes restoration actions occurring within the Yolo Bypass being driven by the 2008 and 2009 USFWS and NMFS BiOps and the restoration of 8,000 acres of intertidal habitat in the Delta and Suisun Marsh.

Land and water-based recreation opportunities and activities occurring within the Delta and at upstream reservoirs under the No Action Alternative (ELT) would be similar to those described under the No Action Alternative during the late long-term timeframe. Because the No Action Alternative (ELT) implementation period would be shorter, the magnitude of land-disturbing activities occurring within the Delta that could disrupt access to land-based recreation sites and disrupt access to Delta channels used for recreation would be expected to be less than the No Action Alternative (LLT). Similarly, changes in water-based recreation opportunities associated with changes in upstream reservoir storage, streamflow, and the abundance of sport fish would also be similar to the No Action Alternative (LLT), but the magnitude of these changes would also be less because of the shorter time period of the No Action Alternative (ELT).

Similar to the No Action Alternative (LLT), CALSIM II output was used to help evaluate the potential changes in north-of-Delta and south-of-Delta reservoirs where recreation opportunities could be affected by the alternatives, including the No Action Alternative (ELT). As shown in Table 4.2.11-1 and Table 4.2.11-2 the No Action Alternative (ELT) conditions would have more years in which reservoir levels fall below the recreation threshold relative to the existing condition with the exception of New Melones Reservoir. Under the No Action Alternative (ELT) conditions, the reservoirs would fall below the thresholds from 5 to 11 additional years than under Existing Conditions whereas New Melones Reservoir would be above the threshold for one additional year. The changes in the SWP and CVP reservoir elevations are attributable to change in demand and other external factors such as climate change. It is not possible to specifically define the exact extent of the changes attributable to future no action operations using these model simulation results. Thus, the precise contributions of sea level rise and climate change to the total differences between Existing Conditions and No Action Alternative (ELT) cannot be isolated in this comparison.

Table 4.2.11-1. Summary of SWP and CVP Reservoir Recreation Opportunities (years below end-of-September recreation threshold) for Existing Conditions and No Action Alternative (ELT)

	Recreation Threshold[a]					
	Trinity Lake		Shasta Lake		Lake Oroville	
	<2,270 ft Elevation		<967 ft Elevation		<700 ft Elevation	
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Years[b]	Change Relative to Existing Condition (CEQA)[c]
Existing Conditions (CEQA)	21		17		17	
No Action (ELT)	32	11	22	5	26	9

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected scenario. An elevation less than the recreation threshold indicates years during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., Existing Conditions). A positive change indicates more years with reduced recreation opportunities relative to the comparison condition. A negative change indicates fewer years with reduced recreation opportunities relative to the comparison condition.

Table 4.2.11-2. Summary of SWP and CVP Reservoir Recreation Opportunities (years below end-of-September recreation threshold) for Existing Conditions and the No Action Alternative (ELT)

	Recreation Threshold[a]					
	Folsom Lake		New Melones Lake		San Luis Reservoir	
	<405 ft Elevation		<900 ft Elevation		<360 ft Elevation	
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Years[b]	Change Relative to Existing Condition (CEQA)[c]
Existing Conditions (CEQA)	22		9		3	
No Action (ELT)	33	11	8	-1	9	6

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected scenario. An elevation less than the recreation threshold indicates years during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., Existing Conditions). A positive change indicates more years with reduced recreation opportunities relative to the comparison condition. A negative change indicates fewer years with reduced recreation opportunities relative to the comparison condition.

As described for the No Action Alternative (LLT) in Chapter 3, *Description of Alternatives* in the Draft EIR/EIS, many of the ongoing programs under No Action Alternative (ELT) would also include development of future projects that would require additional project-level environmental review. Future federal actions would be required to comply with NEPA, the federal Endangered Species Act (ESA), and other federal laws and regulations. Future state and local actions would be required to comply with CEQA, the California Endangered Species Act (CESA), and other state and local laws and regulations. Compliance and permit requirements would be implemented on a case-by-case basis.

The potential for catastrophic seismic events and potential effects on recreation opportunities in the Delta under the No Action Alternative (ELT) would be the same as described under the No Action Alternative (LLT). The change in water quality resulting from a seismic event in which Delta levees fail could result in permanent displacement of existing, well-established public use or private commercial recreation facilities as well as result in long-term reduction of recreation opportunities, recreational navigation opportunities and recreational fishing opportunities. To reclaim land or rebuild levees after a catastrophic event due to climate change or a seismic event would potentially also result in adverse impacts to recreational resources.

CEQA Conclusion: Overall, the ongoing projects, programs, and plans under the No Action Alternative (ELT) would result in the potential for temporary and permanent effects that are not expected to substantially change recreation opportunities or experiences in the Delta region. Adverse effects on recreation would occur as a result of short-term disruptions that would result in less-than-significant impacts. Beneficial impacts on recreation could occur as programs are implemented. Overall, the impact of the No Action Alternative (ELT) on recreation resource is considered less than significant.

4.2.15 Socioeconomics

Under the No Action Alternative (ELT) socioeconomic conditions would continue largely as under Existing Conditions. This alternative includes continued SWP/CVP operations, maintenance, enforcement, and protection programs by federal, state, and local agencies, as well as projects that are permitted or under construction. When compared with conditions at the late long-term, Delta communities and socioeconomic conditions in the Delta would be subject to lower level of risks associated with climate change, seismic activity, and other phenomena, as discussed in Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS.

Population and housing effects in the Delta under the No Action Alternative (ELT) would be anticipated to follow the trends identified in Chapter 16, *Socioeconomics,* Section 16.1 *Environmental Setting/Affected Environment*, of the Draft EIR/EIS, but a smaller increment of growth would be anticipated when compared to conditions in the late long-term. Similarly, the regional economy of the Delta region is expected to be similar in structure to that described for Existing Conditions. Potential changes in expenditures related to recreation and municipal and industrial water uses as well as potential changes in the value of agricultural production could result in changes to regional employment and income in the Delta region under the No Action Alternative (ELT). The scale of the economy would change with population growth; however, the structure of the economy would not. It is possible that some of the projects, programs, and plans considered part of the No Action Alternative (ELT) would reduce the total acreage and value of agricultural production in the Delta region. For example, under the 2008 and 2009 NMFS and USFWS BiOp, up to 8,000 acres of agricultural land could be converted to tidal habitat. Similarly, agricultural land uses in the Yolo Bypass or Suisun Marsh could be periodically or permanently disrupted by other habitat restoration efforts. While local government fiscal conditions in Delta region would be anticipated to be similar to existing conditions, programs resulting in public acquisition of privately-held land, in addition to the population and economic changes described above, could affect property and sales tax revenue.

CEQA Conclusion**:** The ongoing programs and plans under the No Action Alternative (ELT), along with anticipated population growth, would not be anticipated to substantially alter the character of Delta communities, the structure of the regional economy, or local government fiscal conditions, when compared with Existing Conditions and therefore would not be anticipated to result in any physical change to the environment, significant or otherwise.

Effects in South-of-Delta Hydrologic Regions

Under the No Action Alternative (ELT), several assumptions would create a deviation from Existing Conditions. First, an increase in M&I water rights demands is assumed north of the Delta, increasing overall system demands and reducing the availability of CVP water for export south of the Delta. Secondly, the No Action Alternative (ELT) includes the effects of implementation of the Fall X2 standard, which requires additional water releases through the Delta and would therefore reduce the availability of water for export to SWP and CVP facilities. The No Action Alternative (ELT) also includes effects of sea level rise and climate change, factors that would also reduce the amount of water available for SWP and CVP supplies (but not as much of a reduction as estimated for the No Action Alternative (LLT). These factors result in a decrease in deliveries under the No Action Alternative (ELT), when compared to Existing Conditions. A detailed explanation of factors influencing deliveries under the No Action Alternative (LLT) is provided in Section 5.3.3.1 in Appendix A of this RDEIR/SDEIS.

Changes in deliveries would result in similar effects to hydrologic regions as described for the No Action Alternative (LLT), but to a smaller magnitude. Where there are reduced deliveries to agricultural contractors, it is reasonable to expect that agricultural production in affected areas would also decline, with potential resultant changes in employment, labor income, community character, and local government fiscal conditions. Where M&I deliveries increase and accommodate population growth, such growth could stimulate economic activity resulting from increased demand for goods and services. As with estimating changes in agricultural production, the location and extent of population growth would depend largely on local factors. Where M&I deliveries under the No Action Alternative (ELT) would be reduced compared to Existing Conditions to the extent that they would, in the long run, constrain population growth, their implementation could reinforce a socioeconomic status quo or limit potential economic and employment growth in hydrologic regions. Further discussion of these potential effects is included in Section 4.2.27, *Environmental Justice*, and in Section 4.2.29, *Growth Inducement and Other Indirect Effects,* of this RDEIR/SDEIS.

CEQA Conclusion: Operation of water conveyance facilities under the No Action Alternative could affect socioeconomic conditions in the hydrologic regions receiving water from the SWP and CVP However, because these impacts are social and economic in nature, rather than physical, they are not considered environmental impacts under CEQA. To the extent that changes in socioeconomic conditions in the hydrologic regions would lead to physical impacts, such impacts are described in Section 4.2.29, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS.

4.2.16 Aesthetics and Visual Resources

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (at the early long-term timeframe) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 17, Aesthetic and Visual Resources, Section 17.3.3.1 of the Draft EIR/EIS.

Projects that are planned or currently under way that involve construction, operation and maintenance activities may result in potential to affect visual resources and viewer groups. The land uses in the Delta would be similar to those of today because only limited types of development are allowed in the Primary Zone of the Delta. However, some changes in the study area could occur as a result of localized population growth, continued land subsidence on Delta islands, levee instability and potential flood risk, sea level rise, and restoration activities. These changes could result in the conversion of additional agricultural land uses and would consequently affect the visual landscape. However, due to the shorter time frame for the No Action Alternative (ELT), the magnitude of visual effects associated with development and habitat restoration activities within the Plan Area would likely be less than that considered in 2060.

Many of the ongoing programs include development of future projects that would require additional project-level environmental review. Future federal actions would be required to comply with NEPA, the federal Endangered Species Act, and other federal laws and regulations. Compliance and permit requirements would be implemented on a case-by-case basis. Overall, implementing on-going programs and projects under the No Action Alternative (ELT), including changes in farmland are not expected to result in adverse changes to the visual environment because development in much of the study area is restricted by the primary zone designation and city and county ordinances.

CEQA Conclusion: In total, the ongoing programs and plans under the No Action Alternative (ELT) would result in the potential for temporary and permanent effects on the study area visual environment that are not expected to substantially change visual resource elements in the Delta because of the current restrictions on development in the primary zone and city and county ordinances to preserve the visual quality of the Delta. Future state and local actions would be required to comply with CEQA, the California Endangered Species Act, and other state and/or local laws and regulations. Therefore, this potential impact is considered less than significant.

4.2.17 Cultural Resources

The effects of the No Action Alternative (ELT) would be similar to the effects described for the No Action Alternative (LLT) in Chapter 18, *Cultural Resources,* Section 18.3.5.1 of the Draft EIR/EIS. Activities occurring within the Plan Area under the No Action Alternative (ELT) that could affect prehistoric and historic archaeological sites, buried human remains, and built-environment resources would be similar to those described under Existing Conditions. These activities include ongoing programs implemented by federal, state, and local agencies and non-profit groups, as well as projects that are permitted or assumed to be completed during the early long-term period. This includes restoration actions occurring within the Yolo Bypass and the restoration of 8,000 acres of intertidal habitat in the Delta and Suisun Marsh being driven by the 2008 and 2009 USFWS and NMFS BiOps.

Because the No Action Alternative (ELT) implementation period would be shorter, the magnitude of the ground disturbing activities that could adversely affect prehistoric and historic archaeological sites, buried human remains, and built-environment resources would be less than those expected under the No Action Alternative (LLT). However, adverse impacts on these cultural resources could still occur over the early long-term period as a result of ground disturbing activities within the Plan Area due to the planned restoration activities described above, and other actions such as flood control and roadway improvements.

***CEQA Conclusion*:** Under the No Action Alternative (ELT) activities will occur within the Plan Area that include disturbing lands that could contain prehistoric and historic archaeological sites, buried human remains, and built-environment resources. Land use changes within the Plan Area, including habitat restoration projects, could result in loss of these cultural resources, although to a lesser degree than under the No Action Alternative (LLT) because fewer acres would be disturbed. Because prehistoric and historic archaeological sites, buried human remains, and built-environment resources are known to occur within the Plan Area, actions occurring under the No Action Alternative (ELT) could result in disturbance to and potentially significant impacts on these cultural resources. These potential impacts are considered significant.

4.2.18 Transportation

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 19, *Transportation*, Section 19.3.3.1 of the Draft EIR/EIS.

Under the No Action Alternative (ELT), any currently underway or planned project within the study area that involves construction and operation and maintenance activities may result in potential effects on transportation facilities from movement of personnel, delivery of construction equipment, and delivery of goods and services. The effects could include increased delays on already congested roadways or accelerated deterioration of roadway surfaces. Roadways currently experiencing congestion and delays would continue to experience level of service impacts unless capacity enhancements are undertaken.

Construction of the Yolo Bypass Improvements and 8,000 acres of tidal marsh habit restoration implemented under the No Action Alternative (ELT) may add additional trips to affected roadways, which could potentially create localized transportation effects and could affect access to farmland. However, in general, traffic volumes on roadway segments in the Plan Area would likely be less under the ELT timeframe than those considered in 2060 due to less population and employment growth in the region. Similarly, due to the shorter time frame, the magnitude of total construction traffic impacts associated with development and habitat restoration activities within the Plan Area would be less than that considered in 2060.

Under the No Action Alternative (ELT) that amount of growth that could occur would not be expected to substantially affect study area traffic volumes. Accordingly, there would be no adverse changes in the characteristics of the transportation systems over state highways, local roadways, or navigation through Delta channels. Other transportation modes such as bicycle, marine, rail, bus, and air traffic are also not expected to be adversely affected because of the minimal traffic volume growth expected under the No Action Alternative (ELT).

CEQA Conclusion**:** None of the projects or programs assumed through the ELT time period would create new growth that would be expected to substantially affect study area traffic volumes in the Study Area. Moreover, traffic generated under the No Action Alternative (ELT) is not projected to substantially increase delays or deterioration of pavement conditions that are substantial in relation to the existing level of service and pavement conditions. The impacts on other transportation modes such as bicycle, marine, rail, bus, and air traffic are also not expected to be substantially affected because of the minimal traffic volume growth expected under the No Action Alternative (ELT). This impact would be less than significant.

4.2.19 Public Services and Utilities

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 20, *Public Services and Utilities*, Section 20.3.3.1 of the Draft EIR/EIS. Due to the shorter time frame, the magnitude of total impacts to public services and utilities resulting from construction associated with development and habitat restoration activities within the Plan Area would be less under the ELT timeframe than that considered in 2060 due to less development in the region.

Public services such as law enforcement, fire protection, emergency response services, public medical services, public schools, libraries, or other services would operate and expand as needed to appropriately serve the study area in accordance to their respective general plans and applicable local, state, and federal laws pertaining to service levels. Although some changes would be likely, the potential for public services and utilities effects under the No Action Alternative (ELT) would be minor because of the limited development allowed in the Delta primary zone. While development in the secondary zone would be anticipated to occur, required services and infrastructure will keep pace with it based on local general plan requirements.

It is assumed that projects included in the No Action Alternative (ELT) would include typical design and construction practices to avoid or minimize potential impacts on public services and utility systems, and would be subject to a project-level environmental review process to identify potential effects and to include feasible mitigation measures to avoid or substantially reduce potential effects. Public services and utilities effects under the No Action Alternative (ELT) would not be adverse.

CEQA Conclusion: In total, the ongoing programs and plans under the No Action Alternative (ELT) would include activities that will generate impacts on public services such as law enforcement, fire protection, emergency response services, public medical services, public schools, libraries, or other services would operate and expand as needed to appropriately serve the Plan Area in accordance with applicable general plans and local, state, and federal laws pertaining to service levels. However, because these projects have undergone or will undergo separate environmental review, it is assumed that potential public services and utilities effects have been or will be adequately addressed. Therefore, the effects of these plans, policies, and programs are considered less than significant.

4.2.20 Energy

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 21, *Energy*, Section 21.3.3.1 of the Draft EIR/EIS.

The CALSIM-II simulation of No Action Alternative (ELT) upstream reservoir operations and river flows was used to estimate the energy generation at the upstream CVP and SWP facilities. The energy use for south of Delta pumping and delivery of water to CVP and SWP contractors was estimated from the CALSIM-II simulations of CVP and SWP pumping and deliveries for 1922–2003. The combined SWP/CVP energy factor would be about 1.5 gigawatt hours (GWh) per TAF. Accordingly, the No Action Alternative (ELT) would not increase the existing energy use factor and would not result in an adverse effect on energy resources.

CEQA Conclusion: The energy use factor (1.5 GWh per TAF) under the No Action Alternative (ELT) and Existing Conditions would be identical. Because the No Action Alternative (ELT) would not increase the energy use factor, it would not result in a significant impact on energy resources.

4.2.21 Air Quality and Greenhouse Gases

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.3.1 of the Draft EIR/EIS.

Facilities that are planned or currently under construction would result in short-term criteria pollutant and greenhouse gas (GHG) emissions from land disturbance and the use of heavy-duty equipment. Pollutant emissions are highly dependent on the total amount of disturbed area, the duration of construction, and the intensity of construction activity. In addition, the number and types of heavy-duty equipment significantly affect emissions generated by vehicle exhaust. Construction impacts can thus vary depending on the type of construction project implemented under the No Action Alternative (ELT). Due to the shorter time frame, the magnitude of total construction emissions associated with development and habitat restoration activities within the Plan Area would be less than that considered in 2060.

Restoration and conservation activities would take place under the No Action Alternative (ELT) and as part of planned and ongoing programs. These activities could result in temporary air quality effects from earthmoving and use of construction equipment. Due to the addition of the Yolo Bypass Improvements and 8,000 acres of tidal marsh habit restoration under the No Action Alternative (ELT), the magnitude of short-term emissions associated with restoration and conservation activities would be slightly greater than that considered in 2060 for the No Action Alternative as described in the Draft EIR/EIS.

Emissions from construction and restoration and conservation activities under the No Action Alternative (ELT) would result in an adverse effect if the incremental difference, or increase, relative to Existing Conditions exceeds applicable air district or federal *de minimis* thresholds. Future federal actions would be required to comply with NEPA and other federal laws and regulations. Mitigation and permit requirements would be implemented on a case-by-case basis.

There would be no changes attributable to the No Action Alternative (ELT) that would adversely affect long-term operations and maintenance (O&M) criteria pollutant emissions. GHG emissions generated by electricity consumption and distribution at the ELT timeframe are presented in Table 4.2.21-1. Because emissions rates are expected to decrease in the future due to state mandates for renewable energy production, the magnitude of electricity-related emissions would be slightly higher than considered in 2060, but still less than Existing Conditions.

Table 4.2.21-1. Total Criteria Pollutant and GHG Emissions from Electricity Consumption during Operation of the No Action Alternative (ELT) (tons/year)[a,b,c]

Condition	ROG	CO	NO_X	PM10	PM2.5[d]	SO_2	CO_2e[e]
Existing	9	88	1,212	102	102	512	1,672,965
No Action Alternative (ELT)	8	72	992	84	84	418	1,368,527

[a] Emissions assume implementation of RPS (see Appendix 22A, *Air Quality Analysis Methodology*, of the Draft EIR/EIS).

[b] Because GHG emissions are cumulative and not evaluated at the local air basin or air district level. The GHG analysis for SWP power utilizes actual and forecasted GHG emissions rates for the SWP system, which differs slightly from the above analysis. Statewide grid average emission factors were utilized for the above analysis as criteria pollutant emission factors for SWP were unavailable.

[c] Power plants located throughout the state supply the grid with power, which will be distributed to the study area to meet project demand. Power supplied by statewide power plants will generate criteria pollutants. Because these power plants are located throughout the state, criteria pollutant emissions associated with the No Action Alternative electricity demand cannot be ascribed to a specific air basin or air district within the study area.

[d] Emission factors for PM2.5 are currently unavailable. Consequently, PM2.5 emissions were assumed to equal PM10 emissions. Because PM2.5 represents a fraction of PM10, this approach represents a conservative assessment of PM2.5 emissions from electricity consumption.

[e] Emissions presented in metric tons of CO_2e.

CEQA Conclusion: Construction and operation of ongoing projects, programs, and plans under the No Action Alternative (ELT) would generate criteria pollutant and GHG emissions that could affect regional and local air quality. These projects would be required to comply with air district rules and regulations to reduce construction-related criteria pollutant and GHG emissions. Mitigation and permit requirements would be implemented on a case-by-case basis to help reduce construction- and operational-related impacts. Emissions would be considered significant if they exceed local air district thresholds, even with mitigation.

Energy required for long-term operation of the no project will be supplied by the California electrical grid. As shown in Table 4.2.21-1, operation of the No Action Alternative (ELT) would result in a net decrease in GHG emissions, relative to Existing Conditions. Consequently, a long-term GHG benefit would be realized under the No Action Alternative (ELT). Overall, the effect of the No Action Alternative (ELT) on air quality and GHG emissions is considered less than significant.

4.2.22 Noise

The effects of the No Action Alternative as considered for the purposes of Alternative 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 23, *Noise*, Section 23.3.3.1 of the Draft EIR/EIS.

Future noise conditions in the Delta are not expected to change substantially as existing repair, maintenance, habitat protection, and flood management activities would continue. Emergency repair of levees could create higher than normal levels of noise and vibration levels, although the timing and duration of equipment use and associated noise impacts would be unpredictable, as with any emergency event. In general, background noise levels in the Plan Area would likely be less under the ELT timeframe than those considered in 2060 due to less development in the region.

Construction activities and the operation of heavy equipment required for the Yolo Bypass Improvements and tidal habitat restoration would be a source of localized and temporary noise. In general, effects would be avoided through adherence to City and County noise construction ordinances. Equipment needed to implement ongoing programs, plans, and projects in Plan Area would also temporarily increase ambient noise levels. These projects have undergone or will undergo separate environmental review, in which noise reducing measures would be outlined, as necessary. Noise levels would be considered adverse if they exceed local standards, even with mitigation.

CEQA Conclusion: In total, the ongoing programs and plans under the No Action Alternative (ELT) would include activities that will generate temporary and localized noise. These projects have undergone or will undergo separate environmental review, in which noise reducing measures would be outlined, as necessary. Noise levels would be considered significant if they exceed local standards, even with mitigation.

4.2.23 Hazards and Hazardous Materials

The effects of the No Action Alternative as considered for the purposes of Alternatives 4A, 2D, and 5A (ELT) would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 24, *Hazards and Hazardous Materials*, Section 24.3.3.1 of the Draft EIR/EIS.

Projects that are planned or currently under way that involve construction, operation and maintenance activities may result in potential hazards to the environment or public including the potential for encountering contaminated soils and groundwater, release of hazardous materials (including flammable gases) from disturbance of regional fuel pipelines, accidental releases of hazardous materials (e.g., fuels, solvents, and lubricants) and improper disposal of hazardous materials and release of oils, solvents, and fuels from maintaining and cleaning equipment or vehicles. However, due to the shorter time frame, the magnitude of hazards and hazardous materials effects associated with development and habitat restoration activities within the Plan Area would be less than that considered in 2060. Similarly, hazards and hazardous materials effects associated with climate change (levee failure and flooding risks) would be anticipated to be less than under the No Action Alternative (LLT). Generally, impacts would be avoided through adherence to applicable federal, state, and local regulations; project-specific design; and implementation of best management practices (BMPs), environmental commitments, and/or mitigation, including HMMPs, SWPPPs, and SPCCPs. These practices/measures are intended to avoid, prevent, or minimize hazardous spills and construction-related hazards and/or mitigate for such occurrences. However, because the potential exists for hazards and hazardous materials effects to occur under existing plans and programs, adverse effects are expected to occur in the study area under the No Action Alternative.

CEQA Conclusion: Implementation of programs, policies, and projects under the No Action Alternative (ELT) in the study area would have the potential for significant impacts on the public or the environment related to hazards and/or hazardous materials (e.g., through the inadvertent release of fuels or lubricants during construction). However, these impacts would be smaller in scale and more confined in geographic scope relative to the No Action Alternative (LLT). Projects implemented under the No Action Alternative (ELT) would require their own separate environmental compliance processes; would be required to adhere to applicable federal, state, and local regulations; and would incorporate applicable BMPs, environmental commitments, and/or mitigation intended to avoid, prevent, or minimize hazardous spills and construction-related hazards and/or mitigate for such occurrences, which would help ensure that these types of impacts are mitigated to a less-than- significant level.

4.2.24 Public Health

The effects of the No Action Alternative (ELT) as considered for the purposes of Alternatives 4A, 2D, and 5A would be expected to be similar to those effects described for the No Action Alternative (LLT) in Chapter 25, *Public Health*, Section 25.3.3.1 of the Draft EIR/EIS.

New water supply facilities would be constructed under the No Action Alternative (ELT) as listed in Table 25-10 in Chapter 25, *Public Health*, of the Draft EIR/EIS; therefore, there could be a disruption to existing sources of methylmercury associated with this type of construction. Water supply operations under the No Action Alternative (ELT) likely would not involve the operation of solids lagoons or sedimentation basins; therefore, there would be no increase in the public's risk of exposure to vector-borne diseases. Under the No Action Alternative (ELT), there would be a change in various source waters throughout the Delta (i.e., upstream water, Bay water, agricultural return flow), due to potential changes in inflows, particularly from the Sacramento River watershed because of increased water demands or changes to climate and precipitation levels. Water supply operations under the No Action Alternative (ELT) would continue to use the existing source(s) of drinking water from the study area. These sources generally meet regulatory standards for most constituents. However, under the No Action Alternative (ELT), existing exceedances would not increase above baseline conditions (see Section 4.2.7, *Water Quality*, of the RDEIR/SDEIS) to levels that adversely affect any beneficial uses or substantially degrade water quality. Furthermore, drinking water from the study area would continue to be treated prior to distribution into the drinking water system.

Any modified reservoir operations under the No Action Alternative (ELT) are not expected to promote *Microcystis* production upstream of the Delta since large reservoirs upstream of the Delta are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*. As described in Section 4.2.7 (*Water Quality*) above, hydrodynamic changes due to enhancements to the Yolo Bypass and 8,000 acres of tidal habitat would increase hydraulic residence times in the Delta, which would create conditions conducive to the formation of *Microcystis* blooms. Projected future water temperature changes in the Delta under the No Action Alternative (ELT) indicate that water temperatures would increase due to climate change. These temperature increases could lead to earlier attainment of the water temperature threshold of 19°C required to initiate *Microcystis* bloom formation, and thus earlier occurrences of *Microcystis* blooms in the Delta.

Therefore, the combination of increased water residence times in the Delta, due to assumed restoration activities, and increased water temperatures, due to climate change could result in increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta under the No Action Alternative (ELT). As such, impacts on beneficial uses, including drinking water and recreational waters, could occur and public health could be affected. Accordingly, this would be considered an adverse effect.

The No Action Alternative (ELT) may involve the operation of new transmission lines should additional sources of electricity be needed by either the water supply projects or as part of a general plan buildout. It is likely that with population growth projected by various general plans and regional plans would also result in an additional need for electricity and the construction and operation of new transmission lines. Furthermore, as more renewable energy sources such as solar power are developed, new transmission lines will likely be needed to convey power from the renewable energy source to users. Although, it is unknown where new transmission lines would be and if they would be located within close proximity to sensitive receptors (e.g., hospitals, schools, parks), it is likely some of them would be within close proximity to sensitive receptors and present new sources of EMFs. However, the utilities will implement the CPUC design criteria and guidelines regarding EMFs, and CPUC reviews proposals for transmission lines if feasible. Investor-owned utilities are required to obtain a permit from CPUC for construction of certain specified infrastructure (including transmission lines) listed under Public Utilities Code Section 1001 (California Public Utilities Commission 2011). CPUC reviews permit applications under two concurrent processes: (1) an environmental review pursuant to CEQA, and (2) the review of project need and costs pursuant to Public Utilities Code Sections 1001 et seq. and General Order 131-D (CPCN or PTC) (California Public Utilities Commission 2011). Therefore, the No Action Alternative (ELT) is not likely to result in adverse effects on public health with respect to EMFs.

Habitat restoration activities in the study area already approved, such as those associated with the Suisun Marsh Habitat Management, Preservation, and Restoration Plan, could be implemented under the No Action Alternative (ELT) time frame. These habitat restoration activities would generally be located in areas that are already potential sources of vectors, such as existing channels or agricultural areas. Furthermore, activities would be designed to maximize water exchange and flow, thereby minimize stagnant water and the production of mosquitoes. Finally, all of the restoration activities would occur in consultation with existing MVCDs. Therefore, it is not expected that habitat restoration under the No Action Alternative (ELT) would result in a substantial increase in the public's risk of exposure to vector-borne diseases.

Under the No Action Alternative (ELT), as described in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*, of the Draft EIR/EIS, there would be some change in inflows from the Sacramento River due to climate change-related changes in precipitation patterns; therefore, the amount of Delta waters consisting of agricultural return flow would increase slightly. Approximately 5% of the in-Delta agricultural use is livestock, the primary type of agricultural use that generates pathogens. The relatively small increase in the percentage of Delta waters consisting of agricultural return flow is not expected to cause a measureable change in the pathogen concentrations in the Delta waters because livestock is a small percentage of the overall agricultural use and none of the assumed No Action Alternative (ELT) conditions would substantially change the amount of livestock in the study area. Therefore, under the No Action Alternative (ELT), the concentrations of pathogens would remain relatively similar to existing concentrations and recreationists would not experience a substantial increase in exposure.

Construction of habitat restoration projects that are reasonably foreseeable or approved and/or under construction under the No Action Alternative (ELT) would likely temporarily mobilize existing constituents within sediments known to bioaccumulate, such as methylmercury or pesticides. This potential effect is expected in varying degrees depending on the location of restoration projects because the study area is generally known to be out of compliance with methylmercury levels. Construction effects would not be adverse because the mobilization would occur during a limited time and would be localized around the area of construction. Once operational, other habitat restoration projects could result in an increase of methylmercury as a result of biogeochemical processes and sediment conditions established in tidal wetlands. However, it is expected these projects either have, or would evaluate the potential for, methylmercury production and would implement measures to monitor and adaptively manage methylmercury production. For example, the Suisun Marsh Plan EIR/EIS evaluated the potential for methylmercury production due to tidal restoration and determined it would result in less than significant impacts and that monitoring and other measures would be incorporated into the adaptive management plan to manage methylmercury concerns. Therefore, the habitat restoration projects that would occur under the No Action Alternative (ELT) are not likely to adversely affect public health.

***CEQA Conclusion*:** It is expected that implementation of existing plans, or existing and reasonably foreseeable habitat restoration projects, would not result in a substantial increase in the public's risk of exposure to vector-borne diseases because of the location of existing vector habitat, restoration design, and consultation with MVCDs. This is because habitat restoration would be located in areas that are already potential sources of vectors, such as existing channels or agricultural areas. Furthermore, activities would be designed to maximize water exchange and flow, thereby minimizing stagnant water and the production of mosquitoes. Finally, all of the restoration activities would occur in consultation with existing MVCDs. Therefore, it is not expected that habitat restoration under the No Action Alternative (ELT) would result in a substantial increase in the public's risk of exposure to vector-borne diseases. As such, this impact is less than significant.

Construction impacts associated with No Action Alternative (ELT) habitat restoration projects would be less than significant because the mobilization of existing sediment-bound contaminants (e.g., methylmercury) would occur during a limited time and would be localized around the area of construction. Once operational, other habitat restoration projects could result in an increase of methylmercury as a result of biogeochemical processes and sediment conditions established in tidal wetlands. However, it is expected these projects either have, or would evaluate the potential for, methylmercury production and would implement measures to monitor and adaptively manage methylmercury production.

Water supply operations under the No Action Alternative (ELT) would continue to use the existing source(s) of drinking water from the study area. These sources generally meet regulatory standards for most constituents or experience some exceedances for constituents such as arsenic (see Chapter 8, *Water Quality*, of the Draft EIR/EIS. Under the No Action Alternative (ELT), existing exceedances would not increase above baseline conditions and, therefore, this impact would be less than significant.

It is unknown where new transmission lines would be in the ELT period and if they would be located in close proximity to sensitive receptors (e.g., hospitals, schools, parks); however, it is likely some of them would be within close proximity to sensitive receptors and present new sources of EMFs. Utilities will implement the CPUC design criteria and guidelines regarding EMFs, and CPUC reviews proposals for transmission lines if feasible. Accordingly, this impact would be less than significant

Because it is possible that under the No Action Alternative (ELT) increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to increased water temperatures associated with climate change, as well as increased water residence times related to restoration activities, long-term water quality degradation may occur in the Delta and water exported from the Delta to the SWP/CVP Export Service Areas. Thus, impacts on beneficial uses could occur, and therefore this impact would be significant.

4.2.25 Minerals

The effects of the No Action Alternative (ELT) considered for the purposes of Alternative 4A, 2D, and 5A would be expected to be similar to the effects described for the No Action Alternative (LLT) in Chapter 26, *Minerals,* Section 26.3.3.1 of the Draft EIR/EIS. Access to natural gas wells and fields and aggregate resources and resulting production rates would be expected to be similar to those described under Existing Conditions and would include continued programs by federal, state, and local agencies and non-profit groups as well as projects that are permitted or assumed to be constructed in the ELT period. Because of the shorter implementation period, the magnitude of activities that could adversely affect access to natural gas wells and fields and aggregate resources in the Plan Area would be less than those considered under in 060. In addition, impacts on mineral resources attributable to climate change and sea level rise, (increased flooding risk) would be expected to be less when compared to conditions under the No Action Alternative (ELT). There could be adverse impacts on mineral resources in the ELT period as a result of changes in land uses within the Plan Area, primarily as a result of planned restoration activities.

Under the No Action Alternative (ELT), DOGGR regulatory programs that have jurisdiction over natural gas well development and abandonment would continue with no substantive changes. Similarly, programs that regulate mineral resources and programs to identify and conserve mineral resources would be implemented with no substantive changes in the future. CGS and SMGB programs would continue to classify and designate important mineral resource zones (MRZs) and DOC would continue to regulate mineral extraction under SMARA and continue to ensure that mining areas are reclaimed to adequately support future end uses following completion of regulated activities.

CEQA Conclusion: Under the No Action Alternative (ELT), some projects could occur in the Plan Area that could reduce access to natural gas and mineral resources. Land use changes within the Plan Area, including habitat restoration projects, could result in loss of access to mineral resources, although to a lesser degree than under the No Action Alternative (LLT). Access to these resources could be offset by implementing mitigation actions such as directional drilling. Other actions that would consume mineral resources (i.e., restoration actions, flood control improvements, roadway improvements, etc.) would occur within Plan Area, but would be supplied through existing permitted sites. As such, there would be no significant impacts on access to natural gas resources or the availability of aggregate resources within study area under the No Action Alternative (ELT).

4.2.26 Paleontological Resources

The effects of the No Action Alternative (ELT) considered for the purposes of Alternative 4A, 2D, and 5A would be expected to be similar to the effects described for the No Action Alternative (LLT) in Chapter 27, *Paleontological Resources*, Section 27.3.3.1 of the Draft EIR/EIS. Activities within the Plan Area that under the No Action Alternative (ELT) could affect paleontological resources would be expected to be similar to those described under Existing Conditions and would include continued programs by federal, state, and local agencies and non-profit groups as well as projects that are permitted or assumed to be constructed in the ELT period. This includes expected restoration actions within the Yolo Bypass being driven by the 2008 and 2009 USFWS and NMFS BiOps and the restoration of 8,000 acres intertidal habitat in the Delta and Suisun Marsh.

Because of the shorter implementation period, the magnitude of ground disturbing activities that could adversely affect paleontological resources would be less than those expected under the No Action Alternative (LLT). However, there could be adverse impacts on paleontological resources in the ELT period as a result of ground disturbing activities occurring within the Plan Area, as a result of the planned restoration activities described above and other activities such as flood control and roadway improvements.

CEQA Conclusion: Under the No Action Alternative (ELT), activities will occur within the Plan Area that include disturbing land that could impact paleontological resources. Land use changes within the Plan Area, including habitat restoration projects, could result in loss of paleontological resources, although to a lesser degree than under the No Action Alternative (LLT) because fewer acres would be disturbed. Because the region is sensitive for paleontological resources, these actions could collectively result in disturbance of paleontological resources and a potentially significant impact.

4.2.27 Environmental Justice

The effects of the No Action Alternative (ELT) on low income and minority populations would be similar to the effects described for the No Action Alternative in Chapter 28 *Environmental Justice*, Section 28.5.4 of the Draft EIR/EIS. Activities occurring within the Plan Area under the No Action Alternative (ELT) that could result in a disproportionate effect on low income and minority communities would be similar to those described under Existing Conditions. These activities include ongoing programs implemented by federal, state, and local agencies, and non-profit groups, as well as projects that are permitted or assumed to be completed during the early long-term period. This includes restoration actions occurring within the Yolo Bypass and the restoration of 8,000 acres of intertidal habitat in the Delta and Suisun Marsh being driven by the 2008 and 2009 USFWS and NMFS BiOps.

Because the No Action Alternative (ELT) implementation period would be shorter, the magnitude of activities that could adversely affect low income and minority populations would be less than those described for the No Action Alternative. Disproportionate adverse effects on these populations could occur directly as result of constructing a facility within or adjacent to a community or indirectly by alternating land uses in such a fashion that the economic activity that benefits these communities (i.e., agricultural, recreation, etc.) is reduced or eliminated during the early long-term period.

4.2.28 Climate Change

As described in Chapter 29, *Climate Change,* of the Draft EIR/EIS, climate change would be anticipated to change the conditions under which alternatives would be implemented. Under discussion of the No Action Alternative (LLT)[4], the impact analysis associated with each resource includes an evaluation of how the alternatives would affect the specific resource in question. In each of these analyses, where the effects of the alternatives are analyzed at the ELT and the LLT, climate change is integrated into the analysis. In these analyses, the alternatives are evaluated using a projection of future climate that includes changes in temperature, precipitation, humidity, hydrology, and sea level rise (SLR). Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS provides detailed information about the development of the climate change projections. Effects related to climate change would be anticipated to be smaller in magnitude in the ELT timeframe than in the late long-term.

4.2.29 Growth Inducement and Other Indirect Effects

As it relates to this document, growth will occur between the present and the year 2025, with or without the proposed action alternatives. Table 4.2.29-1 summarizes SWP and CVP deliveries under existing conditions (the CEQA baseline) and the No Action Alternative (ELT). Under the No Action Alternative ELT scenario, the facilities and operations of the SWP and CVP would continue to be similar to existing conditions. However, the No Action Alternative (ELT) includes two additional assumptions. First, the No Action Alternative (ELT) assumes that there would be an increase in M&I water rights demands north of the Delta, which would increase overall system demands and reduce the amount of CVP water available for export south of the Delta. Second, the No Action Alternative (ELT) includes effects of implementation of the Fall X2 standard, which requires additional water releases through the Delta and would result in decreased availability of water for export to SWP and CVP facilities. The No Action Alternative (ELT) also includes the effects of sea level rise and climate change, which would reduce the amount of water available for SWP and CVP water supplies, as described in Chapter 5, *Water Supply*, of the Draft EIR/EIS. These factors lead to an overall decrease in SWP and CVP deliveries under the No Action Alternative (ELT) as compared to existing conditions. For a more detailed explanation of factors influencing deliveries under the No Action Alternative (ELT), see Chapter 5, *Water Supply*, of the Draft EIR/EIS.

[4] Late-long term is modeled at 2060 whereas early-long term is modeled at 2025.

Table 4.2.29-1. Existing Conditions and No Action Alternative (ELT): Summary of Annual SWP and CVP Deliveries (thousand acre-feet)

	Existing Conditions		No Action Alternative (ELT)	
	Table A	Table A + Article 21	Table A	Table A + Article 21
M&I[a]	1,852	1,889	1,863	1,888
Agriculture	665	706	626	653
Total SWP	2,517	2,595	2,489	2,541
CVP M&I[a]	125		118	

Sources: Based on projected water deliveries as reported in BDCP modeling results for SWP contractors (SWP_TableA_Art21_delivery_by_contractor_newAlt1A2B_tables_110211.xls, November 2011; SWP_TableA_Art21_delivery_by_contractor_Alt2A_tables_021412.xls, February 2012; and SWP_TableA_Art21_ delivery_by_contractor_tables_110111(031412).xls, March 2012) and CVP contractors (BDCP_Alternatives CVP_M&I_Deliveries_020212.xls, February 2012; BDCP_Alternatives_CVP_M&I_Deliveries_with_Alt8_050112.xls, May 2012; and BDCP_Alternatives_CVP_M&I_Deliveries_ELT_052112, May 2012). California Department of Water Resources 2011b; California Department of Water Resources 2012b; California Department of Water Resources 2012c; California Department of Water Resources 2012d; California Department of Water Resources 2012e; California Department of Water Resources 2012g, adapted by ESA

[a] M&I – Municipal and Industrial (urban) customers.

Deliveries to the Hydrologic Regions

SWP. Under the No Action Alternative (ELT), deliveries would be decreased to all regions in the early long-term relative to existing conditions. In the early long-term, overall deliveries to the San Francisco Bay, South Coast and Colorado River regions would increase slightly to meet projected increases in demands in those areas, while overall deliveries to other regions would decrease. The South Coast Region would experience the largest increase (between 5 and 19 TAF) while the South Lahontan region would experience the largest decrease (approximately 5 TAF). Table A deliveries to M&I contractors overall would increase slightly by 95.7 TAF relative to existing conditions, while total (Table A and Article 21) deliveries to both M&I and agricultural contractors overall would decrease slightly relative to existing conditions.

CVP. Under the No Action Alternative (ELT), deliveries to all M&I contractors and all hydrologic regions would decrease by a total of 6.7 TAF relative to existing conditions.

No Action Alternative ELT Compared to Existing Conditions

SWP. Table A deliveries to all (M&I and agricultural) SWP contractors overall are projected to decrease by 1% relative to existing conditions, while total (Table A plus Article 21) deliveries to all SWP contractors are projected to decrease by 2%. Table A and total deliveries to M&I contractors are projected to increase by 0.6% and decrease by 0.1%, respectively.

CVP. Deliveries to all CVP M&I contractors are projected to decrease by 5% relative to Existing Conditions.

CEQA Conclusion: Under the No Action Alternative (ELT), overall deliveries to SWP and CVP contractors would decrease relative to existing conditions. To the extent that deliveries could remove a barrier to growth in the delivery areas, the No Action Alternative (ELT) would not contribute to growth in areas served by the SWP and CVP. Therefore, this potential impact is considered less than significant.

4.2.30 References

4.2.1 No Action Alternative (ELT) Assumptions for State Water Project and Central Valley Project

None.

4.2.2 No Action Alternative (ELT) Assumptions for Ongoing Programs and Policies

None.

4.2.3 No Action Alternative (ELT) Assumptions for Biological Opinions

None.

4.2.4 Water Supply

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Zone 7 Water Agency. 2010. *2010 Urban Water Management Plan*. December.

4.2.5 Surface Water

None.

4.2.6 Groundwater

None.

4.2.7 Water Quality

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4.2.8 Geology and Seismicity

None.

4.2.9 Soils

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4.2.10 Fish and Aquatic Resources

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4.2.11 Terrestrial Biological Resources

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4.2.12 Land Use

None.

4.2.13 Agricultural Resources

None.

4.2.14 Recreation

None.

4.2.15 Socioeconomics

None.

4.2.16 Aesthetics and Visual Resources

None.

4.2.17 Cultural Resources

None.

4.2.18 Transportation

California Department of Water Resources, Preliminary Estimates of Sediment Load at Proposed DHCCP Intakes (June 28, 2012) Revision 2.

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California Department of Water Resources, Technical Memorandum – Initial Intake Hydraulic Analyses (April 15, 2010).

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4.2.19 Public Services and Utilities

None.

4.2.20 Energy

None.

4.2.21 Air Quality and Greenhouse Gases

None.

4.2.22 Noise

None.

4.2.23 Hazards and Hazardous Materials

None.

4.2.24 Public Health

California Public Utilities Commission.2011. *Transmission Siting and Environmental Permitting*. Available: <http://www.cpuc.ca.gov/PUC/energy/Environment/index.htm>. Accessed: December 10, 2011.

4.2.25 Minerals

None.

4.2.26 Paleontological Resources

None.

4.2.27 Environmental Justice

None.

4.2.28 Climate Change

None.

4.2.29 Growth Inducement and Other Indirect Effects

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4.3 Impacts of Alternative 4A

4.3.1 Water Supply

Facilities construction under Alternative 4A would be identical to that described under Alternative 4. Alternative 4A water conveyance operations would be similar to the range of possible operations for the spring Delta outflow requirements that would occur under Alternative 4 H3 and Alternative 4 H4.

Model simulation results for Alternative 4A Early Long-term (ELT), which are represented by the range of Alternative 4 H3 (ELT) and Alternative 4 H4 (ELT), are summarized in Tables B.1-1 through B.1-3 in Appendix B of the RDEIR/SDEIS. Model simulation results for Alternative 4A at Late Long-term (LLT) which are similar to the range of Alternative 4 H3 (LLT) and Alternative 4 H4 (LLT) are summarized in Tables 5-7 through 5-9 in the Draft EIR/EIS.

As indicated in Section 5.3.2, *Determination of Effects*, of the Draft EIR/EIS, NEPA adverse effect and CEQA significant impact conclusions are not provided for the impacts discussed in this water supply sections.

4.3.1.1 Summary of Water Supply Operations under Alternative 4A

Change in Delta Outflow

Changes in long-term average Delta outflow under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Figures 4.3.1-1 through 4.3.1-3 in this RDEIR/SDEIS and Tables B.1-1 through B.1-3 in Appendix B of this RDEIR/SDEIS.

Changes in long-term average Delta outflow under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-7 through 5-9 of the Draft EIR/EIS.

Late-fall and winter outflows remain similar or show minor reductions in Alternative 4A compared to No Action Alternative. In the spring months, outflow would increase under Alternative 4A as compared to No Action Alternative. SWP and CVP exports in summer months would increase and result in lower outflow as compared to No Action Alternative. In the fall months, outflow under Alternative 4A as compared to No Action Alternative would be similar because of the Fall X2 requirement in wet and above-normal years, and increased or similar outflow in September and October months of all year types due to OMR flow requirements and export reductions.

Long-term average and wet year peak outflows would increase in winter months with a corresponding decrease in spring months because of the shift in system inflows caused by climate change and increased Delta exports as compared to Existing Conditions. In other year types, Alternative 4A would result in higher or similar outflow because of the spring outflow requirements. In summer and fall months, Alternative 4A would result in similar or higher outflow because of changes in export patterns and OMR flow requirements and export reductions in fall months, and also because of the Fall X2 requirements in wet and above normal years. The incremental changes in Delta outflow between Alternative 4A and Existing Conditions would be a function of both the facility and operations assumptions (including north Delta intakes capacity of 9,000 cfs, less negative OMR flow requirements, enhanced spring outflow and/or Fall X2 requirements) and the reduction in water supply availability due to increased north of Delta urban demands, sea level rise and climate change.

Delta outflow under Alternative 4A would likely decrease in winter and summer months, or remain similar or increase in other months, compared to the conditions without the project.

Results for the range of changes in Delta Outflow under Alternative 4A (LLT), which is similar to range of Alternative 4 H3 (LLT) and Alternative 4 H4 (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Figures 4.3.1-4 through 4.3.1-10 and Tables B.1-1 through B.1-3 in Appendix B of this RDEIR/SDEIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 4.3.1-11 through 4.3.1-14 for completeness.

Changes in May and September reservoir storage under Alternative 4A (LLT) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of the Draft EIR/EIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 of the Draft EIR/EIS for completeness.

Results for changes in SWP and CVP reservoir storages under Alternative 4A (LLT), which is similar to range of Alternative 4 H3 (LLT) and Alternative 4 H4 (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Trinity Lake

Under Alternative 4A, average annual end of September Trinity Lake storage as compared to No Action Alternative would increase or remain similar in most years.

Under Alternative 4A, average annual end of September Trinity Lake storage as compared to Existing Conditions would decrease or remain similar. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4A and the results show that average annual end of September Trinity Lake storage could increase or remain similar under Alternative 4A as compared to the conditions without the project.

Shasta Lake

Under Alternative 4A, average annual end of September Shasta Lake storage as compared to No Action Alternative would remain similar at ELT and decrease (up to 3%) at LLT.

Under Alternative 4A, average annual end of September Shasta Lake storage as compared to Existing Conditions would decrease. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4A and the results show that average annual end of September Shasta Lake storage could remain similar or decrease under Alternative 4A as compared to the conditions without the project.

Lake Oroville

Under Alternative 4A, average annual end of September Lake Oroville storage as compared to No Action Alternative would increase.

Under Alternative 4A, average annual end of September Lake Oroville storage as compared to Existing Conditions would decrease in all years. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4A and the results show that average annual end of September Lake Oroville storage would increase under Alternative 4A as compared to the conditions without the project.

Folsom Lake

Under Alternative 4A, average annual end of September Folsom Lake storage as compared to No Action Alternative would remain similar at ELT and decrease (2%) at LLT.

Under Alternative 4A, average annual end of September Folsom Lake storage as compared to Existing Conditions decrease. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4A and the results show that average annual end of September Folsom Lake storage could decrease or remain similar under Alternative 4A as compared to the conditions without the project.

San Luis Reservoir

Under Alternative 4A, average annual end of September San Luis Reservoir storage as compared to the No Action Alternative would mostly decrease, due to changes in export patterns.

Under Alternative 4A, average annual end of September San Luis Reservoir storage as compared to Existing Conditions would decrease. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 4A and the results show that average annual end of September San Luis Reservoir storage would generally decrease under Alternative 4A as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-1 through B.1-3 in Appendix B and Figures 4.3.1-15 through 4.3.1-18 of this RDEIR/SDEIS.

Changes in average annual Delta exports under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-7 through 5-9 of the Draft EIR/EIS.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 4A change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative.

Delta exports would either remain similar or increase in wetter years and decrease in drier years under Alternative 4A as compared to exports under No Action Alternative depending on the capability to divert water at the north Delta intakes during winter and spring months.

Total long-term average annual Delta exports under Alternative 4A would decrease as compared to exports under Existing Conditions reflecting changes in operations due to less negative OMR flows, implementation of Fall X2 and/or spring outflow under Alternative 4A, and sea level rise and climate change.

The incremental change in Delta exports under Alternative 4A as compared to No Action Alternative would be caused by the facility and operations assumptions of Alternative 4A. Delta exports would either remain similar or increase in wetter years and remain similar or decrease in the drier years under Alternative 4A as compared to the conditions without the project.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 4A, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

CEQA Conclusion**:** Constructing Alternative 4A water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes under Alternative 4A provides operational flexibility compared to deliveries under Existing Conditions and the No Action Alternative.

Changes in SWP and CVP Deliveries under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-1 through B.1-3 in Appendix B and Figures 4.3.1-22 through 4.3.1-28 of this RDEIR/SDEIS.

Changes in SWP and CVP Deliveries under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of the Draft EIR/EIS.

Results for SWP and CVP deliveries at LLT are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Total CVP Deliveries

Under Alternative 4A, average annual total CVP deliveries as compared to No Action Alternative, would increase by up to 3% at ELT and by up to 2% at LLT. Under Alternative 4A, average annual total south of Delta CVP deliveries as compared to No Action Alternative, would increase by about 5%.

Under Alternative 4A, average annual total CVP deliveries as compared to Existing Conditions, would increase by up to 3% at ELT and decrease by up to 2% at LLT. Under Alternative 4A, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 4% at ELT and by up to 9% at LLT. However, the decrease would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change, and the results show that average annual total CVP deliveries and average annual total CVP south of Delta deliveries would increase or remain similar under Alternative 4A as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Under Alternative 4A, average annual CVP north of Delta agricultural deliveries would increase by up to 4% at ELT and by up to 2% at LLT as compared to No Action Alternative.

Under Alternative 4A, average annual CVP north of Delta agricultural deliveries as compared to Existing Conditions, would decrease by up to 18% at ELT and by up to 31% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in, the absence of the effects of increased north of delta demands and sea level rise and climate change, and the results show that average annual CVP north of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP north of Delta agricultural deliveries would generally increase or remain similar under Alternative 4A as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Under Alternative 4A, average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would increase by up to 12% at ELT and by up to 13% at LLT.

Under Alternative 4A, average annual CVP south of Delta agricultural deliveries as compared to Existing Conditions would decrease by up to 6% at ELT and 18% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP south of Delta agricultural deliveries would increase or remain similar under Alternative 4A as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 4A as compared to deliveries under the No Action Alternative.

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 4A at ELT as compared to deliveries under the Existing Conditions. Under Alternative 4A at LLT, CVP Settlement Contract deliveries during dry and critical years as compared to Existing Conditions would decrease. This is due to Shasta Lake storage declining to dead pool more frequently, as described previously, under increased north-of Delta demands and climate change and sea level rise conditions. As described in the methods section of Chapter 5, *Water Supply*, in the Draft EIR/EIS, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 4A.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would remain similar. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 4A would be similar to the deliveries under the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Under Alternative 4A, average CVP north of Delta M&I deliveries as compared to No Action Alternative would remain similar of result in minor increase.

Under Alternative 4A, average annual CVP north of Delta M&I deliveries as compared to Existing Conditions would increase by up to 88% at ELT and 82% at LLT. However, this increase primarily would occur because there would be an increase in north of Delta M&I water rights demands under Alternative 4A and No Action Alternative as compared to demands under Existing Conditions.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would remain similar or show minor increase under Alternative 4A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would remain similar or increase under Alternative 4A as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Under Alternative 4A, average CVP south of Delta M&I deliveries as compared to No Action Alternative, would increase by about 4%.

Under Alternative 4A, average annual CVP south of Delta M&I deliveries as compared to Existing Conditions would decrease by up to 2% at ELT and by up to 7% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would remain similar or increase under Alternative 4A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase or remain similar under Alternative 4A as compared to the conditions without the project.

Total SWP Deliveries

Under Alternative 4A, average annual total SWP deliveries as compared to No Action Alternative, would decrease (by about 3%) or increase (by about 12%) depending upon range of spring outflow requirements. Under Alternative 4A, average annual total south of Delta SWP deliveries as compared to No Action Alternative, would decrease (by about 4%) or increase (by about 16%) depending upon range of spring outflow requirements.

Under Alternative 4A, average annual total SWP deliveries as compared to Existing Conditions, would decrease (9%)or increase (5%) at ELT and remain similar or decrease (13%) at LLT depending upon range of spring outflow requirements. Under Alternative 4A, average annual total south of Delta SWP deliveries as compared to Existing Conditions, would decrease (12%) or increase (7%) at ELT and would decrease (17%) or remain similar at LLT depending upon range of spring outflow requirements. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that under Alternative 4A average annual total SWP deliveries would decrease and increase. Therefore, average annual total SWP deliveries and average annual total SWP south of Delta deliveries under Alternative 4A would show a decrease or an increase as compared to the conditions without the project depending upon the range of spring Delta outflow requirements.

SWP Table A Deliveries

Under Alternative 4A, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative, would decrease (by about 7%) or increase (by about 13%) depending upon range of spring outflow requirements. Under Alternative 4A scenarios, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative, would decrease (by about 7%) or increase (by about 13%) depending upon range of spring outflow requirements.

Under Alternative 4A, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would decrease (11%) and increase (8%) at ELT and would decrease (17%) and increase (3%) at LLT depending upon range of spring outflow requirements. Under Alternative 4A, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would decrease (12%) and increase (8%) at ELT and would decrease (17%) and increase (2%) at LLT depending upon range of spring outflow requirements. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries under the No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that under Alternative 4A average annual total SWP Table A deliveries with Article 56 (without Article 21) would decrease or increase depending upon range of spring outflow requirements.

SWP Article 21 Deliveries

Under Alternative 4A, average annual total SWP Article 21 deliveries as compared to No Action Alternative, would increase by about 164%.

Under Alternative 4A, average annual total SWP Article 21 deliveries as compared to Existing Conditions, would decrease by up to 20% at ELT and by up to 32% at LLT. However, this decrease primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase under Alternative 4A as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 4A as compared to the conditions without the project.

SWP Feather River Service Area

Under Alternative 4A, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to No Action Alternative would increase or remain similar.

Under Alternative 4A, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to Existing Conditions, would decrease by up to 4% at ELT and by up to 6% at LLT. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 4A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase or remain similar under Alternative 4A as compared to the deliveries under No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would remain similar under Alternative 4A as compared to the conditions without the project.

NEPA Effects: SWP and CVP deliveries under Alternative 4A as compared to deliveries under No Action Alternative would increase or remain similar. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries under Alternative 4A, are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects,* and other sections of this RDEIR/SDEIS addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 4A would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north of Delta water demands that would occur under No Action Alternative and Alternative 4A and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would generally increase or remain similar under Alternative 4A as compared to deliveries under conditions in 2025 and 2060 without Alternative 4A if sea level rise and climate change conditions are considered the same under both scenarios (Alternative 4A and No Action Alternative). SWP and CVP deliveries under Alternative 4A would generally increase or remain similar as compared to deliveries under Existing Conditions without the effects of increased north of Delta water demands, sea level rise, and climate change. Some reductions in the SWP south of Delta deliveries could occur under Alternative 4A with higher spring outflow requirements. Indirect effects of changes in water deliveries including potential effects on urban areas caused by changes in SWP and CVP water supply deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects,* and other sections of this RDEIR/SDEIS addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 4A increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to the No Action Alternative. Alternative 4A would change the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to Existing Conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would change as well, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Under Alternative 4A as compared to Existing Conditions, the frequency of years in which cross-Delta transfers would increase, and the average annual volume of those transfers would increase. Under Alternative 4A as compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would occur would decrease.

Alternative 4A provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including criteria guiding the operation of water conveyance facilities under Alternative 4A.

NEPA Effects: Alternative 4A would decrease water transfer demand compared to existing conditions. Alternative 4A would decrease conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to No Action Alternative. Prior to approval, each transfer must go through NEPA review and be evaluated by the export facility agency, and may also be subject to CEQA review and/or SWRCB process. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects*, and other sections addressing specific resources.

CEQA Conclusion: Alternative 4A would increase water transfer demand compared to existing conditions. Alternative 4A would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.2.29, *Growth Inducement and Other Indirect Effects,* and other sections addressing specific resources.

4.3.2 Surface Water

Facilities construction under Alternative 4A would be identical to those described under Alternative 4.

Alternative 4A water conveyance operations would be similar to the range of possible operations for the spring Delta outflow requirements that would occur under Alternative 4 H3 and Alternative 4 H4.

Model simulation results for Alternative 4A Early Long-term (ELT), which are represented by the range of Alternative 4 H3 (ELT) and Alternative 4 H4 (ELT), are summarized in Tables B.2-1 through B.2-6 in Appendix B of the RDEIR/SDEIS. Model simulation results for Alternative 4A at Late Long-term (LLT) which are similar to the range of Alternative 4 H3 (LLT) and Alternative 4 H4 (LLT) are summarized in Tables 6-2 through 6-9 in the Draft EIR/EIS.

Section 6.3.2, *Determination of Effects*, of the Draft EIR/EIS describes criteria used for the NEPA adverse effect and CEQA significant impact determinations.

SWP CVP Reservoir Storage and Related Changes to Flood Potential

Impact SW-1: Changes in SWP or CVP Reservoir Flood Storage Capacity

Reservoir storage in Shasta Lake, Folsom Lake, and Lake Oroville during the October through June period is compared to the flood storage capacity of each reservoir to identify the number of months where the reservoir storage is close to the flood storage capacity.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-1 through B.2-6 in Appendix B of this RDEIR/SDEIS.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Tables 6-2 through 6-7 of the Draft EIR/EIS.

NEPA Effects: Under Alternative 4A, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be similar (or show no more than 10% increase) under the No Action Alternative.

A comparison with storage conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that reservoir storages would not be consistently high during October through June under Alternative 4A as compared to the conditions under the No Action Alternative. Therefore, Alternative 4A would not result in adverse effects on reservoir flood storage capacity as compared to the conditions without the project.

CEQA Conclusion: Under Alternative 4A, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be less than under Existing Conditions. These differences represent changes under Alternative 4A, increased demands from Existing Conditions to No Action Alternative, and changes due to sea level rise and climate change.

Alternative 4A would not cause consistently higher storages in the upper Sacramento River watershed during the October through June period. Accordingly, Alternative 4A would result in a less-than-significant impact on flood management. No mitigation is required.

Highest Monthly Flows in Sacramento and San Joaquin Rivers and Related Changes to Flood Potential

Impact SW-2: Changes in Sacramento and San Joaquin River Flood Flows

Changes in highest monthly flows under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-1 through B.2-3 in Appendix B and Figures 4.3.2-1 through 4.3.2-15 of this RDEIR/SDEIS.

Changes in highest monthly flows under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 6-8 through 6-22 and Tables 6-2 through 6-4 of the Draft EIR/EIS.

Sacramento River at Bend Bridge

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase by about 2% of the channel capacity (100,000 cfs) as compared to the flows under Existing Conditions. The increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Sacramento River at Bend Bridge as compared to the conditions without the project.

Sacramento River at Freeport

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would decrease by about 1% of the channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Sacramento River at Freeport as compared to the conditions without the project.

San Joaquin River at Vernalis

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar to (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the San Joaquin River at Vernalis as compared to the conditions without the project.

Sacramento River at Locations Upstream of Walnut Grove (downstream of north Delta intakes)

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would decrease by about 9% of channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 4A.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would decrease by about 8% of channel capacity (110,000 cfs) as compared to the flows under Existing Conditions. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 4A.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Sacramento River upstream of Walnut Grove as compared to the conditions without the project.

Trinity River Downstream of Lewiston Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase by about 4% of channel capacity (6,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Trinity River downstream of Lewiston Lake as compared to the conditions without the project.

American River Downstream of Nimbus Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would remain similar to (or show less than 1% change with respect to the channel capacity: 152,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase by no more than approximately 1% of the channel capacity (152,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the American River at Nimbus Dam as compared to the conditions without the project.

Feather River Downstream of Thermalito Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase by about 1% of channel capacity (210,000 cfs) or remain similar as compared to the flows under the No Action Alternative depending on the range of spring Delta outflow requirements.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase by about 1% of channel capacity (210,000 cfs) or remain similar as compared to the flows under Existing Conditions depending on the range of spring Delta outflow requirements.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Feather River at Thermalito Dam as compared to the conditions without the project.

Yolo Bypass at Fremont Weir

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A would increase no more than approximately 1% of the channel capacity (343,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 4A at ELT would increase no more than 1% of the channel capacity (343,000 cfs) and at LLT would increase no more than 2% of the channel capacity (343,000 cfs) as compared to the flows under the Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 4A as compared to the No Action Alternative. Therefore, Alternative 4A would not result in adverse impacts on flow conditions in the Yolo Bypass at Fremont Weir as compared to the conditions without the project.

NEPA Effects: Overall, Alternative 4A would not result in an increase in potential risk for flood management compared to the No Action Alternative. Highest monthly flows under Alternative 4A in the locations considered in this analysis either were similar to or less than highest monthly flows that would occur under the No Action Alternative; or the increase in the highest monthly flows would be less than the flood capacity for the channels at these locations.

Therefore, Alternative 4A would not result in adverse effects on flood management.

***CEQA Conclusion*:** Alternative 4A would not result in an increase in potential risk for flood management compared to Existing Conditions when the changes due to sea level rise and climate change are eliminated from the analysis. Highest monthly flows under Alternative 4A in the locations considered in this analysis either were similar to or less than those that would occur under Existing Conditions without the changes in sea level rise and climate change; or the increased highest monthly flows would not exceed the flood capacity of the channels at these locations. Accordingly, Alternative 4A would result in a less-than-significant impact on flood management. No mitigation is required.

Reverse Flows in Old and Middle River

Impact SW-3: Change in Reverse Flow Conditions in Old and Middle Rivers

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 4A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-1 through B.2-3 in Appendix B and Figure 4.3.2-16 in this RDEIR/SDEIS.

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 4A (LLT) (similar to range of Alternative 4 H3 [LLT] and Alternative 4 H4 [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figure 6-23 and Tables 6-2 through 6-4 of the Draft EIR/EIS.

Reverse flow conditions for Old and Middle River flows would be reduced in all months under Alternative 4A on a long-term average basis except in April and May, compared to reverse flows under both Existing Conditions and the No Action Alternative. Compared to flows under the No Action Alternative, Old and Middle River flows would be generally less positive in April and May.

NEPA Effects: A comparison with reverse flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 4A without the effects of sea level rise and climate change. The results show that reverse flow conditions under Alternative 4A would be reduced in all months on a long-term average basis except in April and May as compared to No Action Alternative. In April and May the reverse flow conditions would be generally greater than 1% under Alternative 4A as compared to No Action Alternative. The effects to beneficial use of the surface water for water supplies and aquatic resources, is described in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*, of this RDEIR/SDEIS.

***CEQA Conclusion*:** Alternative 4A would provide positive changes related to reducing reverse flows in Old and Middle Rivers in June through March and negative changes in the form of increased reverse flow conditions in April and May, compared to Existing Conditions. The increase (more negative) in reverse flow conditions in April and May is generally greater than 1% as compared to

Existing Conditions. The significance of the impact to beneficial use of the surface water for water supplies and aquatic resources, and appropriate Mitigation Measures for those impacts to beneficial uses is described in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*, of this RDEIR/SDEIS.

Impact SW-4: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Conveyance Facilities

NEPA Effects: Effects associated with construction and operations of facilities under Alternative 4A would be similar to those described under Alternative 1A with the exception of two fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 4A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 4A.

Alternative 4A would involve excavation, grading, stockpiling, soil compaction, and dewatering that would result in temporary and long-term changes to drainage patterns, drainage paths, and facilities that would in turn, cause changes in drainage flow rates, directions, and velocities. Although intakes have been designed and located on-bank to minimize changes to river flow characteristics, some localized water elevation changes would occur upstream and adjacent to each cofferdam at the intake sites due to facility location within the river. These localized surface elevation changes would not exceed an increase of 0.10 feet at any intake location even under flood flow conditions. Although minimal localized effects could occur, construction of cofferdams could impede river flows at the location of the intakes but would not increase water surface elevations upstream by more than 0.10 feet during flood events. Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. Mitigation Measure SW-4 is available to address effects of runoff and sedimentation.

***CEQA Conclusion*:** Alternative 4A could result in alterations to drainage patterns, stream courses, and runoff; and potential for slightly increased surface water elevations near the intakes in the rivers and streams during construction and operations of facilities located within the waterway. Although intakes have been designed and located on-bank to minimize changes to river flow characteristics, some localized water elevation changes would occur upstream and adjacent to each cofferdam at the intake sites due to facility location within the river. These localized surface elevation changes would not exceed an increase of 0.10 feet at any intake location even under flood flow conditions. Potential impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, and from changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

Impact SW-5: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Environmental Commitments 3, 4, and 6–11

NEPA Effects: Alternative 4A would include construction of the restoration area facilities under Environmental Commitments 3, 4, and 6–11.

Riparian habitat restoration is anticipated to occur primarily in association with the restoration of tidal marsh habitat, and channel margin habitat. The restored vegetation has the potential of increasing channel roughness, which could result in increases in channel water surface elevations, including under flood flow conditions, and in decreased velocities. Modified channel geometries could increase or decrease channel velocities and/or channel water surface elevations, including under flood flow conditions. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. The specific permits/decisions/approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations.

***CEQA Conclusion*:** Alternative 4A would include construction of the restoration area facilities under Environmental Commitments 3, 4, and 6–11. Alternative 4A could result in alterations to drainage patterns, stream courses, and runoff; and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. These impacts are considered significant. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. The specific permits/decisions/approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A

Impact SW-6: Create or Contribute Runoff Water Which Would Exceed the Capacity of Existing or Planned Stormwater Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff

Effects associated with construction and operations of facilities under Alternative 4A would be similar to those described under Alternative 1A with the exception of two fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 4A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A because there would be fewer construction sites under this alternative.

NEPA Effects: Paving, soil compaction, and other activities would increase runoff during facilities construction and operations. Construction and operation of dewatering facilities and associated discharge of water would result in localized increases in flows and water surface elevations in receiving channels. These activities could result in adverse effects if the runoff volume exceeds the capacities of local drainages. As noted below in the CEQA Conclusion section, compliance with permit design requirements would avoid adverse effects on surface water quality and flows from dewatering activities. The use of dispersion facilities would reduce the potential for channel erosion. Mitigation Measure SW-4 is available to address adverse effects.

***CEQA Conclusion*:** Alternative 4A actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board and CVFPB (See Section 6.2.2.4 in Chapter 6, *Surface Water*, of the Draft EIR/EIS). Alternative 4A would include provisions to design the dewatering system in accordance with these permits to avoid significant impacts on surface water quality and flows. However, increased runoff could occur from facilities sites during construction or operations and could result in significant impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A

Impact SW-7: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to the Construction of New Conveyance Facilities

NEPA Effects: Effects associated with construction of conveyance facilities under Alternative 4A would be identical to those described under Alternative 1A with the exception of two fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 4A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A.

Alternative 4A would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with USACE, CVFPB, and DWR requirements to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 in Chapter 6, *Surface Water*, of the Draft EIR/EIS. Additionally, DWR would consult with local reclamation districts to ensure that construction activities would not conflict with reclamation district flood protection measures. Determination of design flood elevations would need to consider sea level rise to reduce impacts.

***CEQA Conclusion*:** Alternative 4A would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with the requirements of USACE CVFPB, and DWR to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 in Chapter 6, *Surface Water*, of the Draft EIR/EIS. If the design flood elevations did not consider sea level rise to reduce impacts, these impacts are considered significant. Mitigation Measure SW-7 would reduce this impact to a less-than-significant level.

Mitigation Measure SW-7: Implement Measures to Reduce Flood Damage

Please see Mitigation Measure SW-7 under Impact SW-7 in the discussion of Alternative 1A

Impact SW-8: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to Environmental Commitments 3, 4, and 6–11

Tidal marsh habitat, and channel margin habitat could increase flood potential due to impacts on adjacent levees. The newly flooded areas would have larger wind fetch lengths (unobstructed distance which wind can travel over water and potentially develop large waves caused by wind force not tidal force) compared to the existing fetch lengths of the adjacent leveed channels. An increase in fetch length would result in increases in wave height and velocities that reach the existing levees along adjacent islands and floodplains. These potential increases in wave action could also reach the land-side of the remaining existing levees around the restoration area. In accordance with existing requirements of the USACE, CVFPB, and DWR, Alternative 4A would be designed to avoid increased flood potential as compared to Existing Conditions or No Action Alternative.

NEPA Effects: Alternative 4A would not result in an increase to exposure of people or structures to flooding due to the operation of the Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees, which would be considered an adverse effect. This impact could become more substantial with sea level rise and climate change. Mitigation Measure SW-8 would reduce this potential adverse effect.

***CEQA Conclusion*:** Alternative 4A would not result in an increase to exposure of people or structures to flooding due to the construction or operations of Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW-8 would reduce this potential impact to a level of less than significant.

Mitigation Measure SW-8: Implement Measures to Address Potential Wind Fetch Issues

Please see Mitigation Measure SW-8 under Impact SW-8 in the discussion of Alternative 1A

Impact SW-9: Place within a 100-Year Flood Hazard Area Structures Which Would Impede or Redirect Flood Flows, or Be Subject to Inundation by Mudflow

Effects associated with construction and operations of facilities under Alternative 4A would be identical those described under Alternative 1A with the exception of two fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 4A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. The measures included in Alternative 1A to avoid adverse effects would be included in Alternative 4A. As described under Impact SW-1, Alternative 4A would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American

River, or Feather River, or Yolo Bypass as described under Impact SW-2. Alternative 4A would include measures, including Mitigation Measure SW-4, to address potential issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities.

NEPA Effects: Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These effects are considered adverse. Mitigation Measure SW-4 is available to address these potential effects.

***CEQA Conclusion*:** Alternative 4A would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the Environmental Commitments because the project proponents would be required to comply with the requirements of USACE, CVFPB, and DWR to avoid increased flood potential as described in Section 6.2.2.4 of Chapter 6, *Surface Water*, in the Draft EIR/EIS. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, as well as changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

4.3.3 Groundwater

4.3.3.1 Delta Region

The conveyance facilities included under Alternative 4A are identical to those included under Alternative 4 and the footprint of the Alternative 4A conveyance facilities in the Delta is identical to the Alternative 4 footprint as described in Section 7.3.3.9 in Appendix A of this RDEIR/SDEIS. Therefore, impacts due to construction of the water conveyance facilities in the Delta would be identical to those described for Alternative 4, as they would occur in the same timeframe.

The effects of the operations under Alternative 4A compared to the No Action Alternative (ELT) are similar to the effects of operations under Alternative 4 as compared to the No Action Alternative (LLT) and described in the Draft EIR/EIS Chapter 7, *Groundwater*. Therefore, the effects on the Delta groundwater resources based on the comparison to each of the No Action Alternatives are similar.

Impact GW-1: During Construction, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

See Impact GW-1 under Alternative 4; construction activities and potential impacts under Alternative 4A would be identical to those under Alternative 4 because both alternatives have the same footprint in the Delta.

NEPA Effects: Dewatering would temporarily lower groundwater levels in the vicinity of the dewatering sites. Three areas could be subject to substantial lowering of groundwater levels: (1) In the vicinity of intake pump stations 2, 3, and 5; (2) in the vicinity of the Intermediate Forebay; and (3) in the vicinity of the expanded Clifton Court Forebay portion that includes the Byron Tract area. Groundwater-level lowering from construction dewatering activities is forecasted to be less than 10 feet in the vicinity of the intakes and the Intermediate Forebay and less than 20 feet in the vicinity of the Byron Tract Forebay. Groundwater levels within 2,600 feet of the areas to be dewatered are anticipated to experience groundwater level reductions of less than 20 feet for the duration of the dewatering activities and up to 2 months after dewatering is completed. The sustainable yield of some wells might temporarily be affected by the lower water levels such that they are not able to support existing land uses. The construction of conveyance features would result in effects on groundwater levels and associated well yields that would be temporary. These effects are considered adverse. It should be noted that the forecasted impacts described above reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis.

CEQA Conclusion: Construction activities associated with conveyance facilities under Alternative 4A including temporary dewatering and associated reduced groundwater levels have the potential to temporarily affect the productivity of existing nearby water supply wells. Groundwater levels within 2,600 feet of the areas to be dewatered are anticipated to experience groundwater level reductions of less than 20 feet for the duration of the dewatering activities and up to 2 months after dewatering is completed. Nearby wells could experience significant reductions in well yield, if they are shallow wells and may not be able to support existing land uses. The temporary impact on groundwater levels and associated well yields is considered significant because construction-related dewatering might affect the amount of water supplied by shallow wells located near the construction sites.

Mitigation Measure GW-1 identifies a monitoring procedure and options for maintaining an adequate water supply for land owners that experience a reduction in groundwater production from wells within 2,600 feet of construction-related dewatering activities. It should be noted that the forecasted impacts described above reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis. Implementing Mitigation Measure GW-1 would help address these effects; however, the impact may remain significant because replacement water supplies may not meet the preexisting demands or planned land use demands of the affected party. In some cases this impact might temporarily be significant and unavoidable until groundwater elevations recover to pre-construction conditions which could require several months after dewatering operations cease.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A.

Impact GW-2: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

See Impact GW-2 under Alternative 4; operations under Alternative 4A fall within the range of operations scenarios analyzed for Alternative 4.

NEPA Effects: The new Intermediate Forebay and the expanded Clifton Court Forebay would be constructed to comply with the requirements of the Division of Safety of Dams (DSD) which include design features intended to minimize seepage under the embankments. In addition, the forebays will include a seepage cutoff wall installed to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 4A would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 1A.

Operation of the tunnel would have no impact on existing wells or yields given the facilities would be located more than 100 feet underground and would not substantially alter groundwater levels in the vicinity.

CEQA Conclusion: The new Intermediate Forebay and the expanded Clifton Court Forebay will include design features intended to minimize seepage under the embankments and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 4A would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 1A, which would not reduce the yields of nearby wells.

Operation of the tunnel would have no impact on existing wells or yields given these facilities would be located over 100 feet underground and would not substantially alter groundwater levels in the vicinity.

Therefore, this impact would be less than significant. No mitigation is required.

Impact GW-3: Degrade Groundwater Quality during Construction and Operation of Conveyance Facilities

See Impact GW-3 under Alternative 4; the construction activities under Alternative 4A would be identical to those under Alternative 4, which would be similar to those under Alternative 1A with a lesser magnitude, because only three intakes would be constructed (instead of five). The operations under Alternative 4A fall within the range of operations scenarios analyzed for Alternative 4.

NEPA Effects: Dewatering would temporarily lower groundwater levels and cause small changes in groundwater flow patterns near the intake pump stations along the Sacramento River, Intermediate Forebay, and Byron Tract Forebay. Since no significant regional changes in groundwater flow directions are forecasted, and the inducement of poor-quality groundwater into areas of better quality is unlikely, it is anticipated that there would be no change in groundwater quality for Alternative 4A. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality. There would be no adverse effect.

CEQA Conclusion: No significant groundwater quality impacts are anticipated during construction activities. Because of the temporary and localized nature of construction dewatering, the potential for the inducement of the migration of poor-quality groundwater into areas of higher quality groundwater will be low. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality.

No significant groundwater quality impacts are anticipated in most areas of the Delta during the implementation of Alternative 4A, because changes to regional patterns of groundwater flow are not anticipated. However, degradation of groundwater quality near the Suisun Marsh area are likely, due to the effects of saline water intrusion caused by slightly rising sea levels. Effects due to climate change are provided for informational purposes only and do not lead to mitigation. This impact would be less than significant. No mitigation is required.

Impact GW-4: During Construction of Conveyance Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-4 under Alternative 4; construction activities under Alternative 4A would be identical to those under Alternative 4, which would be similar to those under Alternative 1A with a lesser magnitude, because only three intakes would be constructed (instead of five).

NEPA Effects: In the absence of seepage cutoff walls intended to minimize local changes to groundwater flow, the lowering of groundwater levels due to construction dewatering would temporarily affect localized shallow groundwater flow patterns during and immediately after the construction dewatering period. For the Byron Tract Forebay site, only a portion of the shallow groundwater flow will be directed inward toward the dewatering operations. Forecasted temporary changes in shallow groundwater flow directions and areas of impacts are minor near the intakes. Therefore, agricultural drainage during construction of conveyance features is not forecasted to result in adverse effects under Alternative 4A. In some instances, the lowering of groundwater levels in areas that experience near-surface water level conditions (or near-saturated root zones) would be beneficial. There would be no adverse effect.

CEQA Conclusion: The forecasted changes in shallow groundwater flow patterns due to construction dewatering activities in the Delta are localized and temporary and are not anticipated to cause significant impacts on agricultural drainage. This impact would be less than significant. No mitigation is required.

Impact GW-5: During Operations of New Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-5 under Alternative 4; operations under Alternative 4A would be similar to those under Alternative 4 from a footprint perspective in the Delta Region.

NEPA Effects: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 4A would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, where groundwater recharge from surface water would result in groundwater level increases, similar to Alternative 4 and 1A. If existing agricultural drainage systems adjacent to the forebay are not adequate to accommodate the additional drainage requirements, operation of the forebay could interfere with agricultural drainage in the Delta. This effect would be considered adverse.

CEQA Conclusion: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 4A would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, caused by groundwater recharge from surface water, and could cause significant impacts to agricultural drainage where existing systems are not adequate to accommodate the additional drainage requirements, similar to Alternative 4 and 1A. Implementation of Mitigation Measure GW-5 is anticipated to reduce this impact to a less-than-significant level in most instances, though in some instances mitigation may be infeasible due to factors such as costs that would be imprudent to bear in light of the fair market value of the affected land. The impact is therefore significant and unavoidable as applied to such latter properties.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-6: Deplete Groundwater Supplies or Interfere with Groundwater Recharge Alter Local Groundwater Levels Reduce the Production Capacity of Preexisting Nearby Wells, or Interfere with Agricultural Drainage as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of the environmental commitments under Alternative 4A could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS). Effects associated with the implementation of those environmental commitments are considered adverse. The implementation of Mitigation Measure GW-5 would help address these effects by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed.

CEQA Conclusion: Implementation of the environmental commitments under Alternative 4A could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS). Impacts associated with the implementation of those environmental commitments would result in significant impacts. This impact would be reduced to a less-than-significant level in most instances, with the implementation of Mitigation Measure GW-5 by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed. However, this impact is still considered significant and unavoidable.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-7: Degrade Groundwater Quality as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 4A would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in an adverse effect on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 would help reduce this impact, but the impact would remain significant and unavoidable.

CEQA Conclusion: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 4A would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in significant impacts on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 is available to address this effect.

Mitigation Measure GW-7: Provide an Alternate Source of Water

Please see Mitigation Measure GW-7 under Impact GW-7 in the discussion of Alternative 1A.

4.3.3.2 SWP CVP Export Service Areas

Impact GW-8: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge Alter Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

As described in Chapter 7 in the Draft EIR/EIS, Alternative 4 includes 4 operational scenarios, H1, H2, H3, and H4. Alternative 4A would include total long-term average annual surface water deliveries to the CVP and SWP Service Areas that range between scenarios H3 and H4 deliveries at the early long-term simulation period (see Section 4.3.1, *Water Supply*, of this RDEIR/SDEIS).

Table 4.3.3-1 below shows the long-term average SWP and CVP deliveries for Alternative 4A (ranges of deliveries represent estimates for Alternative 4 scenarios H3 and H4 at early long-term) compared to existing conditions and the No Action Alternative at early long-term.

Table 4.3.3-1. Long-Term State Water Project and Central Valley Project Deliveries to Hydrologic Regions Located South of the Delta at Early Long-Term

	Long-Term Average State Water Project and Central Valley Project Deliveries at Early Long Term(TAF/year)		
Alternative	San Joaquin and Tulare Hydrologic Region	Central Coast Hydrologic Region	Southern California Hydrologic Region
Existing Conditions	2,964	47	1,647
No Action Alternative (ELT)	2,682	43	1,580
Alternative 4A ELT	2,765–2,960	40–50	1,468–1,766

The groundwater resource impacts of Alternative 4A will be similar to those under Alternative 4 compared to the No Action Alternative LLT; but the magnitude of the impacts would be proportional to the change in the quantity of CVP and SWP surface water supplies delivered to the SWP/CVP Export Service Areas compared to the No Action Alternative at ELT. See Table 7-7, in Chapter 7, *Groundwater*, of the Draft EIR/EIS for long-term average SWP and CVP surface water deliveries at LLT.

NEPA Effects: In the San Joaquin and Tulare Hydrologic Region, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 4A ELT are expected to be higher than the exports under the No Action Alternative at early long-term. Increases in surface water deliveries attributable to project operations from the implementation of Alternative 4A are anticipated to result in a corresponding decrease in groundwater use in the San Joaquin and Tulare Export Service Areas as compared to the No Action Alternative (ELT), as discussed in Section 4.2.4, *Water Supply*, of this RDEIR/SDEIS. Higher groundwater levels associated with reduced overall groundwater use would result in a beneficial effect on groundwater levels. Similarly, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 4A at LLT are expected to be higher than the exports under the No Action Alternative at late long-term.

The total long-term average annual SWP deliveries to Southern California areas under Alternative 4A would increase by approximately 186 TAF per year or would decrease by approximately 112 TAF per year depending on the range of spring Delta outflow requirements (see Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS) as compared to the No Action Alternative (ELT). A decrease in surface water deliveries could result in an increase in groundwater pumping and a decrease in groundwater levels, depending on the total water portfolio of the site specific areas. Therefore, decreases in surface water deliveries would result in adverse effects on groundwater levels.

When comparing the total long-term average annual SWP deliveries to Southern California areas under Alternative 4A at LLT with the No Action Alternative (LLT), deliveries would increase by approximately 184 TAF per year or would decrease by approximately 114 TAF per year depending on the range of spring Delta outflow requirements, similar to the comparison at ELT (see Table 7-7 in Chapter 7, *Groundwater*, of the Draft EIR/EIS). Therefore, the effects on groundwater resources would be similar at ELT and at LLT.

However, opportunities for additional pumping might be limited by basin adjudications and other groundwater management programs. Additionally, as discussed in Appendix 5B of the Draft EIR/EIS, *Responses to Reduced South of Delta Water Supplies*, adverse effects might be avoided due to the existence of various other water management options that could be undertaken in response to reduced exports from the Delta. These options include wastewater recycling and reuse, increased water conservation, water transfers, construction of new local reservoirs that could retain Southern California rainfall during wet years, and desalination.

Even if the effect is adverse, feasible mitigation would not be available to diminish this effect due to a number of factors. First, State Water Contractors currently and traditionally have received variable water supplies under their contracts with DWR due to variations in hydrology and regulatory constraints and are accustomed to responding accordingly. Any reductions associated with this impact would be subject to these contractual limitations. Under standard state water contracts, the risk of shortfalls in exports is borne by the contractors rather than DWR. As a result of this variability, many Southern California water districts have complex water management strategies that include numerous options, as described above, to supplement SWP surface water supplies. These water districts are in the best position to determine the appropriate response to reduced imports from the Delta. Second, as noted above, it may be legally impossible to extract additional groundwater in adjudicated basins without gaining the permission of watermasters and accounting for groundwater pumping entitlements and various parties under their adjudicated rights.

CEQA Conclusion*:* For the San Joaquin and Tulare Service Areas, total long-term average surface water deliveries under Alternative 4A at ELT and at LLT would be lower compared to Existing Conditions, largely because of effects due to climate change, sea level rise, and increased water demand north of the Delta. Groundwater pumping under Alternative 4A at ELT is anticipated to be greater than under Existing Conditions, and that groundwater levels in some areas would be lower than under Existing Conditions.

As shown above in the NEPA analysis, SWP and CVP deliveries would increase under Alternative 4A as compared to deliveries under conditions in 2025 without Alternative 4A if sea level rise and climate change conditions are considered the same. For reasons discussed in Chapter 7, *Groundwater*, Section 7.3.1, Methods for Analysis, in the Draft EIR/EIS, DWR has identified effects of action alternatives under CEQA separately from the effects of increased water demands, sea level rise, and climate change, which would occur without and independent of the Alternative 4A. Absent these factors, the impacts of Alternative 4A with respect to groundwater levels are anticipated to be less than significant because groundwater pumping is not anticipated to increase due to Alternative 4A.

Similarly to the NEPA analysis, in Southern California, long-term average surface water supplies would increase by approximately 119 TAF per year or would decrease by approximately 179 TAF per year depending on the range of spring Delta outflow requirements compared to Existing Conditions. A decrease in surface water deliveries could result in an increase in groundwater pumping and a decrease in groundwater levels, depending on the total water portfolio of the site specific areas. Therefore, decreases in surface water deliveries would result in significant impacts on groundwater resources under Alternative 4A. As discussed above in the NEPA conclusion, Southern California water districts may be able to avoid this impact due to various water management options. For reasons also discussed above, no feasible mitigation would be available to mitigate this impact if it is significant. Due to these uncertainties, the overall impact for Alternative 4A considered significant and unavoidable. When comparing the total long-term average annual SWP deliveries to Southern California areas under Alternative 4A at LLT with Existing Conditions, deliveries would increase by approximately 21 TAF per year or would decrease by approximately 277 TAF per year depending on the range of spring Delta outflow requirements, similar to the comparison at ELT (see Table 7-7 in Chapter 7, *Groundwater*, of the Draft EIR/EIS).

Impact GW-9: Degrade Groundwater Quality

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 4A are expected to increase as compared to the No Action Alternative (ELT) as well as at LLT. Increased surface water deliveries could result in a decrease in groundwater use. The decreased groundwater use is not anticipated to alter regional patterns of groundwater flow in these service areas. Therefore, it is not anticipated this would result in an adverse effect on groundwater quality in these areas because similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater as might occur with increased pumping.

Long-term average annual SWP surface water supplies to Southern California could decrease depending on the range of spring Delta outflow requirements compared to the No Action Alternative at ELT and at LLT.

It is unclear, however, whether such reductions would lead to increased groundwater pumping for reasons discussed in connection to Impact GW-8. If groundwater pumping is increased, there could be resulting changes in regional patterns of groundwater flow and a change in groundwater quality. Due to the uncertainty associated with these effects, this effect is considered adverse. For the same reasons discussed earlier in connection with the possibility of increased groundwater pumping in Southern California, there is no feasible mitigation available to mitigate any changes in regional groundwater quality.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 4A with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin. Therefore, no significant groundwater quality impacts are anticipated in these areas during the implementation of Alternative 4A because it is not anticipated to alter regional groundwater flow patterns. Therefore, this impact is considered less than significant because groundwater levels and flow patterns would not change compared to Existing Conditions, and similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater.

However, implementation of Alternative 4A at ELT and at LLT could degrade groundwater quality in portions of the Southern California SWP Export Service Areas; this impact is considered significant due to the possibility of increased groundwater pumping and the resulting effects on regional groundwater flow patterns. As discussed above, there is no feasible mitigation available to address this significant impact. The impact would be considered significant and unavoidable in these areas.

Due to the uncertainties identified in connection with the potential response to Impact GW-8 under Alternative 4A in Southern California, the overall impact for Impact GW-9 Alternative 4A is considered significant and unavoidable.

Impact GW-10: Result in Groundwater Level–Induced Land Subsidence

Groundwater level-induced land subsidence has the highest potential to occur in the San Joaquin and Tulare Export Service Areas, based on historical data, if groundwater pumping substantially increases due to the Alternatives.

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 4A are expected to increase as compared to the No Action Alternative (ELT) as well as at LLT. Increased surface water deliveries could result in a decrease in groundwater pumping. The decreased groundwater pumping would result in higher groundwater levels, and therefore, the potential for groundwater level-induced land subsidence is reduced under Alternative 4A. Operations under Alternative 4A would not result in an adverse effect on the potential for groundwater level-induced land subsidence in these areas because groundwater levels would not decline such that compaction of unconsolidated materials in the unconfined aquifer would occur.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 4A with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin. Therefore, the potential for groundwater level-induced land subsidence is anticipated to be less than significant in these areas during the implementation of Alternative 4A because it is not anticipated to result in a decline in groundwater levels such that compaction of unconsolidated materials in the unconfined aquifer would occur.

4.3.4 Water Quality

The water quality changes described for Alternative 4A reflect assumed water conveyance facilities operations. Alternative 4A includes water conveyance operational criteria similar to Alternative 4 (Operational Scenario H), but would be limited to operations within the range of Scenarios H3 and H4, as fully described in Chapter 3, *Description of Alternatives*, in Appendix A of the RDEIR/SDEIS. Alternative 4A operations are represented by the Scenarios H3 and H4 as follows:

- Scenario H3 – Includes spring outflow consistent with D-1641 and fall outflow consistent with Fall X2 requirements of the FWS 2008 BiOp.
- Scenario H4 – Includes higher spring outflow requirements than D-1641, and Fall X2 requirements of the FWS 2008 BiOp.

H3 and H4 operational criteria differ in the spring outflow that is assumed, and represent the range of operational effects of Alternative 4A. The facilities operations and maintenance impact analysis compares Alternative 4A results over the range of outcomes from the operational sub-scenarios to Existing Conditions (CEQA) and the No Action Alternative (NEPA).

The water quality changes described for Alternative 4A are also affected by assumptions regarding the extent of habitat restoration to be implemented. As described in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS, Alternative 4A does not include the full suite of conservation actions included in Alternative 4. Aside from the water conveyance facilities, the most important differences from a water quality perspective are:

- CM2 – Yolo Bypass Improvements: this is included in Alternative 4, but not included in Alternative 4A; and
- CM4 – Tidal Natural Communities Restoration: includes 65,000 acres in Alternative 4, but would be significantly less under Alternative 4A.

This results in somewhat different patterns of water withdrawals from the Delta, and potentially somewhat different effects on water quality and aquatic habitat conditions in the Plan Area than analyzed for Alternative 4. As described in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS, actions associated with Alternative 4 that are not proposed to be implemented under Alternative 4A would continue to be pursued as part of existing, but separate, projects and programs associated with the 2008 USFWS and 2009 NMFS BiOps (e.g., 8,000 acres of tidal habitat restoration and Yolo Bypass improvements), California EcoRestore, and the 2014 California Water Action Plan.

The analysis of boron, bromide, chloride, Dissolved organic carbon (DOC), electrical conductivity (EC), and nitrate under Alternative 4A in the ELT is based on modeling conducted for Alternative 4 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described above, Yolo Bypass Improvements are not a component of Alternative 4A and the amount of tidal habitat restoration (i.e. Environmental Commitment 4) would be significantly less than that represented in the modeling. In general, the significance of this difference is that the assessment of bromide, chloride, and EC for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), likely overestimates increases in bromide, EC, and chloride that could occur, particularly in the west Delta. Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 4A and the No Action Alternative (ELT).

Due to the reduced suite of environmental commitments in Alternative 4A compared to Alternative 4 (in particular, significantly less tidal restoration), there generally are fewer significant impacts identified for Alternative 4A than for Alternative 4.

Impact WQ-1: Effects on Ammonia Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), substantial point and non-point sources of ammonia-N do not exist upstream of the SRWTP at Freeport in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Thus, like Alternative 4, operation of the water conveyance facilities under Alternative 4A would have negligible, if any, effect on ammonia concentrations in the rivers and reservoirs upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT). Any negligible increases in ammonia-N concentrations that could occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to ammonia.

Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), a substantial decrease in Sacramento River ammonia concentrations is expected under Alternative 4A relative to Existing Conditions, due to planned lowering of ammonia in the SRWTP effluent discharge, and this is expected to decrease ammonia concentrations for all areas of the Delta that are influenced by Sacramento River water. Concentrations of ammonia at locations not influenced notably by Sacramento River water would change little relative to Existing Conditions, due to the similarity in San Joaquin River and San Francisco Bay concentrations and the lack of expected changes in either of these concentrations. Thus, Alternative 4A would not result in substantial increases in ammonia concentrations in the Plan Area, relative to Existing Conditions.

Relative to the No Action Alternative (ELT and LLT), the primary mechanism that could potentially alter ammonia concentrations under Alternative 4A is decreased flows in the Sacramento River, which would lower dilution available to the SRWTP discharge. This flow change would be attributable only to operations of the water conveyance facilities, since the same assumptions regarding SRWTP discharge ammonia concentrations, water demands, climate change, and sea level rise apply to both Alternative 4A and the No Action Alternative (ELT and LLT). A simple mass balance calculation was performed to calculate ammonia concentrations downstream of the SRWTP discharge (i.e., downstream of Freeport) under Alternative 4A and the No Action Alternative (ELT) to assess the effects of the flow changes. Monthly average CALSIM II flows at Freeport and the upstream ammonia concentration (0.04 mg/L-N; Central Valley Water Board 2010a:5) were used, together with the SRWTP permitted average dry weather flow (181 mgd) and seasonal ammonia limitations (1.5 mg/L-N in Apr–Oct, 2.4 mg/L-N in Nov–Mar), to estimate the average change in ammonia concentrations downstream of the SRWTP. Table 4.3.4-1 shows monthly average and long-term annual average predicted concentrations under the H3 and H4 operations scenarios. As

Table 4.3.4-1 shows, average monthly ammonia concentrations in the Sacramento River downstream of Freeport (upon full mixing of the SRWTP discharge with river water) under Alternative 4A and the No Action Alternative (ELT) are expected to be similar. In comparison to the No Action Alternative (ELT), minor increases in monthly average ammonia concentrations would occur during January through March, July through September, and during November for both operations scenarios (H3 and H4). Minor decreases in ammonia concentrations are expected for scenarios H3 and H4 in April and May. A minor increase in the annual average concentration would occur under Alternative 4A, compared to the No Action Alternative (ELT). Relative to the No Action Alternative (LLT), Alternative 4A is expected to result in similar minor increases in Sacramento River ammonia concentration, because the increased water demands, climate change, and sea level rise in the LLT would occur under both alternatives, and neither would affect ammonia sources or loading. The estimated ammonia concentrations in the Sacramento River downstream of Freeport under Alternative 4A would be similar to existing source water concentrations for the San Francisco Bay and San Joaquin River. Consequently, changes in source water fraction anticipated under Alternative 4A, relative to the No Action Alternative (ELT and LLT), are not expected to substantially increase ammonia concentrations at any Delta locations.

Ammonia concentrations downstream of Freeport in the Sacramento River under Alternative 4A would be similar to those under Alternative 4 (see Table 8-67 in Appendix A of the RDEIR/SDEIS). As stated for Alternative 4, any negligible increases in ammonia concentrations that could occur at certain locations in the Delta under Alternative 4A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to ammonia.

Table 4.3.4-1. Estimated Ammonia (mg/L as N) Concentrations in the Sacramento River Downstream of the Sacramento Regional Wastewater Treatment Plant for the No Action Alternative Early Long-term (ELT) and Alternative 4A

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Average
No Action Alternative (ELT)	0.076	0.082	0.068	0.060	0.057	0.060	0.058	0.062	0.067	0.060	0.067	0.063	0.065
Alternative 4A, Scenario H3	0.076	0.086	0.068	0.061	0.058	0.061	0.057	0.060	0.067	0.063	0.071	0.075	0.067
Alternative 4A, Scenario H4	0.076	0.086	0.068	0.061	0.058	0.061	0.057	0.060	0.067	0.063	0.071	0.066	0.066

SWP/CVP Export Service Areas

As discussed above, for areas of the Delta that are influenced by Sacramento River water, including Banks and Jones pumping plants, ammonia-N concentrations are expected to decrease under Alternative 4A, relative to Existing Conditions (in association with less diversion of water influenced by the SRWTP). Like Alternative 4, this decrease in ammonia-N concentrations for water exported via the south Delta pumps is not expected to result in an adverse effect on beneficial uses or substantially degrade water quality of exported water, with regard to ammonia. Furthermore, as discussed above, for all areas of the Delta, including Banks and Jones pumping plants, ammonia concentrations are not expected to be substantially different under Alternative 4A relative to the No Action Alternative (ELT and LLT). Thus, any negligible increases in ammonia concentrations that could occur at Banks and Jones pumping plants would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade water quality at these locations, with regard to ammonia.

NEPA Effects: In summary, ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas are not expected to be substantially different under Alternative 4A relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on ammonia are considered to be not adverse.

CEQA Conclusion: The magnitude and direction of changes in ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas would be approximately the same as expected under Alternative 4, relative to Existing Conditions. There would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 4A relative to Existing Conditions. As such, Alternative 4A is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because ammonia concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-2: Effects on Ammonia Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands in the Delta formerly used for irrigated agriculture. Although this may decrease ammonia loading to the Delta from agriculture, increased biota in those areas as a result of restored habitat may increase ammonia loading originating from flora and fauna. Ammonia loaded from organisms is expected to be converted rapidly to nitrate by established microbial communities. Thus, these land use changes would not be expected to substantially increase ammonia concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect ammonia sources or loading. Based on these findings, the effects on ammonia from the implementation Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A are determined to not be adverse.

***CEQA Conclusion*:** Land use changes that would occur from the environmental commitments are not expected to substantially increase ammonia concentrations, because the amount of area to be converted would be small relative to existing habitat, and any resulting ammonia would likely be rapidly converted to nitrate. Thus, it is expected there would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. As such, implementation of these environmental commitments would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Because ammonia concentrations would not be expected to increase substantially from implementation of these environmental commitments, no long-term water quality degradation would be expected to occur and, thus, no significant impact on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-3: Effects on Boron Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 4A there would be no expected change to the sources of boron in the Sacramento River and east-side tributary watersheds and, thus, resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of boron in the rivers and reservoirs of these watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease by 1%, relative to Existing Conditions (in association with the different operational components of Alternative 4A in the ELT, climate change, and increased water demands) (Table Bo-1 in Appendix B of this RDEIR/SDEIS). The reduced flow relative to Existing Conditions would result in possible increases in long-term average boron concentrations of up to about 0.5% relative to the Existing Conditions. Flows would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial boron increases relative to the No Action Alternative (ELT). The increased boron concentrations, relative to Existing Conditions, under Alternative 4A in the ELT would not increase the frequency of exceedances of any applicable objectives or criteria and would not be expected to cause further degradation at measurable levels in the lower San Joaquin River, and thus would not cause the existing impairment there to be discernibly worse. Consequently, Alternative 4A in the ELT would not be expected to cause exceedance of boron objectives/criteria or substantially degrade water quality with respect to boron, and thus would not adversely affect any beneficial uses of the Sacramento River, the east-side tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect boron sources in these areas.

Delta

Effects of water conveyance facilities on boron under Alternative 4A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased boron concentrations at western Delta locations associated with restoration environmental commitments under Alternative

4A because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-4. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 4A would result in increased long-term average boron concentrations for the 16-year period modeled at most of the interior Delta locations (increases up to 8% at the S. Fork Mokelumne River at Staten Island, 11% at Franks Tract, and 15% at Old River at Rock Slough) (Tables Bo-4 and Bo-5 in Appendix B of this RDEIR/SDEIS). The long-term average boron concentrations at most of the western Delta assessment locations would not change measurably. The long-term annual average and monthly average boron concentrations, for either the 16-year period or drought period modeled, would never exceed the 2,000 μg/L human health advisory objective (i.e., for children) or the 500 μg/L agricultural objective at the majority of assessment locations, which represents no change from the Existing Conditions and No Action Alternative (ELT) (Table Bo-3 in Appendix B of this RDEIR/SDEIS). A small increase in the frequency of exceedances 500 μg/L agricultural objective at the Sacramento River at Mallard Island (i.e., as much as 7% in the drought period relative to the No Action Alternative [ELT]) would not be anticipated to substantially affect agricultural diversions which occur primarily at interior Delta locations. Minor reductions in long-term average assimilative capacity of up to 9% at interior Delta locations (i.e., Old River at Rock Slough) would occur with respect to the 500 μg/L agricultural objective (Tables Bo-6 and Bo-7 in Appendix B of this RDEIR/SDEIS). However, because the absolute boron concentrations would still be well below the lowest 500 μg/L objective for the protection of the agricultural beneficial use under Alternative 4A, the levels of boron degradation would not be of sufficient magnitude to substantially increase the risk of exceeding objectives or cause adverse effects to municipal and agricultural water supply beneficial uses, or any other beneficial uses, in the Delta (Figure Bo-1 in Appendix B of this RDEIR/SDEIS).

Effects of Alternative 4A in the Delta in the LLT, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to those described above for the ELT. Boron concentrations may be higher at western Delta locations due to greater effects of climate change on sea level rise that would occur in the LLT; however, these effects are independent of the alternative. Further, boron is of concern in waters diverted for agricultural use, which primarily occurs in the interior Delta, and based on Delta source water characteristics (see Table 8-42 in Appendix A of the RDEIR/SDEIS), boron concentrations in the interior Delta would be expected to remain suitable for agricultural use.

SWP/CVP Export Service Areas

Under the Alternative 4A, long-term average boron concentrations would decrease at the Banks pumping plant (as much as 25%) and at Jones pumping plant (as much as 22%) relative to Existing Conditions, and the reductions would be similar compared to No Action Alternative (ELT) (Tables Bo-4 and Bo-5 in Appendix B of this RDEIR/SDEIS) as a result of export of a greater proportion of low-boron Sacramento River water. Commensurate with the decrease in exported boron concentrations, boron concentrations in the lower San Joaquin River may be reduced and would likely alleviate or lessen any expected increase in boron concentrations at Vernalis associated with flow reductions (see discussion of Upstream of the Delta), as well as locations in the Delta receiving a large fraction of San Joaquin River water. Reduced export boron concentrations also may contribute to reducing the existing CWA Section 303(d) impairment in the lower San Joaquin River and associated TMDL actions for reducing boron loading. These same effects on boron at the Banks and Jones pumping plants would be expected in the LLT, because the primary effect of climate change on sea level rise and boron concentrations is expected in the western Delta.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of boron or contribute towards a substantial change in existing sources of boron in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 4A would result in relatively small increases in long-term average boron concentrations in the Delta, not measurably increase boron levels in the lower San Joaquin River, and reduce boron levels in water exported to the SWP/CVP export service areas. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality.

CEQA Conclusion: Based on the above assessment, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in boron levels upstream of the Delta. Small increases in boron levels predicted for interior Delta locations in response to a shift in the Delta source water percentages would not be expected to cause exceedances of objectives, or substantial degradation of these water bodies. Alternative 4A maintenance also would not result in any substantial increases in boron concentrations in the affected environment. Boron concentrations would be reduced in water exported from the Delta to the CVP/SWP Export Service Areas, thus reflecting a potential improvement to boron loading in the lower San Joaquin River.

Boron is not a bioaccumulative constituent, thus any increased concentrations under Alternative 4A would not result in adverse boron bioaccumulation effects to aquatic life or humans. Relative to Existing Conditions, Alternative 4A would not result in substantially increased boron concentrations such that frequency of exceedances of municipal and agricultural water supply objectives would increase. The levels of boron degradation that may occur under Alternative 4 would not be of sufficient magnitude to cause substantially increased risk for adverse effects to municipal or agricultural beneficial uses within the affected environment. Long-term average boron concentrations would decrease in Delta water exports to the SWP and CVP service area, which may contribute to reducing the existing CWA Section 303(d) impairment of agricultural beneficial uses in the lower San Joaquin River. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-4: Effects on Boron Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 4A present no new direct sources of boron to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. Habitat restoration activities in the Delta, while involving increased land and water interaction within these habitats, would not be anticipated to contribute boron which is primarily associated with source water inflows to the Delta (i.e., San Joaquin River, agricultural drainage, and Bay source water). Moreover, some habitat restoration would occur on lands within the Delta currently used for irrigated agriculture, thus replacing agricultural land uses with restored habitats. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated boron concentrations, which would be considered an improvement compared to the No Action Alternative (ELT and LLT). Consequently, as they pertain to boron, implementation of the environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 4A would not present new or substantially changed sources of boron to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. As such, their implementation would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or other criteria would be exceeded in water bodies of the affected environment located upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas or substantially degrade the quality of these water bodies, with regard to boron. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-5: Effects on Bromide Concentrations Resulting from Facilities Operations and Maintenance Upstream of the Delta

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 4A in the ELT there would be no expected change to the sources of bromide in the Sacramento River and east-side tributary watersheds. Thus, changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of bromide in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial bromide increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River, which is the beneficial use most sensitive to elevated bromide concentrations. Consequently, Alternative 4A in the ELT would not be expected to adversely affect the MUN beneficial use, or any other beneficial uses, of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta due to changes in bromide concentrations.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect bromide sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-6. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the modeling methodology.

Estimates of bromide concentrations at Delta assessment locations were generated using a mass balance approach, and using relationships between EC and chloride and between chloride and bromide and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in bromide at Delta assessment locations based on both approaches.

Based on the mass balance modeling approach for bromide, relative to Existing Conditions, Alternative 4A long-term average bromide concentrations would increase in the S. Fork Mokelumne River at Staten Island, and decrease at all other assessment locations (Table Br-1 in Appendix B of this RDEIR/SDEIS). Average bromide concentrations at Staten Island would increase from 50 µg/L under Existing Conditions to 63–64 µg/L (26–28% increase depending on operations scenario) for the modeled 16-year hydrologic period (1976–1991). However, multiple interior and western Delta assessment locations would have an increased frequency of exceedance of 50 µg/L, which is the CALFED Drinking Water Program goal for bromide as a long-term average applied to drinking water intakes (Table Br-1 in Appendix B of this RDEIR/SDEIS). These locations are the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The greatest increase in frequency of exceedance of the CALFED Drinking Water Program long-term goal of 50 µg/L would occur in the S. Fork Mokelumne River (24–25% increase depending on operations scenario) and Sacramento River at Emmaton (2–4% increase depending on operations scenario). The increase in frequency of exceedance of the 50 µg/L threshold at the other locations would be 2% or less. Similarly, these locations would have an increased frequency of exceedance of 100 µg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts (Table Br-1 in Appendix B of this RDEIR/SDEIS). The greatest increase in frequency of exceedance of 100 µg/L would occur at Franks Tract (6% increase) and San Joaquin River at Antioch (4–5% increase depending on operations scenario). The increase in frequency of exceedance of the 100 µg/L threshold at the other locations would be 3% or less.

Changes in long-term average bromide concentrations and changes in threshold exceedance frequencies relative to the No Action Alternative (ELT) are generally of similar magnitude to those previously described relative to Existing Conditions (Table Br-1 in Appendix B of this RDEIR/SDEIS). However, unlike the Existing Conditions comparison, relative to the No Action Alternative (ELT), long-term average bromide concentrations at Buckley Cove would increase under Alternative 4A, although the increases would be relatively small (<1%).

Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent with the discussion above, and assessment of bromide using these modeling results leads to the same conclusions as are presented above for the mass balance approach (Tables Br-2 in Appendix B of this RDEIR/SDEIS).

Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT). Also, the magnitude of bromide concentration increases at Mallard Slough and in the San Joaquin River at Antioch during their historical months of use, relative to Existing Conditions and the No Action Alternative (ELT) would be generally similar to those described for Alternative 4 (Tables Br-5 and Br-6 in Appendix B of this RDEIR/SDEIS), and the frequency of exceedance of bromide thresholds would be similar (Tables Br-3 and Br-4 in Appendix B of this RDEIR/SDEIS). As described for Alternative 4, the use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion.

SWP/CVP Export Service Areas

Under Alternative 4A, long-term average bromide concentrations at the Banks and Jones pumping plants, based on the mass balance modeling approach, would decrease. Long-term average bromide concentrations for the modeled 16-year hydrologic period at the pumping plants would decrease by as much as 48% relative to Existing Conditions and 44% relative to the No Action Alternative (ELT) (Table Br-1 in Appendix B of this RDEIR/SDEIS). As a result, less frequent exceedances of the 50 μg/L and 100 μg/L assessment thresholds would occur and an overall improvement in SWP/CVP Export Service Areas water quality would occur respective to bromide. Commensurate with the decrease in exported bromide, an improvement in lower San Joaquin River bromide would also occur since bromide in the lower San Joaquin River is principally related to irrigation water deliveries from the Delta. Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide are consistent with the mass balance results, and assessment of bromide using these modeling results leads to the same conclusions as are presented for the mass balance approach (Table Br-2 in Appendix B of this RDEIR/SDEIS).

The effects of Alternative 4A in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above, because the sea level rise that could occur in the LLT would not be expected to result in substantial bromide contributions to the water exported at Banks and Jones pumping plants.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of bromide or contribute towards a substantial change in existing sources of bromide in the affected environment. Maintenance activities would not be expected to cause any substantial change in bromide such that MUN beneficial uses, or any other beneficial use, would be adversely affected anywhere in the affected environment.

***NEPA Effects*:** In summary, the operations and maintenance activities under Alternative 4A, relative to the No Action Alternative (ELT and LLT) would result in an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and San Joaquin River at Buckley Cove; there would be decreases in long-term average bromide concentrations at the other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island would be less than the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts, and the increase in the San Joaquin River at Buckley Cove would be minimal (<1%). Thus, these increased bromide concentrations are not expected to result in adverse affects to MUN beneficial uses, or any other beneficial use, at these locations. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: While greater water demands under Alternative 4A would alter the magnitude and timing of reservoir releases north and east of the Delta, these activities would have negligible, if any, effect on the sources of bromide, and ultimately the concentration of bromide in the Sacramento River, the San Joaquin River, the eastside tributaries, and the various reservoirs of the related watersheds, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS).

Under Alternative 4A there would be an increased frequency of exceedance of the 50 µg/L and 100 µg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and decrease at all other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island (63–64 µg/L) would be less than the 100 µg/L believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts. Further, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), the use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and thus has historically been opportunistic and opportunity to use these intakes would remain. Thus, these increased bromide concentrations would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The assessment of effects on bromide in the SWP/CVP Export Service Areas is based on assessment of changes in bromide concentrations at Banks and Jones pumping plants. Long-term average bromide concentrations at the Banks and Jones pumping plants are predicted to decrease by as much as 48% relative to Existing Conditions and there would be less frequent exceedance of bromide concentration thresholds.

Based on the above, Alternative 4A would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide. Alternative 4A would not result in any substantial change in long-term average bromide concentration or exceed 50 and 100 µg/L assessment threshold concentrations by frequency, magnitude, and geographic extent that would result in adverse effects on any beneficial uses within affected water bodies. Bromide is not a bioaccumulative constituent and thus concentrations under this alternative would not result in bromide bioaccumulating in aquatic organisms. Increases in exceedances of the 100 µg/L assessment threshold concentration would be 6% or less at all locations assessed, which is considered to be less than substantial long-term degradation of water quality. The levels of bromide degradation that may occur under the Alternative 4A would not be of sufficient magnitude to cause substantially increased risk for adverse effects on any beneficial uses of water bodies within the affected environment. Bromide is not CWA Section 303(d) listed and thus the minor increases in long-term average bromide concentrations would not affect existing beneficial use impairment because no such use impairment currently exists for bromide. Based on these findings, this impact is less than significant. No mitigation is required.

Impact WQ-6: Effects on Bromide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new sources of bromide to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Such replacement or substitution of land use activity would not be expected to result in new or increased sources of bromide to the Delta. Therefore, as they pertain to bromide, implementation of these environmental commitments would not be expected to adversely affect MUN beneficial use, or any other beneficial uses, of the affected environment.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable bromide concentration changes.

In summary, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A relative to the No Action Alternative (ELT and LLT), would have negligible, if any, effects on bromide concentrations. Therefore, the effects on bromide from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of bromide to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution would not be expected to substantially increase or present new sources of bromide. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, effects on bromide concentrations throughout the affected environment, would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide, and would not cause changes in bromide concentrations that would result in significant impacts on any beneficial uses within affected water bodies. Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of significant impacts on beneficial uses, would not cause greater bioaccumulation of bromide, and would not further impair any beneficial uses due to bromide concentrations because no uses are currently impaired due to bromide levels. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-7: Effects on Chloride Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on chloride concentrations in reservoirs and rivers upstream of the Delta would be the similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Chloride loading in these watersheds would remain unchanged and resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of chloride in the rivers and reservoirs of these watersheds. There would be no expected change to the sources of chloride in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of chloride in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial chloride increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, Alternative 4A in the ELT would not be expected to cause exceedances of chloride objectives/criteria or substantially degrade water quality with respect to chloride, and thus would not adversely affect any beneficial uses of the Sacramento River, the eastside tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 4A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect chloride sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-8. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Estimates of chloride concentrations at Delta assessment locations were generated using a mass balance approach and EC-chloride relationships and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in chloride at Delta assessment locations based on both approaches.

Modeling of chloride using both the mass balance approach and EC-chloride relationship predicts that Alternative 4A in the ELT would result in similar or reduced long-term average chloride concentrations, relative to Existing Conditions, for the 16-year period modeled at all assessment locations except for the S. Fork Mokelumne River at Staten Island. The increase in long-term average chloride concentration at Staten Island would be 4 mg/L (25%) based on the mass balance modeling and 2 mg/L (9%) based on the EC-chloride relationship (Tables Cl-6 though Cl-9 in Appendix B of this RDEIR/SDEIS). These increases are extremely small in absolute terms and relative to applicable water quality objectives, and are within the estimated modeling uncertainty. The results differ from Alternative 4, under which there would be increased long-term average chloride concentrations also at the North Bay Aqueduct at Barker Slough. The change in long-term average chloride concentrations relative to the No Action Alternative (ELT) would be similar to those relative to Existing Conditions.

The following outlines the modeled chloride changes relative to the applicable objectives and beneficial uses of Delta waters.

Municipal Beneficial Uses Relative to Existing Conditions

Estimates of chloride concentrations generated using EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses on a basis of the percent of years the chloride objective is exceeded for the modeled 16-year period. The objective is exceeded if chloride concentrations exceed 150 mg/L for a specified number of days in a given water year at Antioch and Contra Costa Pumping Plant #1. For Alternative 4A, the modeled frequency of objective exceedance would decrease at the Contra Costa Pumping Plant #1 from 6.7% of years under Existing Conditions, to 0% of years under operations scenario H3 and H4 (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Evaluation of the 250 mg/L Bay-Delta WQCP objective for chloride utilized results from both the mass balance approach and EC-chloride relationship. The basis for the evaluation was the predicted number of days the objective would be exceeded for the modeled 16-year period.

Based on the mass balance approach, there would be a decreased frequency of exceedance of the 250 mg/L objective under Alternative 4A, relative to Existing Conditions, at all locations except in the Sacramento River at Mallard Island and the Sacramento River at Emmaton. In the Sacramento River at Mallard Island, the frequency of objective exceedance would increase from 85% under Existing Conditions to 86% under Alternative 4A for the entire period modeled under both operations scenarios (Table Cl-2 in Appendix B of this RDEIR/SDEIS). In the Sacramento River at Emmaton, there would be an increase in chloride objective exceedance during the drought period modeled, from 55% to 57% under operations scenario H3, although these changes are within the uncertainty of the modeling approach; there would be no increase in objective exceedances under operations scenario H4.

The mass balance results also indicate reduced assimilative capacity with respect to the 250 mg/L objective during certain months and at certain locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in March and April of up to 18% for the 16-year period modeled, and 61% for the drought period modeled (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced, in February through June by up to 5% for the entire period modeled and 7% for the drought period modeled. These estimates include the effect of climate change and sea level rise, as well as the alternative. Comparisons to the No Action Alternative (ELT) below provide an assessment of the effect of the alternative alone.

When utilizing the EC-chloride relationship to model chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity would be similar to that discussed when utilizing the mass balance modeling approach (Tables Cl-3, Cl-13, and Cl-15 in Appendix B of this RDEIR/SDEIS). However, the EC-chloride relationships predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

CWA Section 303(d) Listed Water Bodies–Relative to Existing Conditions

Tom Paine Slough in the southern Delta is on the state's CWA Section 303(d) list for chloride with respect to the secondary MCL of 250 mg/L. Monthly average chloride concentrations at the Old River at Tracy Road for the 16-year period modeled, which represents the nearest DSM2-modeled location to Tom Paine Slough, would be generally similar under Alternative 4A in the ELT relative to Existing Conditions, and thus, would not be further degraded on a long-term basis and Alternative 4A in the ELT would thus not make this impairment discernibly worse (Figure Cl-1 in Appendix B of this RDEIR/SDEIS).

Suisun Marsh also is on the state's CWA Section 303(d) list for chloride in association with the Bay-Delta WQCP objectives for maximum allowable salinity during the months of October through May, which establish appropriate seasonal salinity conditions for fish and wildlife beneficial uses. With respect to Suisun Marsh the monthly average chloride concentrations for the 16-year period modeled would generally increase under Alternative 4A in the ELT relative to Existing Conditions in March through May at the Sacramento River at Mallard Island (Figure Cl-2 in Appendix B of this RDEIR/SDEIS) and at Collinsville (Figure Cl-3 in Appendix B of this RDEIR/SDEIS), and increase substantially in October through May at Montezuma Slough at Beldon's Landing (i.e., over a doubling of concentration in December through February) (Figure Cl-4 in Appendix B of this RDEIR/SDEIS). However, modeling of Alternative 4A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results for Suisun Marsh, but EC levels were still somewhat higher than EC levels under Existing Conditions for several locations and months. Although chloride was not specifically modeled in these sensitivity analyses, it is expected that chloride concentrations would be nearly proportional to EC levels in Suisun Marsh. Additionally, although these analyses were only conducted at the LLT, they are expected to generally also apply to the ELT. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions (see Appendix 8H Attachment 1 in Appendix A of the RDEIR/SDEIS for more information on these sensitivity analyses). Since Alternative 4A in the ELT includes operation of the gates, and includes very little tidal restoration area, it is anticipated that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 4A in the ELT would be very similar to Existing Conditions. For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

Municipal Beneficial Uses Relative to No Action Alternative (ELT)

Similar to the assessment conducted for Existing Conditions, estimates of chloride concentrations generated from EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses. For Alternative 4A in the ELT, the modeled frequency of objective exceedance would not change at the Contra Costa Pumping Plant #1--the No Action Alternative (ELT) and Scenarios H3 and H4 all would have 0% exceedance (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Based on the mass balance approach, the frequency of exceedance of the 250 mg/L objective under Alternative 4A in the ELT would be the same, or would decrease, at all locations relative to the No Action Alternative (ELT) (Table Cl-2 in Appendix B of this RDEIR/SDEIS). Estimates of long-term use of assimilative capacity using the mass balance results indicated the potential for reduced assimilative capacity with respect to the 250 mg/L objective for certain months and locations. Calculations using the long-term monthly average concentrations showed that in the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in April of 2% for the entire period modeled and 32% for the drought period modeled under operations scenario H3, but an increase in assimilative capacity under operations scenario H4 for both the entire period modeled and the drought period (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). The same approach showed that assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced in March through June, by up to 5%, and in October by up to 21% for the entire period modeled. During the drought period modeled, there would be similar reductions of assimilative capacity in April through June by up to 3% and a reduction in assimilative capacity of up to 88% in September (Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS). However, this approach used long-term average chloride concentrations, which can be heavily influenced by changes in a small number of years when chloride concentrations would already be very high. Additionally, when long term averages are just below the objective, very small changes in chloride that are within the modeling uncertainty can result in very high estimates of use of assimilative capacity. To further investigate the potential for water quality degradation with respect to chloride, the concentrations of chloride during individual water years was examined.

This further examination was limited to the mass balance approach, since when utilizing the EC-chloride relationship to model monthly average chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity were similar to that discussed for the mass balance modeling approach (Tables Cl-3, Cl-13, and Cl-15 in Appendix B of this RDEIR/SDEIS). However, utilizing the EC-chloride relationships predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

Figure Cl-9 shows chloride concentrations in April during the five-year drought period (1987–1991) at Antioch, where Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS indicated up to 32% use of assimilative capacity. The figure shows that during three of the five years, chloride concentrations increased relative to the No Action Alternative (ELT) and decreased in the other two years. The absolute differences estimated are fairly small and may be within modeling uncertainty. Figures Cl-10 and Cl-11 show a box and whisker plot and exceedance plot for April at Antioch for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that while the median chloride concentration is slightly increased relative to the No Action Alternative (ELT) under both scenarios, the maximums, 25th percentile, and 75th percentile values are all decreased. Based on this analysis, long-term degradation is not expected at Antioch in April during drought years.

Figure Cl-12 shows chloride levels in September at Contra Costa Pumping Plant #1 during the drought period (1987–1991), where Tables Cl-12 and Cl-14 in Appendix B of this RDEIR/SDEIS indicated 88% use of assimilative capacity. In general, changes in chloride concentrations relative to the No Action Alternative (ELT) are fairly small, and may be within modeling uncertainty. Figures Cl-13 and Cl-14 show a box and whisker plot and exceedance plot for September at Contra Costa Pumping Plant #1 for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that the median chloride concentration is slightly decreased relative to the No Action Alternative (ELT) under both scenarios, and chloride concentrations are generally similar to the No Action Alternative (ELT) throughout the range seen. The 88% use of assimilative capacity was shown because long term averages were just below the criterion, so a very small increase in chloride (that is probably within the modeling uncertainty) resulted in a very high estimate of use of assimilative capacity. Similar results are shown in Figure Cl-15, Cl-16, and Cl-17 for October at Contra Costa Pumping Plant #1. Median concentrations decreased slightly, and the exceedance plot shows generally similar concentrations throughout the range seen. Figure Cl-15 shows that while some years see increased concentrations (e.g., 1978, 1989), other years see decreased concentrations (e.g., 1980, 1982). Based on this analysis, long-term degradation is not expected at Contra Costa Pumping Plant #1 in September during drought years, or October on a long-term average basis.

Furthermore, sensitivity analyses conducted of Alternative 4 Scenario H3 without restoration areas indicated lower chloride levels in the western Delta than with the restoration areas. It is thus likely that modeling of Alternative 4A that does not include restoration areas would show lower levels of chloride at Antioch in April, and at Contra Costa Pumping Plant #1 in September and October than is shown herein using the Alternative 4 (ELT) modeling.

Based on the low level of water quality degradation estimated for the western Delta, and the lack of exceedance of water quality objectives, Alternative 4A is not expected to have substantial adverse effects on municipal and industrial beneficial uses in the western Delta.

CWA Section 303(d) Listed Water Bodies–Relative to No Action Alternative (ELT)

With respect to the state's CWA Section 303(d) listing for chloride, Alternative 4A would generally result in similar changes to those discussed for the comparison to Existing Conditions. Monthly average chloride concentrations at Tom Paine Slough would not be further degraded on a long-term basis, based on changes that would occur in Old River at Tracy Road (Figure Cl-1 in Appendix B of this RDEIR/SDEIS). Modeling indicated that monthly average chloride concentrations at source water channel locations for the Suisun Marsh would increase substantially in some months during October through May relative to the No Action Alternative (ELT) (Figures Cl-2, Cl-3, and Cl-4 in Appendix B of this RDEIR/SDEIS), but the results of sensitivity analyses performed indicate that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 4A in the ELT would be very similar to the No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, chloride concentrations under Alternative 4A could be less than under the No Action Alternative (ELT). For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

The effects of Alternative 4A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in chloride in the west Delta. Small increases in chloride concentrations may occur in some areas, but it is not expected that these increases would cause exceedance of Bay-Delta WQCP objectives of cause substantial long-term degradation that would impact municipal and industrial beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 4A in the ELT, long-term average chloride concentrations at the Banks and Jones pumping plants, based on the mass balance analysis of modeling results for the 16-year period, would decrease relative to Existing Conditions. Chloride concentrations would be reduced by 42–47% at Banks pumping plant, depending on operations scenario (Tables Cl-6 and Cl-8 in Appendix B of this RDEIR/SDEIS). At Jones pumping plant, chloride concentrations would be reduced 41–43%, depending on operations scenario (Tables Cl-6 and Cl-8 in Appendix B of this RDEIR/SDEIS). The frequency of exceedances of applicable water quality objectives would decrease relative to Existing

Conditions, for both the 16-year period and the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). The chloride concentration changes relative to the No Action Alternative (ELT) would be similar. Consequently, water exported into the SWP/CVP Export Service Areas would generally be of similar or better quality with regard to chloride relative to Existing Conditions and the No Action Alternative (ELT). Results of the modeling approach which utilized a EC-chloride relationship are consistent these results, and assessment of chloride using these modeling output results in the same conclusions as for the mass balance approach (Tables Cl-3, Cl-7, and Cl-9 in Appendix B of this RDEIR/SDEIS).

Commensurate with the reduced chloride concentrations in water exported to the SWP/CVP Export Service Area, reduced chloride loading in the lower San Joaquin River would be anticipated which would likely reduce chloride concentrations at Vernalis.

The effects of Alternative 4A in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be very similar to effects in the ELT.

Maintenance of SWP and CVP facilities would not be expected to create new sources of chloride or contribute towards a substantial change in existing sources of chloride in the affected environment. Maintenance activities would not be expected to cause any substantial change in chloride such that any long-term water quality degradation would occur, thus, beneficial uses would not be adversely affected anywhere in the affected environment.

***NEPA Effects*:** In summary, relative to the No Action Alternative (ELT and LLT), Alternative 4A would not result in substantially increased chloride concentrations upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Area on a long-term average basis that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Based on these findings, this effect is determined to not be adverse.

***CEQA Conclusion*:** Chloride is not a constituent of concern in the Sacramento River watershed upstream of the Delta, thus river flow rate and reservoir storage reductions that would occur under Alternative 4A relative to Existing Conditions, would not be expected to result in a substantial adverse change in chloride levels. Additionally, relative to Existing Conditions, Alternative 4A would not result in reductions in river flow rates (i.e., less dilution) or increased chloride loading such that there would be any substantial increase in chloride concentrations upstream of the Delta in the San Joaquin River watershed.

Relative to Existing Conditions, Alternative 4A would not result in substantially increased chloride concentrations in the Delta on a long-term average basis that would result in adverse effects on the municipal and industrial water supply beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use.

Chloride concentrations would be reduced under Alternative 4A in water exported from the Delta to the SWP/CVP Export Service Areas thus reflecting a potential improvement to chloride loading in the lower San Joaquin River.

Chloride is not a bioaccumulative constituent, thus any increased concentrations under the Alternative 4A would not result in substantial chloride bioaccumulation impacts on aquatic life or humans. Alternative 4A maintenance would not result in any substantial changes in chloride concentration upstream of the Delta or in the SWP/CVP Export Service Areas

Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-8: Effects on Chloride Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects**:** The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would present no new direct sources of chloride to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Consequently, as they pertain to chloride, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated chloride concentrations, which would be considered an improvement relative to the No Action Alternative (ELT and LLT). Therefore, the effects on chloride from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion**:** Implementation of the Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of chloride to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. Replacement of irrigated agricultural land uses in the Delta with habitat restoration may result in some reduction in discharge of agricultural field drainage with elevated chloride concentrations, thus resulting in improved water quality conditions. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-9: Effects on Dissolved Oxygen Resulting from Facilities Operations and Maintenance

As described in detail for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), DO levels are primarily affected by water temperature, flow velocity, turbulence, amounts of oxygen demanding substances present (e.g., ammonia, organics), and rates of photosynthesis (which is influenced by nutrient levels), respiration, and decomposition. Water temperature and salinity affect the maximum DO saturation level (i.e., the highest amount of oxygen the water can dissolve). Flow velocity affects the turbulence and re-aeration of the water (i.e., the rate at which oxygen from the atmosphere can be dissolved in water). High nutrient content can support aquatic plant and algae growth, which in turn generates oxygen through photosynthesis and consumes oxygen through respiration and decomposition.

As described for Alternative 4, amounts of oxygen demanding substances present (e.g., ammonia, organics) in the reservoirs and rivers upstream of the Delta, rates of photosynthesis (which is influenced by nutrient levels/loading), and respiration and decomposition of aquatic life is not expected to change sufficiently under Alternative 4A to substantially alter DO levels relative to Existing Conditions or the No Action Alternative (ELT and LLT). Further, the rivers upstream of the Delta are well oxygenated and experience periods of supersaturation (i.e., when DO level exceeds the saturation concentration). Because these are large, turbulent rivers, any reduced DO saturation level that would be caused by an increase in temperature under Alternative 4A would not be expected to cause DO levels to be outside of the range seen historically. Flow changes that would occur under Alternative 4A would not be expected to have substantial effects on river DO levels; likely, the changes would be immeasurable. This is because sufficient turbulence and interaction of river water with the atmosphere would continue to occur to maintain water saturation levels (due to these factors) at levels similar to that of Existing Conditions and the No Action Alternative (ELT and LLT).

Also as described for Alternative 4, salinity changes would generally have relatively minor effects on Delta DO levels. Further, the relative degree of tidal exchange of flows and turbulence, which contributes to exposure of Delta waters to the atmosphere for reaeration, would not be expected to substantially change relative to Existing Conditions or the No Action Alternative (ELT and LLT), such that these factors would reduce Delta DO levels below objectives or levels that protect beneficial uses. Similarly, increased temperature under Alternative 4A would generally have relatively minor effects on Delta DO levels, relative to Existing Conditions.

Similar to Alternative 4, flows in the San Joaquin River at Stockton were evaluated, and are shown in Figure DO-1 in Appendix B of this RDEIR/SDEIS. The figure shows that while flows would change somewhat, they would generally be within the range of flows seen under Existing Conditions and the No Action Alternative. Reports indicate that the aeration facility performs adequately under the range of flows from 250-1,000 cfs (ICF International 2010). Based on the above, the expected changes in flows in the San Joaquin River at Stockton are not expected to substantially move the point of minimum DO, and therefore the aeration facility would likely still be located appropriately to keep DO levels above Basin Plan objectives. Overall, assuming continued operation of the aerators, the alternative is not expected to have a substantial adverse effect on DO in the Deep Water Ship Channel. It is expected that DO levels in the Deep Water Ship Channel, which is CWA Section 303(d) listed as impaired due to low DO, would remain similar to those under Existing Conditions and the No Action Alternative (ELT and LLT) or improve as TMDL-required studies are completed and actions are implemented to improve DO levels. DO levels in other Clean Water Act Section 303(d)-listed waterways would not be expected to change relative to Existing Conditions or the No Action Alternative (ELT and LLT), as the circulation of flows, tidal flow exchange, and re-aeration would continue to occur.

In the SWP/CVP Export Service Areas, the primary factor that would affect DO in the conveyance channels and ultimately the receiving reservoirs would be changes in the levels of nutrients and oxygen-demanding substances and DO levels in the exported water. As described above and for Alternative 4, exported water could potentially be warmer and have higher salinity relative to Existing Conditions and the No Action Alternative (ELT and LLT). Nevertheless, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions or the No Action Alternative (ELT and LLT) due to water quality regulations, canal turbulence, exposure of the water to the atmosphere, and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

NEPA Effects: Because DO levels are not expected to change substantially relative to the No Action Alternative (ELT and LLT), the effects on DO from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: The effects of Alternative 4A on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DO levels in the reservoirs, because oxygen sources (surface water aeration, aerated inflows, vertical mixing) would remain. Similarly, river flow rate reductions would not be expected to result in a substantial adverse change in DO levels in the rivers upstream of the Delta, given that mean monthly flows would remain within the ranges historically seen under Existing Conditions and the affected river are large and turbulent. Any reduced DO saturation level that may be caused by increased water temperature would not be expected to cause DO levels to be outside of the range seen historically. Finally, amounts of oxygen demanding substances and salinity would not be expected to change sufficiently to affect DO levels.

It is expected there would be no substantial change in Delta DO levels in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to DO. DO levels would be affected by nutrient loading, which the state regulates the discharges of, and this loading would not be expected to lower DO levels relative to Existing Conditions based on historical DO levels. Further, the anticipated changes in salinity would have relatively minor effects on DO levels, and tidal exchange, which contribute to the reaeration of Delta waters would not be expected to change substantially.

There is not expected to be substantial, if even measurable, changes in DO levels in the SWP/CVP Export Service Areas waters, relative to Existing Conditions, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions (due to water quality regulations), canal turbulence and exposure of the water to the atmosphere and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels are expected, long-term water quality degradation would not be expected to occur, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and DO-related impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-10: Effects on Dissolved Oxygen Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects**:** Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. The increased habitat provided by these environmental commitments could contribute to an increased biochemical or sediment demand, through contribution of organic carbon and plants decaying, though the areal extent of the effects would be less than under Alternative 4, because less land would be converted under Alternative 4A. The areal extent of new habitat implemented for the Environmental Commitments would be small relative to the existing and No Action Alternative tidal area, and similar habitat exists currently in the Delta and is not identified as contributing to adverse DO conditions. Although additional DOC loading to the Delta may occur (see impact WQ-18), the amount expected would be minimal and only a fraction of the DOC is available to microorganisms that would consume oxygen as part of the decay and mineralization process. Since decreases in dissolved organic carbon are not typically observed in Delta waterways due to these processes, any increase in DOC is unlikely to contribute to adverse DO levels in the Delta.

CM14, which under Alternative 4 would fund improvements to the oxygen aeration facility in the Stockton Deep Water Ship Channel to meet TMDL objectives established by the Central Valley Water Board, would not be implemented under Alternative 4A. However, the existing aeration facility would continue to be operated to enhance DO levels in the channel. Thus, DO levels would be expected similar those under the No Action Alternative (ELT and LLT).

CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in stormwater, also would not be implemented under Alternative 4A. Thus, the potential for reduced biochemical oxygen demand load described for Alternative 4 would not occur in the near-term and loading of these constituents and, thus DO levels, would be expected to be similar to that which would occur under the No Action Alternative (ELT and LLT).

The remaining environmental commitments would not affect DO levels because they are actions that do not affect the presence of oxygen-demanding substances.

Based on the above findings, the effects on DO from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

***CEQA Conclusion*:** It is expected that DO levels in the Upstream of the Delta Region, in the Plan Area, or in the SWP/CVP Export Service Areas following implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not be substantially different from existing DO conditions, because these would contribute to a minimal, localized change in oxygen-demanding substances associated with habitat restoration, if at all. Therefore, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels would be expected, long-term water quality degradation would not be expected, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-11: Effects on Electrical Conductivity Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on EC levels in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). The extent of new urban growth would be less in the ELT, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further decrease loading of EC-related parameters to tributaries. Based on these considerations, and those described in Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS, EC levels (highs, lows, typical conditions) in the

Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under Alternative 4A could occur, but would be slightly less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because the effects of climate change and increase water demands on flows, which could effect dilution of high EC discharges, would be less in the ELT. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected to be of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

As mentioned at the beginning of Section 4.3.4, the analysis of EC under Alternative 4A is based on modeling conducted for Alternative 4 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. Also, the modeling was originally performed assuming the Emmaton compliance point shifted to Threemile Slough. However, Yolo Bypass Improvements are not a component of Alternative 4A and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the Alternative 4A modeling. Also, Alternative 4A does not include a change in compliance point from Emmaton to Threemile Slough. Furthermore, there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance, when in reality no such exceedance would occur. The result of all of these factors is that the quantitative modeling results presented in this assessment is not entirely predictive of actual effects under Alternative 4A, and the results should be interpreted with caution. In order to understand the significance of all of these factors on the results, sensitivity analyses and other analyses were performed to evaluate the impact of maintaining the compliance point at Emmaton, the impact of having substantially less restoration than included in the modeling that was analyzed, and whether exceedances were indeed modeling artifacts or were potential alternative-related effects that may actually occur. For more information on these sensitivity analyses, refer to Chapter 8, Section 8.3.1.7, *Electrical Conductivity*, and Appendix 8H Attachment 1, both in Appendix A of the RDEIR/SDEIS.

In this assessment, the modeling results are described and then in most cases are qualified in light of findings from the sensitivity analyses. Conclusions thus represent assessment of the combination of the modeling results and sensitivity analysis findings.

The modeling of EC under Alternative 4A included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes (i.e., water conveyance facilities). Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-12. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Relative to Existing Conditions and the No Action Alternative (ELT), initial review of modeling results indicated that Alternative 4A would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and San Joaquin River at San Andreas Landing and Prisoners Point (Table EC-1 in Appendix B of this RDEIR/SDEIS). Additionally, the modeling results indicated potentially large increases in EC in Suisun Marsh. However, to understand and interpret these results, considerations must be made regarding uncertainty in the modeling, differing assumptions between the modeling and the alternative, and sensitivity analyses. These objectives and locations are addressed in the context of these considerations in detail below. At all other locations, the level of exceedance and EC in the modeling results was approximately equivalent or lower than under Existing Conditions and the No Action Alternative (ELT).

Sacramento River at Emmaton

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of dry and critical water years. However, sensitivity analyses have shown that the level of effect would be less than presented in the modeling. Remaining increases in exceedance of the objective and degradation are expected to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Delta Cross Channel operation. Further discussion is provided below.

Modeling results indicated that the percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 13% under the No Action Alternative (ELT), to 17–18% and the percent of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative (ELT), to 26–28%, depending on the operations scenario. Although these results are for modeling that was originally performed for Alternative 4 at the ELT assuming the Emmaton compliance point shifted to Threemile Slough, Alternative 4A does not include a change in compliance point from Emmaton to Threemile Slough.

Sensitivity analyses were performed that modeled Alternative 4 scenario H3 at the LLT with Emmaton as the compliance point. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS). Assuming the compliance location at Emmaton instead of Threemile Slough in the CALSIM II modeling decreased exceedances at Emmaton from 28% to 15% under Alternative 4, operations scenario H3 at the LLT (see Appendix 8H, Attachment 1, of the RDEIR/SDEIS for more discussion of these sensitivity analyses), which would still be greater than Existing Conditions, but is very close to the No Action Alternative (ELT). Table 2 of Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS indicates that most of these exceedances are a result of modeling artifacts, but some exceedances are due to deadpool conditions that occurred in 1977, 1981, and 1990 under Alternative 4 scenario H3 at the LLT and not under Existing Conditions. As discussed in Chapter 5, *Water Supply*, Section 5.3.1, *Methods for Analysis*, of this RDEIR/SDEIS, under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions. However, these results indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects to agricultural beneficial uses.

This is evidenced in the modeling results, which indicated that long-term monthly average EC levels at Emmaton would increase 1–22% for the entire period modeled (1976–1991) and 4–44% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). The largest increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. During these periods, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would be considered not adverse.

San Joaquin River at San Andreas Landing

Alternative 4A is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions and the No Action Alternative (ELT). Modeling results estimated that the percent of days the San Andreas Landing EC objective would be exceeded would increase from 1% under Existing Conditions to 2% under operations scenario H3, and would decrease to 0% under operations scenario H4 (Table EC-1 in Appendix B of this RDEIR/SDEIS). The percent of days out of compliance with the EC objective for San Andreas Landing would increase from 1% under Existing Conditions to 4% for operations scenario H3, and would decrease to 0% under operations scenario H4. San Andreas Landing average EC would decrease 6% for the entire period modeled, but would increase 1–3% during the drought period modeled, relative to Existing Conditions (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). Results relative to the No Action Alternative (ELT) were similar (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). However, sensitivity analyses performed for Alternative 4 scenario H3 at the LLT indicate that many of these exceedances are likely modeling artifacts, and the small number of remaining exceedances would be small in magnitude, lasting only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, in Appendix A of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS).

San Joaquin River at Prisoners Point

Modeling results indicated that the EC objective that applies between the San Joaquin River at Jersey Point and Prisoners Point would be exceeded at Prisoners Point more often under Alternative 4A than under Existing Conditions and the No Action Alternative (ELT). However, modeling results without restoration areas would be expected to show a lesser effect, and remaining exceedances are expected to be able to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Head of Old River Barrier management. Further discussion is provided below.

Modeling results estimated that the percent of days the Prisoners Point EC objective would be exceeded would increase from 6% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 17–20% and the percent of days out of compliance with the EC objective would increase from 10% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 20–23%, depending on the operations scenario (Table EC-1 in Appendix B of this RDEIR/SDEIS). The magnitude of the exceedances is estimated to be very small—the objective is 440 µmhos/cm, and the EC during times of exceedance was generally between 440 and 550 µmhos/cm. The exceedances generally occurred in drier water years, when flows are lower. During these times, the EC in the San Joaquin River at Vernalis is greater than in the Sacramento River entering the Delta, and is high enough on its own to cause an exceedance.

There are two main drivers of the increase in exceedances under the alternative: an increase in San Joaquin River flow at Prisoners Point during April and May under the alternative, relative to Existing Conditions and the No Action Alternative (ELT), and a reduction in the amount of Sacramento River water moving past Prisoners Point under the alternative. The result is increased San Joaquin River water at Prisoners Point, and a reduction in the dilution that the Sacramento River provides the higher EC San Joaquin River. The increase in San Joaquin River flow at Prisoners Point is due to a reduction in pumping from the south Delta under the alternative, as well as due to the presence of the Head of Old River Barrier, which increases flow in the San Joaquin River downstream of Old River by preventing flow from entering Old River. The reduction in Sacramento River water influence is due to less pumping at the south Delta pumping plants (i.e., greater pumping draws more Sacramento River water through the Delta).

Sensitivity analyses conducted for Alternative 4 scenario H3 at the LLT indicated that removing all tidal restoration areas (such as is largely the case in Alternative 4A at the ELT) would reduce the number of exceedances by about 9 percentage points, but there would still be more exceedances than under Existing Conditions or the No Action Alternative. Sensitivity analyses also indicated that if the Head of Old River Barrier was open in April and May, exceedances would be reduced by about 5 percentage points. Both of these analyses also showed lower EC during April and May, including during times when modeling showed the objective to be exceeded. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT. Results of the sensitivity analyses indicate that the exceedances are partially a function of the restoration that was assumed in the Alternative 4A modeling, but partly due also to operations of the alternative itself, due to Head of Old River Barrier assumptions and south Delta export differences (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses). Appendix 8H, Attachment 2, in Appendix A of the RDEIS/SDEIS contains a more detailed assessment of the likelihood of exceedances estimated via modeling for Alternatives 1–9 impacting aquatic life beneficial uses. Specifically, Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination for those alternatives. However, based on the sensitivity analyses conducted, modeling of Alternative 4A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 4 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Suisun Marsh

For Suisun Marsh October–May is the period when Bay-Delta WQCP EC objectives for protection of fish and wildlife apply. Modeling results indicate that average EC for the entire period modeled would increase in the Sacramento River at Collinsville during the months of March through May relative to Existing Conditions, by 0.1–0.2 mS/cm (Table EC-3 in Appendix B of this RDEIR/SDEIS). In Montezuma Slough at National Steel, average EC levels would increase in December through March by 0.1–0.4 mS/cm (Table EC-4 in Appendix B of this RDEIR/SDEIS). The most substantial EC increase would occur in Montezuma Slough near Beldon Landing, with long-term average EC levels increasing by 1.1–5.3 mS/cm, depending on the month and operations scenario, at least doubling during some months the long-term average EC relative to Existing Conditions (Table EC-5 in Appendix B of this RDEIR/SDEIS). Sunrise Duck Club and Volanti Slough also would have long-term average EC increases during October–May ranging 0.7–3.1 mS/cm (Tables EC-6 and EC-7 in Appendix B of this RDEIR/SDEIS). Modeled long-term average EC increases in Suisun Marsh under Alternative 4A relative to the No Action Alternative (ELT) are similar to the increases relative to Existing Conditions.

However, modeling used in the assessment of Alternative 4A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results discussed above, but EC levels were still somewhat higher than EC levels under Existing Conditions and the No Action Alternative for several locations and months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions and the No Action Alternative (see Appendix 8H, Attachment 1, of the Draft EIR/EIS for more information on these sensitivity analyses). Since Alternative 4A at the ELT includes operation of the gates, and includes very little tidal restoration areas, it is anticipated that EC increases in Suisun Marsh predicted via the modeling would not occur, and that EC in Suisun Marsh under Alternative 4A would be very similar to Existing Conditions and No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, EC under Alternative 4A could be less than under the No Action Alternative (ELT). For these reasons, any changes in EC in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 4A, at the Banks pumping plant, there would be no exceedance of the Bay-Delta WQCP's 1,000 µmhos/cm EC objective for the entire period modeled under operations scenario H4 (Table EC-2 in Appendix B of this RDEIR/SDEIS). However, under operations scenario H3, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 2% for the drought period modeled. This differs from Alternative 4, under which there would be no exceedance of the EC objective under either operations scenario. Relative to Existing Conditions, average EC levels under Alternative 4A would decrease 25–28% for the entire period modeled and 21–27% during the drought period modeled, depending on the operations scenario. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 21–25% for the entire period modeled and 18–25% during the drought period modeled (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS).

At the Jones pumping plant, there would be no exceedance of the Bay-Delta WQCP s 1,000 μmhos/cm EC objective for the entire period modeled under operations scenario H3 (Table EC-2 in Appendix B of this RDEIR/SDEIS). However, under operations scenario H4, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 0% for the drought period modeled. This differs from Alternative 4, under which there would be no exceedance of the EC objective under either operations scenario. Relative to Existing Conditions, average EC levels under Alternative 4A would decrease 25% for the entire period modeled and 22–23% during the drought period modeled, depending on the operations scenario. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 22% for the entire period modeled and 19–20% during the drought period modeled, depending on the operations scenario (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS).

Based on the decreases in long-term average EC levels that would occur at the Banks and Jones pumping plants, Alternative 4A would not cause degradation of water quality with respect to EC in the SWP/CVP Export Service Areas rather, Alternative 4A would improve long-term average EC conditions in the SWP/CVP Export Service Areas.

Commensurate with the EC decrease in exported waters, an improvement in lower San Joaquin River average EC levels would be expected since EC in the lower San Joaquin River is, in part, related to irrigation water deliveries from the Delta. While the magnitude of this expected lower San Joaquin River improvement in EC is difficult to predict, the relative decrease in overall loading of EC-elevating constituents to the Export Service Areas would likely alleviate or lessen any expected increase in EC at Vernalis related to decreased annual average San Joaquin River flows.

The export area of the Delta is listed on the state's CWA Section 303(d) list as impaired due to elevated EC Alternative 4A would result in lower average EC levels relative to Existing Conditions and the No Action Alternative (ELT) and, thus, would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters.

NEPA Effects: In summary, based on the results of the modeling and sensitivity analyses conducted, it is unlikely that there would be increased frequency of exceedance of agricultural EC objectives in the western, interior, or southern Delta. However, modeling results indicate that there could be increased long-term and drought period average EC levels during the summer months that would occur in the western Delta (i.e., in the Sacramento River at Emmaton) under Alternative 4A relative to the No Action Alternative (ELT), that could contribute to adverse effects on the agricultural beneficial uses. In addition, the increased frequency of exceedance of the San Joaquin River at Prisoners Point EC objective could contribute to adverse effects on fish and wildlife beneficial uses (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 4A, relative to the No Action Alternative (ELT), and thus it is not expected that they would contribute to additional beneficial use impairment. The increases in EC in the Sacramento River at Emmaton, particularly during summer months of dry and critical water years, and the additional exceedances of water quality objectives in the San Joaquin River at Prisoners Point constitute an adverse effect on water quality. Mitigation Measure WQ-11 would be available to reduce these effects.

CEQA Conclusion: River flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in EC levels in the reservoirs and rivers upstream of the Delta, given that: changes in the quality of watershed runoff and reservoir inflows would not be expected to occur in the future; the state's regulation of point-source discharge effects on Delta salinity-elevating parameters and the expected further regulation as salt management plans are developed; the salt-related TMDLs adopted and being developed for the San Joaquin River; and the expected improvement in lower San Joaquin River average EC levels commensurate with the lower EC of the irrigation water deliveries from the Delta.

Relative to Existing Conditions, Alternative 4A would not result in any substantial increases in long-term average EC levels in the SWP/CVP Export Service Areas, and exceedance of the Bay-Delta WQCP EC objective would be infrequent. Average EC levels for the entire period modeled would decrease at both the Banks and Jones pumping plants and, thus, this alternative would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters. Rather, this alternative would improve long-term EC levels in the SWP/CVP Export Service Areas, relative to Existing Conditions.

Further, relative to Existing Conditions, Alternative 4A would not result in substantial increases in long-term average EC in Suisun Marsh. Thus, EC levels in Suisun Marsh are not expected to further degrade existing EC levels and thus would not contribute additionally to adverse effects on the fish and wildlife beneficial uses. Because EC is not bioaccumulative, any changes in long-term average EC levels would not directly cause bioaccumulative problems in fish and wildlife. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 4A, relative to Existing Conditions, and thus it is not expected that they would contribute to additional beneficial use impairment.

In the Plan Area, Alternative 4A is not expected to result in an increase in the frequency with which Bay-Delta WQCP EC objectives are exceeded, except for at the San Joaquin River at Prisoners Point (fish and wildlife objective; 11–14% increase). The increased frequency of exceedance of the fish and wildlife objective at Prisoners Point could contribute to adverse effects on aquatic life (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. However, modeling of Alternative 4A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 4 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Average EC levels at Emmaton would increase by 4–5% during the drought period modeled. The largest monthly average increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. The increases in drought period average EC levels could cause substantial water quality degradation that would potentially contribute to adverse effects on the agricultural beneficial uses in the western Delta. The comparison to Existing Conditions reflects changes in EC due to both Alternative 4A operations and climate change/sea level rise. The adverse effects expected to occur at Emmaton would be due in part to the effects of climate change/sea level rise, and in part due to Alternative 4A operations. This is evidenced by the significant effects expected in the No Action Alternative (ELT) at Emmaton relative to Existing Conditions, as well as the fact that a lesser level of adverse effects is expected at

Emmaton under Alternative 4A relative to the No Action Alternative (ELT). During summer of dry and critical water years, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would not be expected to adversely affect beneficial uses. Because EC is not bioaccumulative, the increases in long-term average EC levels would not directly cause bioaccumulative problems in aquatic life or humans. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse.

Based on these findings, this impact in the Plan Area is considered to be significant. Implementation of Mitigation Measure WQ-11 would be expected to reduce these effects to a less-than-significant level.

Mitigation Measure WQ-11: Avoid or Minimize Reduced Water Quality Conditions

The implementation of mitigation actions shall be focused on avoiding or minimizing those incremental effects attributable to implementation of Alternative 4A operations only. Mitigation actions to avoid or minimize the incremental EC effects attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 4A. The goal of specific actions is to reduce/avoid additional exceedances of Delta EC objectives and reduce long-term average concentration increases to levels that would not adversely affect beneficial uses within the Delta. Implementation of Mitigation Measure WQ-11 would be expected to reduce effects on EC to a less-than-significant level.

Mitigation Measure WQ-11a: Adaptively Manage Diversions at the North and South Delta Intakes to Reduce or Eliminate Water Quality Degradation in Western Delta

Modeling results for Alternative 4A indicated water quality degradation in the Sacramento River at Emmaton during May-September of dry and critical water year types, relative to the No Action Alternative (ELT). Additional flow in the Sacramento River at Emmaton would be expected to reduce EC levels under Alternative 4A to levels closer to the No Action Alternative (ELT) that would not be expected to adversely affect beneficial uses. By reducing diversions from the north Delta intakes during these periods (and consequently increasing diversions from the south Delta intakes), additional flow would be available in the Sacramento River to reduce water quality degradation with respect to EC. The BDCP proponents shall adaptively manage the split between north and south Delta diversions during May-September of dry and critical water years to limit EC in the Sacramento River at Emmaton to levels consistent with the No Action Alternative.

Mitigation Measure WQ-11b: Adaptively Manage Head of Old River Barrier and Diversions at the North and South Delta Intakes to Reduce or Eliminate Exceedances of the Bay-Delta WQCP Objective at Prisoners Point

Modeling results for Alternative 4A indicated additional exceedances of the Bay-Delta WQCP objective for protection of striped bass between Jersey Point and Prisoners Point at Prisoners Point. It is expected that by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, exceedances of the EC objective at Prisoners Point could be avoided, and EC levels at Prisoners Point would be decreased to a level that would not adversely affect aquatic life beneficial uses. The BDCP proponents shall adaptively manage the Head of Old River Barrier and the split between north and south Delta diversions during April-May to avoid exceedances of the objective at Prisoners Point. These actions would not be required in critical water years, when the objective does not apply. The BDCP proponents will consult with CDFW, USFWS, and NMFS to ensure that such actions are warranted to avoid adverse impacts of salinity on striped bass spawning in the San Joaquin River, and to minimize adverse effects these mitigation actions may have on other species.

Impact WQ-12: Effects on Electrical Conductivity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15 and 16.

***NEPA Effects*:** The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new direct sources of EC to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. As they pertain to EC, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. Such replacement or substitution of land use activity is not expected to result in new or increased sources of EC to the Delta and, in fact, could decrease EC through elimination of high EC agricultural runoff.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable EC changes.

In summary, implementation of the environmental commitments would not be expected to adversely affect EC levels in the affected environment and thus would not adversely affect beneficial uses or substantially degrade water quality with regard to EC within the affected environment. Therefore, the effects on EC from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of EC to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution is not expected to substantially increase or present new sources of EC, and could actually decrease EC loads to Delta waters, because agricultural drainage can be a source of elevated EC. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, adverse effects on EC levels throughout the affected environment and would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria that would result in adverse effects on any beneficial uses within affected water bodies. Further, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of adverse effects on beneficial uses. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-13: Effects on Mercury Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the Alternative 4A on mercury levels in surface waters upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT) would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because factors which affect mercury concentrations in surface waters upstream of the Delta are similar under Alternatives 4 and 4A. The changes in flow in the Sacramento River under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) would not be of the magnitude of storm flows, in which substantial sediment-associated mercury is mobilized. Therefore, mercury loading should not be substantially different due to changes in flow. In addition, even though it may be flow-affected, total mercury concentrations remain well below criteria at upstream locations. Any negligible changes in mercury concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to mercury. Both waterborne methylmercury concentrations and largemouth bass fillet mercury concentrations are expected to remain above guidance levels at upstream of Delta locations, but would not change substantially because the anticipated changes in flow are not expected to substantially change mercury loading relative to Existing Conditions or the No Action Alternative (ELT).

The upstream of Delta areas in the north will benefit from the implementation of the Cache Creek, Sulfur Creek, Harley Gulch, and Clear Lake Mercury TMDLs and the American River methylmercury TMDL. These projects will target specific sources of mercury and methylation upstream of the Delta and could result in net improvement to Delta mercury loading in the future. The implementation of these projects could help to ensure that upstream of Delta environments will not be substantially degraded for water quality with respect to mercury or methylmercury.

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-14. See Chapter 8, Section 8.3.1.3, *Plan Area,* in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 4A on waterborne concentrations of mercury (Table Hg-1 in Appendix B of this RDEIR/SDEIS) and methylmercury (Table Hg-2 in Appendix B of this RDEIR/SDEIS), and fish tissue mercury concentrations for largemouth bass fillet (Tables Hg-3 through Hg-8 in Appendix B of this RDEIR/SDEIS) were evaluated for nine Delta locations.

Similar to Alternative 4, increases in long-term average mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) would be very small, 0.4 ng/L or less. Also, use of assimilative capacity for mercury relative to the 25 ng/L ecological threshold under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), would be very low, approximately 2% or less for all Delta locations (Tables Hg-9 and Hg-10 in Appendix B of this RDEIR/SDEIS). These concentration changes and small changes in assimilative capacity for mercury are not expected to result in adverse (or positive) effects to beneficial uses.

Changes in methylmercury concentrations in water also are expected to be very small. The greatest annual average methylmercury concentration under Alternative 4A would be 0.166 ng/L for the San Joaquin River at Buckley Cove (all scenarios), for the drought period modeled, which would be slightly higher than Existing Conditions (0.161 ng/L) and slightly lower than the No Action Alternative (ELT) (0.168 ng/L) (Table Hg-2 in Appendix B of this RDEIR/SDEIS). All methylmercury concentrations in water were estimated to exceed the TMDL guidance objective of 0.06 ng/L under Existing Conditions and, therefore, no assimilative capacity exists.

Fish tissue estimates for largemouth bass fillet show small or no increases in mercury concentrations under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) based on long-term annual average concentrations for mercury at the Delta locations (Tables Hg-5 and Hg-8 in Appendix B of this RDEIR/SDEIS). Concentrations expected for scenario H3 with Equation 2 would increase by 10 percent to 12 percent in Mokelumne River (South Fork) at Staten Island, Franks Tract, Old River at Rock Slough, and San Joaquin River at Antioch relative to Existing Conditions in all years and by 11 percent to 12 percent at Staten Island and Rock Slough relative to the No Action Alternative (ELT) in all years (Table Hg-6 in Appendix B of this RDEIR/SDEIS). Concentrations expected for scenario H4 show decreases (11%) with Equation 2 in the North Bay Aqueduct at Barker Slough relative to Existing Conditions in all years and for the drought period modeled, and a decrease of 11 percent relative to the No Action Alternative (ELT) for the drought period (Table Hg-8 in Appendix B of this RDEIR/SDEIS). Because the increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a complete discussion of the uncertainty associated with the fish tissue estimates.

Briefly, the bioaccumulation models contain multiple sources of uncertainty associated with their development. These are related to: analytical variability; temporal and/or seasonal variability in Delta source water concentrations of methylmercury; interconversion of mercury species (i.e., the non-conservative nature of methylmercury as a modeled constituent); and limited sample size (both in number of fish and time span over which the measurements were made), among others. Although there is considerable uncertainty in the models used, the results serve as a reasonable approximations of a very complex process. Considering the uncertainty, small (i.e., < 20–25%) increases or decreases in modeled fish tissue mercury concentrations at a low number of Delta locations (i.e., 2–3) should be interpreted to be within the uncertainty of the overall approach, and not predictive of actual adverse effects. Larger increases, or increases evident throughout the Delta, can be interpreted as more reliable indicators of potential adverse effects.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

SWP/CVP Export Service Areas

The analysis of mercury and methylmercury in the SWP/CVP Export Service Areas was based on concentrations estimated at the Banks and Jones pumping plants. Both waterborne total and methylmercury concentrations for Alternative 4A, all scenarios, at the Jones and Banks pumping plants, would be lower than Existing Conditions and the No Action Alternative (ELT) (Tables Hg-1 and Hg-2 in Appendix B of this RDEIR/SDEIS). Therefore, mercury shows an increased assimilative capacity at these locations (Tables Hg-9 and Hg-10 in Appendix B of this RDEIR/SDEIS).

The largest improvements in bass tissue mercury concentrations and exceedance quotients ([EQs]; modeled tissue divided by TMDL guidance concentration) for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT) at any location within the Delta are expected for the Banks and Jones pumping plant export pump locations. The greatest improvement in largemouth bass tissue mercury concentration are expected for scenario H4 at the Banks and Jones pumping plants (-14% and -16%, respectively) relative to the No Action Alternative (ELT) (Tables Hg-5 through Hg-8 in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

***NEPA Effects*:** Based on the above discussion, Alternative 4A would not cause concentrations of mercury and methylmercury in water and fish tissue in the affected environment to be substantially different from the No Action Alternative (ELT and LLT) and, thus, would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to the No Action Alternative (ELT and LLT), Alternative 4A would not be expected to increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, the effects of Alternative 4A on mercury in the affected environment are considered to be not adverse.

***CEQA Conclusion*:** Under Alternative 4A, greater water demands and climate change would alter the magnitude and timing of reservoir releases and river flows upstream of the Delta in the Sacramento River watershed and east-side tributaries, relative to Existing Conditions. Concentrations of mercury and methylmercury upstream of the Delta would not be substantially different relative to Existing Conditions due to the lack of important relationships between mercury/methylmercury concentrations and flow for the major rivers.

Methylmercury concentrations exceed criteria at all locations in the Delta and no assimilative capacity exists. However, monthly average waterborne concentrations of total and methylmercury, over the period of record, under Alternative 4A would be very similar to Existing Conditions.

Similarly, estimates of fish tissue mercury concentrations show small differences would occur among sites for Alternative 4A as compared to Existing Conditions for Delta sites.

Assessment of effects of mercury in the SWP/CVP Export Service Areas were based on effects on mercury concentrations and fish tissue mercury concentrations at the Banks and Jones pumping plants. The Banks and Jones pumping plants are expected to show increased assimilative capacity for waterborne mercury and decreased fish tissue concentrations of mercury for Alternative 4A, all scenarios, as compared to Existing Conditions.

As such, Alternative 4A is expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, Alternative 4A would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-14: Effects on Mercury Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects**:** The potential types of effects on mercury resulting from implementation of the environmental commitments under Alternative 4A would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on mercury and methylmercury at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service Areas related to habitat restoration would be considerably lower than described for Alternative 4. This is because the amount of habitat restoration to be implemented under Alternative 4A would be very low compared to the total proposed restoration area that would be implemented under Alternative 4. The small amount of habitat restoration to be implemented under Alternative 4A may occur on lands in the Delta formerly used for irrigated agriculture. Habitat restoration proposed under Alternative 4A has the potential to increase water residence times and increase accumulation of organic sediments that are known to enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, there remain uncertainties related to site-specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta in the vicinity of the restored areas. Therefore, the effect of Environmental Commitments 3, 4, 6–12, 15, and 16 on mercury and methylmercury is considered to be adverse.

CEQA Conclusion**:** There would be no substantial, long-term increase in mercury or methylmercury concentrations or loads in the rivers and reservoirs upstream of the Delta or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. However, in the Delta, due to the small amount of tidal restoration areas proposed, relative to Existing Conditions, uptake of mercury from water and/or methylation of inorganic mercury may increase in localized areas as part of the creation of new, marshy, shallow, or organic-rich restoration areas. Although not quantifiable, on a local level, increases in methylmercury concentrations may be measurable. Methylmercury is CWA Section 303(d)-listed within the affected environment, and therefore any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. Because mercury is bioaccumulative, increases in water-borne mercury or methylmercury that could occur in some areas could bioaccumulate to somewhat greater levels in aquatic organisms and would, in turn, pose health risks to fish, wildlife, or humans. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, the uncertainties related to site specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta result in this potential impact being considered significant because, as described above, any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. No mitigation measures would be available until specific restoration actions are proposed. Therefore, this impact is considered significant and unavoidable.

Impact WQ-15: Effects on Nitrate Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), nitrate levels in the major rivers (Sacramento, Feather, American) are low, generally due to ample dilution available in the reservoirs and rivers relative to the magnitude of the point and non-point source discharges, and there is no correlation between historical water year average nitrate concentrations and water year average flow in the Sacramento River at Freeport. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT), are expected to have negligible, if any, effects on average reservoir and river nitrate-N concentrations in the Sacramento River watershed upstream of the Delta.

In the San Joaquin River watershed, nitrate concentrations are higher than in the Sacramento River watershed, owing to use of nitrate based fertilizers throughout the lower watershed. The correlation between historical water year average nitrate concentrations and water year average flow in the San Joaquin River at Vernalis is a weak inverse relationship—that is, generally higher flows result in lower nitrate concentrations, while low flows result in higher nitrate concentrations (linear regression r^2=0.49; Figure 2 in Appendix 8J, *Nitrate*, of the Draft EIR/EIS). Under Alternative 4A, long-term average flows at Vernalis would decrease an estimated 1% relative to Existing Conditions and would remain virtually the same relative to the No Action Alternative (ELT). Given the relatively small decreases in flows and the weak correlation between nitrate and flows in the San Joaquin

River, it is expected that nitrate concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT).

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any negligible changes in nitrate concentrations that may occur under Alternative 4A in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to nitrate.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-16. See section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Mass balance calculations indicate that under Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives (Table N-1 in Appendix B of this RDEIR/SDEIS). Although changes at specific Delta locations and for specific months may be substantial on a relative basis (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS), the absolute concentration of nitrate in Delta waters would remain low (<1.4 mg/L-N) in relation to the drinking water MCL of 10 mg/L-N, as well as all other thresholds (see *Nitrate* within Chapter 8, Section 8.3.17, *Constituent-Specific Considerations Used in the Assessment*, in Appendix A of the RDEIR/SDEIS). Long-term average nitrate concentrations are anticipated to remain below 1 mg/L-N at all 11 Delta assessment locations except the San Joaquin River at Buckley Cove, where long-term average concentrations would be somewhat above 1 mg/L-N. Nevertheless, at this location, long-term average nitrate concentrations would be somewhat reduced under Alternative 4A relative to Existing Conditions, and slightly increased relative to the No Action Alternative (ELT). Overall, the difference in long-term average nitrate concentrations at various locations throughout the Delta under Alternative 4A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), no additional exceedances of the MCL are anticipated at any location under Alternative 4A, regardless of operations scenario (Table N-1 in Appendix B of this RDEIR/SDEIS).

Use of assimilative capacity relative to the drinking water MCL of 10 mg/L-N under Alternative 4A would be low or negligible (i.e., <4%) in comparison to both Existing Conditions and the No Action Alternative (ELT), for all locations and months, for all modeled years (1976–1991), and for the drought period (1987–1991) (Tables N-6 and N-7 in Appendix B of this RDEIR/SDEIS). One exception is for Buckley Cove on the San Joaquin River in August, where use of assimilative capacity available during the drought period relative to the No Action Alternative (ELT) would range from 6.3% to 6.5%. Changes in use of assimilative capacity relative to Existing Conditions and the No

Action Alternative (ELT) under Alternative 4A would be approximately the same as described for Alternative 4.

As described for Alternative 4, actual nitrate concentrations would likely be higher than the modeling results indicate in certain locations under Alternative 4A. This is the mass balance modeling does not account for contributions from the SRWTP, which would be implementing nitrification/partial denitrification, or Delta wastewater treatment plant dischargers that practice nitrification, but not denitrification. However, as described for Alternative 4, any increases in nitrate concentrations that may occur at certain locations within the Delta under Alternative 4A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to nitrate.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

SWP/CVP Export Service Areas

Assessment of effects of Alternative 4A on nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate at the Banks and Jones pumping plants.

Results of the mass balance calculations indicate that the change in nitrate concentrations and use of assimilative capacity would be similar for the two operations scenarios of Alternative 4A (Tables N-4 through N-7 in Appendix B of this RDEIR/SDEIS). Relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations at Banks and Jones pumping plants under Alternative 4A are anticipated to decrease on a long-term average annual basis (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS). During the late summer, particularly in the drought period assessed, concentrations are expected to increase substantially on a relative basis (i.e., >50%), but the absolute value of these changes (i.e., in mg/L-N) would be small. Additionally, given the many factors that contribute to potential algal blooms in the SWP and CVP canals within the Export Service Areas, and the lack of studies that have shown a direct relationship between nutrient concentrations in the canals and reservoirs and problematic algal blooms in these water bodies, there is no basis to conclude that these small (i.e., generally <0.3 mg/L-N), seasonal increases in nitrate concentrations would increase the potential for problem algal blooms in the SWP/CVP Export Service Areas. Overall, the difference in long-term average nitrate concentrations at Banks and Jones pumping plants under Alternative 4A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4, no additional exceedances of the MCL are anticipated under Alternative 4A (Table N-1 in Appendix B of this RDEIR/SDEIS). On a monthly average basis and on a long-term annual average basis, for all modeled years and for the drought period only, use of assimilative capacity available under Existing Conditions and the No Action Alternative (ELT), relative to the 10 mg/L-N MCL, would be negligible (<3%) for both Banks and Jones pumping plants (Tables N-4 and N-5 in Appendix B of this RDEIR/SDEIS). Use of assimilative capacity relative to Existing Conditions and the No Action Alternative (ELT) for Alternative 4A would be slightly less than expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any increases in nitrate concentrations that may occur in water exported via Banks and Jones pumping plants are not expected to result in adverse effects to beneficial uses or substantially degrade the quality of exported water, with regard to nitrate.

NEPA Effects**:** Modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed. In the Delta, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any Delta location, and use of assimilative capacity available under the No Action Alternative, relative to the drinking water MCL of 10 mg/L-N, would be low. Long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to differ negligibly relative to the No Action Alternative (ELT and LLT) and no additional exceedances of the 10 mg/L-N MCL are anticipated. Therefore, the effects on nitrate from implementing water conveyance facilities are considered to be not adverse.

CEQA Conclusion: Nitrate concentrations are generally low in the reservoirs and rivers of the watersheds, owing to substantial dilution available for point sources and the lack of substantial nonpoint sources of nitrate upstream of the SRWTP in the Sacramento River watershed, and in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers).Although higher in the San Joaquin River watershed, nitrate concentrations are not well-correlated with flow rates. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed.

In the Delta, results of the mass balance calculations indicate that under Alternative 4A, relative to Existing Conditions, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any location, and use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <4%) for all for virtually all locations and months.

Assessment of effects of nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate concentrations at the Banks and Jones pumping plants. Results of the mass balance calculations indicate that under Alternative 4A relative to Existing Conditions, long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly. No additional exceedances of the 10 mg/L-N MCL are anticipated, and use of assimilative capacity available under Existing Conditions, relative to the MCL would be negligible (i.e., <3%) for both Banks and Jones pumping plants for all months.

Based on the above, there would be no substantial, long-term increase in nitrate concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the SWP/CVP Export Service Areas under Alternative 4A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any increases that may occur in some areas and months would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, increases that may occur in some areas and months would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-16: Effects on Nitrate Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands within the Delta formerly used for agriculture. As discussed for Impact WQ-2, increased biota that may result in those areas may increase ammonia, which in turn may be converted to nitrate by established microbial communities. However, the areal extent of new habitat implemented for the Environmental Commitments would be less than the existing and No Action Alternative habitat areas, and similar habitat exists currently in the Delta and is not identified as contributing to adverse nitrate conditions. Thus, these land use changes would not be expected to substantially increase nitrate concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect nitrate sources or loading. Based on these findings, the effects on nitrate from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Land use changes that would occur from the environmental commitments are not expected to substantially increase nitrate concentrations, because the amount of area to be converted would be small relative to existing habitat, and existing habitats are not known for contributing to adverse nitrate conditions. Thus, it is expected that implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-17: Effects on Dissolved Organic Carbon Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on DOC concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 because factors affecting DOC concentrations (e.g., source and non-point source inputs) in these water bodies would be similar.

Moreover, long-term average flow and DOC levels in the Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated. Thus changes in system operations and resulting reservoir storage levels and river flows under Alternative 4A would not be expected to cause substantial long-term changes in DOC concentrations in the water bodies upstream of the Delta. Any changes in DOC levels in water bodies upstream of the Delta under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be of sufficient frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies.

Delta

Effects of water conveyance facilities on long-term average DOC concentrations under Alternative 4A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration under Alternative 4A because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-18. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Under Alternative 4A, the geographic extent of effects pertaining to long-term average DOC concentrations in the Delta would be similar to that described for Alternative 4, although the magnitude of predicted long-term change and relative frequency of concentration threshold exceedances would be lower. The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 4A would result in small increases in long-term average DOC concentrations for both the modeled 16-year period (1976–1991) and drought period (1987–1991) at several interior Delta locations (increases up to 0.3 mg/L at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1) (Table DOC-1 in Appendix B of this RDEIR/SDEIS). The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at the Contra Costa Pumping Plant #1 locations exceeding the 3 mg/L (i.e., increase from 52% under Existing Conditions to 72% under Alternative 4A for the modeled 16-year period). The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower.

While Alternative 4A would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. As discussed for Alternative 4, substantial changes in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 4A are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Relative to Existing Conditions and the No Action Alternative (ELT and LLT), Alternative 4A would lead to predicted improvements in long-term average DOC concentrations at Barker Slough, as well as Banks and Jones pumping plants (discussed below).

SWP/CVP Export Service Areas

Under the Alternative 4A, long-term average DOC concentrations would decrease at Barker Slough (as much as 0.1–0.2 mg/L) and at both the Banks and Jones pumping plants (as much as 0.4 mg/L) relative to Existing Conditions and depending on operational scenario, and the reductions would be similar compared to No Action Alternative (ELT) (Table DOC-1 in Appendix B of this RDEIR/SDEIS). Decreases in long-term average DOC would result in generally lower exceedance frequencies for concentration thresholds, although the frequency of exceedances of the 3 mg/L threshold during the modeled drought period would increase at the Banks and Jones pumping plants (i.e., increase from 57% under Existing Conditions to 77% under Alternative 4A). Comparisons to the No Action Alternative (ELT) yield similar trends, but with slightly smaller magnitude drought period changes.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Maintenance of SWP and CVP facilities under Alternative 4A would not be expected to create new sources of DOC or contribute towards a substantial change in existing sources of DOC in the affected area.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 4A, relative to the No Action Alternative (ELT and LLT), would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. The long-term average DOC concentrations at Banks and Jones pumping plants are predicted to decrease by about 0.4 mg/L, while long-term average DOC concentrations for some Delta interior locations are predicted to increase by as much as 0.3 mg/L. Regardless of operational scenario, the increase in long-term average DOC concentration that could occur within the Delta interior would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters. Based on these findings, the effect of operations and maintenance activities on DOC under Alternative 4A is determined to be not adverse.

CEQA Conclusion: For the same reasons described for Alternative 4, the operations and maintenance activities under Alternative 4A, relative to the Existing Conditions, would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DOC levels upstream of the Delta. Moreover, long-term average flow and DOC at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in DOC concentrations upstream of the Delta.

Relative to Existing Conditions, the Alternative 4A would result in relatively small increases (i.e., ≤0.3 mg/L) in long-term average DOC concentrations at some interior Delta locations. The predicted increases under the operational scenarios modeled would not substantially increase the frequency with which long-term average DOC concentrations exceeds 2, 3, or 4 mg/L. While the operational scenarios would lead to slightly higher long-term average DOC concentrations at the interior Delta locations and some municipal water intakes, the predicted changes would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

Relative to Existing Conditions, the Alternative 4A would result in reduced long-term average DOC concentrations at the Banks and Jones pumping plants and Barker Slough. However, Alternative 4A would result in slightly greater frequency of exceedance of the 3 mg/L DOC concentration threshold during the modeled drought period. Nevertheless, under any operational scenario, an overall improvement in DOC-related water quality would be predicted in the SWP/CVP Export Service Areas.

Based on the above, the operations and maintenance activities of Alternative 4A Scenarios H3–H4 would not result in any substantial change in long-term average DOC concentration. The increases in long-term average DOC concentration that could occur within the Delta would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters or waters of the SWP/CVP Service Area. Because DOC is not bioaccumulative, the increases in long-term average DOC concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-18: Effects on Dissolved Organic Carbon Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

The potential types of effects on DOC resulting from implementation of the environmental commitments under Alternative 4A would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on DOC at locations upstream of the Delta, in the Delta, and the SWP/CVP export service areas would be considerably lower than described for Alternative 4.

As described for Alternative 4, Environmental Commitments 3, 9, 11, 12, 15, and 16 would present no major sources of DOC to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Area that would adversely affect beneficial uses. Environmental Commitments 4, 6, 7, and 10 include habitat restoration activities known to be sources of DOC. However, the amount of new habitat restoration to be implemented would be very small compared to the areal extent of existing habitat and that proposed for the No Action Alternative. Based on the amount of habitat restoration proposed, DOC loading from these areas would be very low in these water bodies. Consequently, relative to the Existing Conditions and No Action Alternative (ELT and LLT), the potential DOC loading to the Delta would be minimal, and thus not contribute substantially to the amounts of DOC in raw drinking water supplies.

NEPA Effects: Relative to existing habitat and that to be developed under the No Action Alternative (ELT and LLT), the area of new habitat restoration implemented for the environmental commitments would be very small. Implementation of non-habitat restoration environmental commitments would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, any increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Based on these findings, the effect of the environmental commitments on DOC is determined to be not adverse.

CEQA Conclusion: Implementation of habitat restoration environmental commitments is not expected to cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas, relative to the Existing Conditions, because the land area proposed for restoration would be relatively small compared to existing land area and sources of DOC. Implementation of other environmental commitments also would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Furthermore, DOC is not bioaccumulative, therefore changes in DOC concentrations would not cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-19: Effects on Pathogens Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 4A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described for Alternative 4, pathogen concentrations in the Sacramento and San Joaquin Rivers have a minimal relationship to flow rate in these rivers. Further, urban runoff contributions during the dry season would be expected to be a relatively small fraction of the rivers' total flow rates. During wet weather events, when urban runoff contributions would be higher, the flows in the rivers also would be higher. Given the small magnitude of urban runoff contributions relative to the magnitude of river flows and that pathogen concentrations in the rivers have a minimal relationship to river flow rate, river flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in pathogen concentrations in the reservoirs and rivers upstream of the Delta.

The effects of Alternative 4A relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be changes in the relative percentage of water throughout the Delta being comprised of various source waters (i.e., water from the Sacramento River, San Joaquin River, Bay water, eastside tributaries, and agricultural return flow), due to potential changes in inflows particularly from the Sacramento River watershed. However, as described for Alternative 4, it is expected there would be no substantial change in Delta pathogen concentrations in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to pathogens, because it is expected that pathogen sources in close proximity to Delta sites would have a greater influence on pathogen levels at the site, rather than the primary source(s) of water to the site. In-Delta potential pathogen sources, including water-based recreation, tidal habitat, wildlife, and livestock-related uses, would continue under this alternative. As such, there is not expected to be substantial, if even measurable, changes in pathogen concentrations in the SWP/CVP Export Service Area waters.

As such, Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or U.S. EPA-recommended pathogen criteria would be exceeded in water bodies of the affected environment located upstream of the Delta or substantially degrade the quality of these water bodies, with regard to pathogens.

NEPA Effects: Because pathogen levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on pathogens from implementing Alternative 4A are determined to be not adverse.

CEQA Conclusion: The effects of Alternative 4A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-20: Effects on Pathogens Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. Tidal wetlands are known to be sources of coliforms originating from aquatic, terrestrial, and avian wildlife that inhabit these areas (Desmarais et al. 2001, Grant et al. 2001, Evanson and Ambrose 2006, Tetra Tech 2007). Specific locations of restoration areas for this alternative have not yet been established. However, most low-lying land suitable for restoration is unsuitable for livestock. Therefore, it is likely that the majority of land to be converted to wetlands would be crop-based agriculture or fallow/idle land. Because of a great deal of scientific uncertainty in the loading of coliforms from these various sources, the resulting change in coliform loading is uncertain, but it is anticipated that coliform loading to Delta waters would increase. Based on findings from the Pathogens Conceptual Model that pathogen concentrations are greatly influenced by the proximity to the source, this could result in localized increases in wildlife-related coliforms relative to the No Action Alternative (ELT and LLT). The geographic extent of the potential increases would be less than under Alternative 4, because less land would be converted under Alternative 4A. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses.

The remaining environmental commitments would not be expected to affect pathogen levels, because they are actions that do not affect the presence of pathogen sources.

Based on these findings, the effects on pathogens from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Based on findings from the Pathogens Conceptual Model that pathogen concentrations are greatly influenced by the proximity to the source, implementation of Environmental Commitments 3, 4, and 6–11 could result in localized increases in wildlife-related coliforms relative to Existing Conditions. The geographic extent of the increase would be less than under Alternative 4, because less land would be converted under Alternative 4A. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-21: Effects on Pesticide Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT), would be similar to those expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because under Alternative 4A, the primary factor that would influence pesticide concentrations in surface waters upstream of the Delta—the effect of timing and magnitude of reservoir releases on dilution capacity—is expected to change by a similar degree. As shown in Tables P-1 through P-4 in Appendix B of this RDEIR/SDEIS, changes in average winter and summer flow rates, relative to Existing Conditions and the No Action Alternative (ELT), are expected to be similar to or less than changes in flow rates expected under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis (shown in Tables 1–4 in Appendix 8L, *Pesticides*, of the Draft EIR/EIS). Similarly, the primary factor that would influence pesticide concentrations in surface waters of the Delta and in the SWP/CVP Export Service Areas (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As shown for the two operational scenarios of Alternative 4A (Figures B.4-23 through B.4-66 in Appendix B of this RDEIR/SDEIS), the percent change in monthly average source water fractions would be similar to changes expected under Alternative 4 (Figures 133–175 in Appendix 8D, *Source Water Fingerprinting Results*, of the Draft EIR/EIS).

It was concluded for Alternative 4, and thus for Alternative 4A based on similar flow changes, that the potential average summer flow reductions would not be of sufficient magnitude to substantially increase in-river pesticide concentrations or alter the long-term risk of pesticide-related effects on aquatic life beneficial uses upstream of the Delta. Greater long-term average flow reductions, and corresponding reductions in dilution/assimilative capacity, would be necessary before long-term risk of pesticide related effects on aquatic life beneficial uses would be adversely altered. Similarly, the modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 4A would not be of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses of the Delta. Based on the general observation that San Joaquin River, in comparison to the Sacramento River, is a greater contributor of organophosphate insecticides in terms of greater frequency of incidence and presence at concentrations exceeding water quality benchmarks, modeled increases in Sacramento River fraction at Banks and Jones would generally represent an improvement in export water quality respective to pesticides.

The flow changes in the LLT would be expected in the ranges of that described above for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), and that described for Alternative 4 relative to the No Action Alternative (LLT) in Chapter 8, Section 8.3.3.9, in Appendix A of this RDEIR/SDEIS. Thus, similar to above and Alternative 4, the flow changes that would occur in the LLT under Alternative 4A, relative to Existing Conditions and the No Action Alternative (LLT), would not be expected to result in changes in dilution of pesticides of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses upstream of the Delta, in the Delta, or the SWP/CVP Export Service Areas.

NEPA Effects: In summary, the changes in long-term average flows on the Sacramento, Feather, American, and San Joaquin Rivers under Alternative 4A relative to the No Action Alternative (ELT and LLT) would be of insufficient magnitude to substantially increase the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in these water bodies upstream of the Delta. Similarly, changes in source water fractions to the Delta would be of insufficient magnitude to substantially alter the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in the Delta or CVP/SWP Export Service Areas. Therefore, the effects on pesticides from the water conveyance facilities are determined not to be adverse.

***CEQA Conclusion*:** Based on the discussion above, the effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or slightly less than those described for the Alternative 4. The considered operational scenarios of Alternative 4A would not result in any substantial change in long-term average pesticide concentration or result in substantial increase in the anticipated frequency with which long-term average pesticide concentrations would exceed aquatic life toxicity thresholds or other beneficial use effect thresholds upstream of the Delta, at the 11 assessment locations analyzed for the Delta, or the SWP/CVP service area. Numerous pesticides are currently used throughout the affected environment, and while some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence for their presence in waters affected by SWP and CVP operations (i.e., diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative, and thus changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, while there are numerous CWA Section 303(d) listings throughout the affected environment that name pesticides as the cause for beneficial use impairment, the modeled changes in upstream river flows and Delta source water fractions under Scenarios H3–H4 would not be expected to make any of these beneficial use impairments measurably worse. Because long-term average pesticide concentrations are not expected to increase substantially, no long-term water quality degradation with respect to pesticides is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-22: Effects on Pesticide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), Environmental Commitments 3, 4, and 6–11 could involve the conversion of active or fallow agricultural lands to natural landscapes, such as wetlands, grasslands, floodplains, and vernal pools. In the long-term, conversion of agricultural land to natural landscapes could possibly result in a limited reduction in pesticide use throughout the Delta. In the short-term, tidal and non-tidal wetland restoration over former agricultural lands may include the contamination of water with pesticide residues contained in the soils. Present use pesticides typically degrade fairly rapidly, and in such cases where pesticide containing soils are flooded, dissipation of those pesticides would be expected to occur rapidly. Environmental Commitments 12, 15, and 16 do not include actions that would affect pesticide sources or loading. Unlike under Alternative 4, *CM13 Invasive Aquatic Vegetation Control* and *CM19 Urban Stormwater Treatment* would not be implemented. Because of this, benefits to water quality from treatment measures that would reduce pesticide loading from urban land uses, as well as adverse impacts to water quality from application of herbicides directly to waters in the plan area that would occur under Alternative 4 would not occur under Alternative 4A.

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on pesticides from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly, such that pesticide levels would differ little from Existing Conditions. Therefore, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increases in pesticide concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas. As such, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pesticide concentrations are not expected to increase substantially, no long-term water quality degradation for pesticides is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term pesticide concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Environmental Commitments 3, 4, 6–12, 15, 16 do not include the use of pesticides known to be bioaccumulative in animals or humans, nor do the environmental commitments propose the use of any pesticide currently named in a CWA Section 303(d) listing of the affected environment. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-23: Effects on Phosphorus Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 4A on phosphorus concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because factors which affect phosphorus concentrations in surface waters of these areas are the same under Alternative 4 and Alternative 4A. As described for Alternative 4, phosphorus loading to waters upstream of the Delta is not anticipated to change, and because changes in flows do not necessarily result in changes in concentrations or loading of phosphorus to these water bodies, substantial changes in phosphorus concentration are not anticipated under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), upstream of the Delta. Phosphorus concentrations may increase during January through March at locations in the Delta where the source fraction of San Joaquin River water increases, due to the higher concentration of phosphorus in the San Joaquin River during these months compared to Sacramento River water or San Francisco Bay water. However, based on the DSM2 fingerprinting results (Figures B.4-1 through B.4-66 in Appendix B of this RDEIR/SDEIS), together with source water concentrations (in Figure 8-56 in Appendix A of the RDEIR/SDEIS), the magnitude of increases during these months is expected to be negligible to low (i.e., <0.02 mg/L) at all Delta locations relative to Existing Conditions and the No Action Alternative (ELT and LLT). Thus, phosphorus concentrations in the Delta and waters exported from Banks and Jones pumping plants to the SWP/CVP Export Service Areas are expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT).

NEPA Effects: In summary, operation of the water conveyance facilities would have little to no effect on phosphorus concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on phosphorus are considered to be not adverse.

CEQA Conclusion**:** The effects of Alternative 4A on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the Alternative 4. There would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 4A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because phosphorus concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-24: Effects on Phosphorus Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) Environmental Commitments 3, 4, and 6–11 would include activities that create additional aquatic habitat, which may affect phosphorus dynamics and speciation in localized areas where the restoration would occur, but would not contribute to additional phosphorus loading. Therefore, phosphorus concentrations are not expected to change substantially in the affected environment as a result of these restoration activities. Unlike under Alternative 4, *CM19 Urban Stormwater Treatment* would not be implemented under Alternative 4A. Because urban stormwater is a potential source of phosphorus in the affected environment, the slight decreases in phosphorus loading expected to occur as a result of implementation of CM19 under Alternative 4, relative to Existing Conditions and the No Action Alternative, would not occur under Alternative 4A. Environmental Commitments 12, 15, and 16 do not include actions that would affect phosphorus sources or loading.

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on phosphorus from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, there would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the waters exported to the SWP/CVP Export Service Areas due to implementation of these environmental commitments relative to Existing Conditions. Because phosphorus concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and, thus, the environmental commitments would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, any increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-25: Effects on Selenium Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 4A on selenium concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), because factors affecting selenium concentrations in these water bodies would be similar. Substantial point sources of selenium do not exist upstream in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Nonpoint sources of selenium within the watersheds of the Sacramento River and the eastern tributaries also are relatively low, resulting in generally low selenium concentrations in the reservoirs and rivers of those watersheds. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river selenium concentrations upstream of Freeport in the Sacramento River watershed or in the eastern tributaries upstream of the Delta. Similarly, it is expected that selenium concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under Alternative 4A, given the relatively small decreases in flows and the considerable variability in the relationship between selenium concentrations and flows in the San Joaquin River. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 4A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-26. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Alternative 4A would result in small changes in average selenium concentrations in water relative to Existing Conditions and No Action Alternative (ELT) at all modeled Delta assessment locations (Table Se-1 in Appendix B of this RDEIR/SDEIS). Long-term average concentrations at some interior and western Delta locations would increase by 0.01–0.04 μg/L for the entire period modeled (1976–1991), depending on operational scenario. These small increases in selenium concentrations in water would result in small reductions (4% or less) in available assimilative capacity for selenium, relative to USEPA's draft water quality criterion of 1.3 μg/L (Tables Se-8a and Se-8b in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water under Alternative 4A (range 0.09–0.40 μg/L) would be similar to Existing Conditions (range 0.09–0.41 μg/L) and the No Action Alternative (ELT) (range 0.09–0.39 μg/L), and would be below the draft water quality criterion of 1.3 μg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS). These changes would be nearly identical to those under Alternative 4.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in small changes (about 1% or less) in estimated selenium concentrations in most biota (whole-body fish, bird eggs [invertebrate diet or fish diet], and fish fillets) throughout the Delta, with little difference among locations (Tables Se-2a, Se-2b, Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS). Level of Concern Exceedance Quotients (i.e., modeled tissue divided by Level of Concern benchmarks) for selenium concentrations in those biota for all years and for drought years are less than 1.0, indicating low probability of adverse effects. Similarly, Advisory Tissue Level Exceedance Quotients for selenium concentrations in fish fillets for all years and drought years are less than 1.0. Estimated selenium concentrations in sturgeon for the San Joaquin River at Antioch are predicted to increase by about 17 to 19 percent relative to Existing Conditions and to the No

Action Alternative (ELT) in all years (from about 4.7 to about 5.6 mg/kg dry weight [dw]), and those for sturgeon in the Sacramento River at Mallard Island are predicted to increase by about 12 percent in all years (from about 4.4 to 4.9 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Selenium concentrations in sturgeon during drought years are expected to increase by about 4 to 7 percent at those locations (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Detection of small changes in whole-body sturgeon such as those estimated for the western Delta would require very large sample sizes because of the inherent variability in fish tissue selenium concentrations. Low Toxicity Threshold Exceedance Quotients for selenium concentrations in sturgeon in the western Delta would exceed 1.0 for drought years at both locations (as they do for Existing Conditions and the No Action Alternative (ELT) and for all years in the San Joaquin River at Antioch (where quotient increases from 0.94 to 1.1) (Table Se-7 in Appendix B of this RDEIR/SDEIS). The High Toxicity Threshold Quotient would be less than 1.0 at both locations for all years and drought years (Table Se-7 in Appendix B of this RDEIR/SDEIS).

The disparity between larger estimated changes for sturgeon and smaller changes for other biota is attributable largely to differences in modeling approaches, as described in Appendix 8M, *Selenium*, in Appendix A of this RDEIR/SDEIS. The model for most biota was calibrated to encompass the varying concentration-dependent uptake from waterborne selenium concentrations (expressed as the K_d, which is the ratio of selenium concentrations in particulates [as the lowest level of the food chain] relative to the waterborne concentration) that was exhibited in data for largemouth bass in 2000, 2005, and 2007 at various locations across the Delta. In contrast, the modeling for sturgeon could not be similarly calibrated at the two western Delta locations and used literature-derived uptake factors and trophic transfer factors for the estuary from Presser and Luoma (2013). As noted in Appendix 8M, there was a significant negative log-log relationship of K_d to waterborne selenium concentration that reflected the greater bioaccumulation rates for bass at low waterborne selenium than at higher concentrations. There was no difference in bass selenium concentrations in the Sacramento River at Rio Vista in comparison to the San Joaquin River at Vernalis in 2000, 2005, and 2007 [Foe 2010], despite a nearly 10-fold difference in waterborne selenium. Thus, there is more confidence in the site-specific modeling based on the Delta-wide model that was calibrated for bass data than in the estimates for sturgeon based on "fixed" K_ds for all years and for drought years without regard to waterborne selenium concentration at the two locations in different time periods.

Residence time of water in the Delta is expected to increase relative to Existing Conditions primarily as a result of habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur under the No Action Alternative (ELT) separate from Alternative 4A. Although estimates of the residence time increases are not available for Alternative 4A, estimates for Alternative 4 Scenario H3 at the Late Long Term (presented in Table 8-60a in Section 8.3.1.7 of Appendix A in the *Microcystis* subsection) which contained 65,000 acres of tidal restoration are available, and is expected that residence time increases under Alternative 4A would be substantially less than identified for Alternative 4 in the table.

If increases in fish tissue or bird egg selenium were to occur as a result of increased residence time, the increases would likely be of concern only where fish tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is, where biota concentrations are currently low and not approaching thresholds of concern (which, as discussed above, is the case throughout the Delta, except for sturgeon in the western Delta), changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Thus, the most likely area in which biota tissues would be at levels high enough that additional bioaccumulation due to increased residence time from restoration areas would be a concern is the western Delta and Suisun

Bay for sturgeon. Based on the expected minor increases in residence time in the western Delta and Suisun Bay, any increases are not expected to be of sufficient magnitude to substantially affect selenium bioaccumulation.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in essentially no change in selenium concentrations throughout the Delta for most biota (about 1% or less), although larger increases in selenium concentrations are predicted for sturgeon in the western Delta. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. The modeling of bioaccumulation for sturgeon is less calibrated to site-specific conditions than that for other biota, which was calibrated on a robust dataset for modeling of bioaccumulation in largemouth bass as a representative species for the Delta. Overall, Alternative 4A would not be expected to substantially increase the frequency with which applicable water quality criterion, or toxicity and level of concern benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon relative to the low benchmark and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium. These changes would be similar to those described for Alternative 4.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

SWP/CVP Export Service Areas

Alternative 4 would result in small (0.05–0.09 μg/L) decreases in long-term average selenium concentrations in water at the Banks and Jones pumping plants, relative to Existing Conditions and the No Action Alternative (ELT), for the entire period modeled (Table Se-1 in Appendix B of this RDEIR/SDEIS). These decreases in long-term average selenium concentrations in water would result in increases in available assimilative capacity for selenium at these pumping plants, relative to the USEPA's draft water quality criterion of 1.3 μg/L (Tables Se-8a and Se-8b in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water for Alternative 4A (range 0.16–0.19 μg/L) would be well below the draft water quality criterion of 1.3 μg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS).

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 4A would result in small changes (about 1% or less) in estimated selenium concentrations in biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets) (Tables Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS). Concentrations in biota would not exceed any selenium toxicity or level of concern benchmarks for Alternative 4A (Tables Se-4a and Se-4b in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

NEPA Effects**:** Relative to the No Action Alternative (ELT and LLT), Alternative 4A would result in essentially negligible changes in selenium concentrations in water upstream of the Delta. Similarly, there would be negligible changes in selenium water and most biota concentrations in the Delta, with no exceedances of benchmarks for biological effects. For sturgeon in the Delta, there would be only a small increase of threshold exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark. At the Banks and Jones pumping plants, Alternative 4A would cause no increases in the frequency with which applicable benchmarks would be exceeded and would slightly improve the quality of water in selenium concentrations. Therefore, the effects on selenium (both as waterborne and as bioaccumulated in biota) from Alternative 4A are considered to be not adverse.

***CEQA Conclusion*:** There are no substantial point sources of selenium in watersheds upstream of the Delta, and no substantial nonpoint sources of selenium in the watersheds of the Sacramento River and the eastern tributaries. Nonpoint sources in the San Joaquin Valley that contribute selenium to the Delta will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board [2010d] and State Water Board [2010b, 2010c]) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 4A, relative to Existing Conditions, are expected to cause negligible changes in selenium concentrations in water. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Relative to Existing Conditions, modeling estimates indicate Alternative 4A would result in essentially no change in selenium concentrations in water or most biota throughout the Delta, with no exceedances of benchmarks for biological effects. The Low Toxicity Threshold Exceedance Quotient for selenium concentrations in sturgeon for all years in the San Joaquin River at Antioch would increase slightly, from 0.94 for Existing Conditions to 1.1 for Alternative 4A. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. Overall, Alternative 4A would not be expected to substantially increase the frequency with which applicable benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium.

Assessment of effects of selenium in the SWP/CVP Export Service Areas is based on effects on selenium concentrations at the Banks and Jones pumping plants. Relative to Existing Conditions, all Alternative 4A would cause no increases in the frequency with which applicable benchmarks would be exceeded, and would slightly improve the quality of water in selenium concentrations at the Banks and Jones pumping plants.

Based on the above, selenium concentrations that would occur in water under Alternative 4A would not cause additional exceedances of applicable state or federal numeric or narrative water quality objectives/criteria, or other relevant water quality effects thresholds identified for this assessment, by frequency, magnitude, and geographic extent that would result in adverse effects to one or more beneficial uses within affected water bodies. In comparison to Existing Conditions, water quality conditions under Alternative 4A would not increase levels of selenium by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of selenium in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Water quality conditions under these alternative scenarios with respect to selenium would not cause long-term degradation of water quality in the affected environment, and therefore would not result in use of available assimilative capacity such that exceedances of water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. This alternative would not further degrade water quality by measurable levels, on a long-term basis, for selenium and, thus, cause the CWA Section 303(d)-listed impairment of beneficial use to be made discernibly worse. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-26: Effects on Selenium Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) Environmental Commitments 12, 15, and 16 do not involve actions that would increase selenium loading or otherwise alter selenium concentrations or residence time such that there would be a change in selenium concentrations in water or biota. Further, with the possible exception of changes in Delta hydrodynamics resulting from habitat restoration, Environmental Commitments 3, 4, and 6–11 would not substantially increase selenium concentrations in the water bodies of the affected environment. Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics, and thus such effects of these restoration measures were included in the assessment of facilities operations and maintenance (see Impact WQ-25).

While the implementation of Environmental Commitment 4 would create shallow backwater areas that could result in local increased water residence times, the extent of these areas would be minimal relative to the area of the Delta, and environmental changes associated with their development are unlikely to be of magnitude that would measurably change selenium concentrations in water or biota, relative to Existing Conditions. Further, although water residence times associated restoration could increase, they are not expected to increase without bound, and selenium concentrations in the water column would not continue to build up and be recycled in sediments and organisms as may be the case within a closed water system. However, because increases in bioavailable selenium in habitat restoration areas are uncertain, proposed avoidance and minimization measures would require evaluating risks of selenium exposure at a project level for each restoration area, minimizing to the extent practicable potential risk of additional bioaccumulation, and monitoring selenium levels in fish and/or wildlife to establish whether, or to what extent, additional bioaccumulation is occurring. See Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS for a description of the environmental commitment project proponents are making with respect to selenium management; and Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for additional detail on this avoidance and minimization measure (AMM27).

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to the No Action Alternative (ELT and LLT), under which more restoration would occur. Therefore, the effects on selenium from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

***CEQA Conclusion*:** Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to Existing Conditions. Therefore, it is expected that with implementation of these environmental commitments there would be no substantial, long-term increase in selenium concentrations in water in the rivers and reservoirs upstream of the Delta, water in the Delta, or the waters exported to the SWP/CVP Export Service Areas, relative to Existing Conditions. As such, these environmental commitments would not cause additional exceedances of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Given the factors discussed in the assessment above and for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), any increases in bioaccumulation rates from waterborne selenium that could occur in some areas as a result of increased water residence times would not be of sufficient magnitude and geographic extent that any portion of the Delta would be expected to have measurably higher body burdens of selenium in aquatic organisms, and therefore would not substantially increase risk for adverse effects to beneficial uses. Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause long-term degradation of water quality resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely. Also, these environmental commitments would not result in substantially increased risk for adverse effects to any beneficial uses. Furthermore, although the Delta is a CWA Section 303(d)-listed water body for selenium, given the discussion in the assessment above, it is unlikely that restoration areas would result in measurable increases in selenium in fish tissues or bird eggs such that the beneficial use impairment would be made discernibly worse.

Because it is unlikely that substantial increases in selenium in fish tissues or bird eggs would occur such that effects on aquatic life beneficial uses would be anticipated, and because of the avoidance and minimization measures that are designed to further minimize and evaluate the risk of such increases (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for more detail on AMM27) as well as the Selenium Management environmental commitment (see Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS this impact is considered less than significant. No mitigation is required.

Impact WQ-27: Effects on Trace Metal Concentrations Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 4A on trace metal concentrations in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

Given the poor association of dissolved trace metal concentrations with flow, river flow rate and reservoir storage reductions that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in trace metal concentrations in the reservoirs and rivers upstream of the Delta.

In the Delta, for metals of primarily aquatic life concern (copper, cadmium, chromium, lead, nickel, silver, and zinc), average and 95th percentile trace metal concentrations of the primary source waters to the Delta are very similar, and very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria, including those that are hardness-based (see Tables 8-51 and 8-52 in Appendix A of this RDEIR/SDEIS). No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average and 95th percentile source water concentrations for copper, cadmium, chromium, led, nickel, silver, and zinc do not exceed their respective criteria, more frequent exceedances of criteria in the Delta would not occur. For metals of primarily human health and drinking water concern (arsenic, iron, manganese), average and 95th percentile concentrations are also very similar (see Tables 8–10 in Appendix 8N,*Trace Metals*, of the Draft EIR/EIS) and average concentrations are below human health criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be expected to occur.

Because Alternative 4A would not result in substantial increases in trace metal concentrations in the water exported from the Delta or diverted from the Sacramento River through the proposed conveyance facilities, there is not expected to be substantial changes in trace metal concentrations in the SWP/CVP Export Service Areas, relative to Existing Conditions or the No Action Alternative (ELT and LLT).

As such, Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals.

NEPA Effects: Alternative 4A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals, relative to the No Action Alternative (ELT and LLT)., Therefore, the effects on trace metals from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: While Alternative 4A would alter the magnitude and timing of reservoir releases north, south and east of the Delta, this would have no substantial effect on the various watershed sources of trace metals. Moreover, long-term average flow and trace metals at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in trace metal concentrations upstream of the Delta.

Average and 95th percentile trace metal concentrations are very similar across the primary source waters to the Delta. Given this similarity, very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that trace metals do not already exceed water quality criteria, more frequent exceedances of criteria in the Delta would not be expected to occur under Alternative 4A.

Because Alternative 4A is not expected to result in substantial changes in trace metal concentrations in Delta waters, which includes Banks and Jones pumping plants, effects on trace metal concentrations in the SWP/CVP Export Service Area are expected to be negligible.

As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur in water bodies of the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-28: Effects on Trace Metal Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, including areas upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in urban stormwater, would not be implemented under Alternative 4A, thus the associated trace metal reduction described for Alternative 4 would not occur under this alternative. However, stormwater discharges would continue to be regulated by the state and contributions would be expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT). The remaining environmental commitments would not be expected to affect trace metal levels, because they are actions that do not affect the presence of trace metal sources. As they pertain to trace metals, implementation of these environmental commitments would not be expected to adversely affect beneficial uses of the affected environment or substantially degrade water quality with respect to trace metals.

NEPA Effects: Because Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, the effects on trace metal concentrations from implementing these environmental commitments are determined to be not adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in trace metal concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas, because they present no new sources of trace metals to the affected environment. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-29: Effects on TSS and Turbidity Resulting from Facilities Operations and Maintenance

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), the operation of the water conveyance facilities under Alternative 4A is expected to have a minimal effect on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT). This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be the same. TSS concentrations and turbidity levels in rivers upstream of the Delta are affected primarily by: 1) TSS concentrations and turbidity levels of the water released from the upstream reservoirs, 2) erosion occurring within the river channel beds, which is affected by river flow velocity and bank protection, 3) TSS concentrations and turbidity levels of tributary inflows, point-source inputs, and nonpoint runoff as influenced by surrounding land uses; and 4) phytoplankton, zooplankton and other biological material in the water. Within the Delta, TSS concentrations and turbidity levels in Delta waters are affected by TSS concentrations and turbidity levels of inflows (and associated sediment load), as well as fluctuation in flows within the channels due to the tides, with sediments depositing as flow velocities and turbulence are low at periods of slack tide, and sediments becoming suspended when flow velocities and turbulence increase when tides are near the maximum. TSS and turbidity variations can also be attributed to phytoplankton, zooplankton and other biological material in the water. These factors would be similar under Alternative 4A and Alternative 4, are expected to be minimally different from Existing Conditions and the No Action Alternative (ELT and LLT). Because Alternative 4A is expected to have minimal effect on TSS concentrations and turbidity levels in Delta waters, including water exported at the south Delta pumps, relative to Existing Conditions or the No Action Alternative (ELT and LLT), Alternative 4A also is expected to have minimal effect on TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters.

NEPA Effects: Because TSS concentrations and turbidity levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on TSS and turbidity from implementing Alternative 4A are determined to not be adverse.

CEQA Conclusion: As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) changes in river flow rate and reservoir storage that would occur under Alternative 4A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in TSS concentrations and turbidity levels in the reservoirs and rivers upstream of the Delta, given that suspended sediment concentrations are more affected by season than flow. Within the Delta, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years, and high storm event inflows would not be substantially affected. Thus, it is expected that the TSS concentrations and turbidity levels in the affected channels would not be substantially different from the levels under Existing Conditions. There is not expected to be substantial, if even measurable, changes in TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters under Alternative 4A, relative to Existing Conditions, because this alternative is not expected to result in substantial changes in TSS concentrations and turbidity levels at the south Delta export pumps, relative to Existing Conditions. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels are not expected to be substantially different, long-term water quality degradation is not expected, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-30: Effects on TSS and Turbidity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. Creation of habitat and open water through implementation of these environmental commitments could affect Delta hydrodynamics and, thus, erosion and deposition potential in certain Delta channels, though the geographic extent of the effects would be substantially less than under Alternative 4, because less land would be converted under Alternative 4A. The magnitude of increases in TSS concentrations and turbidity levels in the affected channels due to higher potential of erosion cannot be readily quantified. The increases in TSS concentrations and turbidity levels in the affected channels could be substantial in localized areas, depending on how rapidly the channels equilibrate with the new tidal flux regime, after implementation of this alternative. However, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years. Within the reconfigured channels there could be localized increases in TSS concentrations and turbidity levels, but within the greater Plan Area it is expected that the TSS concentrations and turbidity levels would not be substantially different from the levels under Existing Conditions or the No Action Alternative (ELT and LLT).

CM19, which under Alternative 4 would fund projects to contribute to reducing pollutant discharges in stormwater, would not be implemented under Alternative 4A, thus the associated TSS and turbidity reduction described for Alternative 4 would not occur under this alternative. Nevertheless, stormwater discharges would still be subject to the state's NPDES program requirements to implement control measures, which would contribute to controlling TSS and turbidity in discharges.

The remaining environmental commitments would not be expected to affect TSS concentrations and turbidity levels, because they are actions that do not affect the presence of TSS and turbidity sources.

***NEPA Effects*:** Localized, temporary changes in TSS and turbidity could occur associated with the restoration actions of Environmental Commitments 3, 4, 6–12, 15, and 16. However, these changes would be gradual and not expected to substantially differ from No Action Alternative (ELT and LLT) conditions. Therefore, the effects on TSS and turbidity from implementing these environmental commitments are determined to be not adverse.

***CEQA Conclusion*:** It is expected that the TSS concentrations and turbidity levels Upstream of the Delta, in the Plan Area, and the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not be substantially different relative to Existing Conditions, except within localized areas of the Delta modified through creation of habitat and open water. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels Upstream of the Delta, in the greater Plan Area, and in the SWP/CVP Export Service Areas are not expected to be substantially different, long-term water quality degradation is not expected relative to TSS and turbidity, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-31: Water Quality Effects Resulting from Construction-Related Activities for the Water Conveyance Facilities and Environmental Commitments

The potential construction-related water quality effects that would occur under Alternative 4A would be of a lower magnitude compared to the effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the size and number of construction activities for some environmental commitments under Alternative 4A would be reduced, or not occur, compared to Alternative 4. The construction-related activities for the water conveyance facilities under Alternative 4A would be the same as described for Alternative 4. However, there would be substantially less area of in-water habitat restoration activities implemented under Alternative 4A compared to Alternative 4. Therefore, the amount of construction activity under Alternative 4A would be lower than described for Alternative 4, thus resulting in less potential for construction-related disturbances and contaminant discharges to surface waters.

The construction-related activities for Alternative 4A would be most extensive for the new water conveyance facilities. Construction of water conveyance facilities would involve vegetation removal, material storage and handling, excavation, overexcavation for facility foundations, surface grading, trenching, road construction, levee construction, construction site dewatering, soil stockpiling, reusable tunnel material (RTM) dewatering basin construction and storage operations, and other general facility construction activities (i.e., concrete, steel, carpentry, and other building trades) over approximately 7,500 acres during the course of constructing the facilities. Vegetation would be removed (via grubbing and clearing) and grading and other earthwork would be conducted at the intakes, pumping plants, the intermediate forebay, the Byron Tract Forebay, canal and gates between the Byron Tract Forebay tunnel shafts and the approach canal to the Banks Pumping Plant, borrow areas, RTM and spoil storage areas, setback and transition levees, sedimentation basins, solids handling facilities, transition structures, surge shafts and towers, substations, transmission line footings, access roads, concrete batch plants, fuel stations, bridge abutments, barge unloading facilities, and laydown areas. Construction of each intake would take nearly four years to complete.

Habitat restoration environmental commitments in the Delta, including restored tidal wetlands, floodplain, and related channel margin and off-channel habitats, also would involve substantial in-water construction-related activities in localized areas of the Delta. Other non-habitat restoration environmental commitments are not anticipated to involve construction activities that would result in substantial discharges of any constituents of concern.

NEPA Effects: Potential construction-related water quality effects may include discharges of turbidity/TSS due to the erosion of disturbed soils and associated sedimentation entering surface water bodies or other construction-related wastes (e.g., concrete, asphalt, cleaning agents, paint, and trash). Construction activities also may result in temporary or permanent changes in stormwater generation or drainage and runoff patterns (i.e., velocity, volume, and direction) that may cause or contribute to soil erosion and offsite sedimentation, such as creation of additional impervious surfaces (e.g., pavement, buildings, compacted soils), blockage or restriction of existing drainage channels, or general surface drainage changes from grading and excavation activity. Additionally, the use of heavy earthmoving equipment may result in spills and leakage of oils, gasoline, diesel fuel, and related petroleum contaminants used in the fueling and operation of such construction equipment.

Land surface grading and excavation activities, or exposure of disturbed sites immediately following construction and prior to stabilization, could result in rainfall- and stormwater-related soil erosion, runoff, and offsite sedimentation in surface water bodies. The initial runoff following construction, or return of seasonal rains to previously disturbed sites, can result in runoff with peak pollutant levels and is referred to as "first flush" storm events. Soil erosion and runoff can also result in increased concentrations and loading of organic matter, nutrients (nitrogen and phosphorus), and other contaminants contained in the soil such as trace metals, pesticides, or animal-related pathogens. Graded and exposed soils also can be compacted by heavy machinery, resulting in reduced infiltration of rainfall and runoff, thus increasing the rate of runoff (and hence contaminants) to downstream water bodies.

Construction activities also would be anticipated to involve the transport, handling, and use of a variety of hazardous substances and non-hazardous materials that may adversely affect water quality if discharged inadvertently to construction sites or directly to water bodies. Typical construction-related contaminants include petroleum products for refueling and maintenance of machinery (e.g., fuel, oils, solvents), concrete, paints and other coatings, cleaning agents, debris and trash, and human wastes. Construction activities also would involve large material storage and laydown areas, and occasional accidental spills of hazardous materials stored and used for construction may occur. Contaminants released or spilled on bare soil also may result in groundwater contamination. Dewatering operations may contain elevated levels of suspended sediment or other constituents that may cause water quality degradation.

The intensity of construction activity along with the fate and transport characteristics of the chemicals used, would largely determine the magnitude, duration, and frequency of construction-related discharges and resulting concentrations and degradation associated with the specific constituents of concern. The potential water quality concerns associated with the major categories of contaminants that might be discharged as a result of construction activity include the following.

- Suspended sediment: May increase turbidity (i.e., reduce water clarity) that can affect aquatic organisms and increase the costs and effort of removal in municipal/industrial water supplies. Downstream sedimentation can affect aquatic habitat, or cause a nuisance if it affects functions of agricultural or municipal intakes, or boat navigation.
- Organic matter: May contribute turbidity and oxygen demanding substances (i.e., reduce dissolved oxygen levels) that can affect aquatic organisms. Organic carbon may increase the potential for disinfection byproduct formation in municipal drinking water supplies.
- Nutrients: May contribute nitrogen, phosphorus, and other key nutrients that can contribute to nuisance biostimulation of algae and vascular aquatic plants, which may affect municipal water supplies, recreation, aquatic life, and aesthetics.
- Petroleum hydrocarbons: May contribute toxic compounds to aquatic life, and oily sheens may reduce oxygen/gas transfer in water, foul aquatic habitats, and reduce water quality for municipal supplies, recreation, and aesthetics.
- Trace constituents (metals, pesticides, synthetic organic compounds): Compounds in eroded soil or construction-related materials (e.g., paints, coatings, cleaning agents) may be toxic to aquatic life.
- Pathogens: Bacteria, viruses, and protozoans may affect aquatic life and increase human health risks via municipal water supplies, reduced recreational water quality, or contaminated shellfish beds.

- Other inorganic compounds: Construction-related materials can contain inorganic compounds such as acidic/basic materials which can change pH and may adversely affect aquatic life and habitats. Concrete contains lime which can increase pH levels, and drilling fluids may alter pH.

Some construction-related contaminants, such as PAHs that may be in some fuel and oil petroleum byproducts, may be bioaccumulative in aquatic and terrestrial organisms. Construction activities also may disturb areas where bioaccumulative constituents are present in the soil (e.g., mercury, selenium, organochlorine pesticides, PCBs, and dioxin/furan compounds), or may disturb soils that contain constituents included on the Section 303(d) lists of impaired water bodies in the affected environment. While the 303(d)-listed Delta channels impaired by mercury are widespread, impairment by selenium, pesticides, PCBs, and dioxin/furan compounds is more limited, and there are no 303(d) listings for PAH impairment. Bioaccumulation of constituents in the aquatic foodchain, and 303(d)-related impaired water bodies, arise as a result of long-term loading of a constituent or a pervasive and widespread source of constituent discharge (e.g., mercury).However, as a result of the generally localized disturbances, and intermittent and temporary nature of construction-related activities, construction would not be anticipated to result in contaminant discharges of substantial magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected.

The environmental commitments for construction-related water quality protection would be specifically designed as a part of the final design, included in construction contracts as a required element, and would be implemented to avoid, prevent, and minimize the potential discharges of constituents of concern to water bodies and associated adverse water quality effects and comply with state water quality regulations. Additionally, temporary and permanent changes in stormwater drainage and runoff would be minimized and avoided through construction of new or modified drainage facilities, as described in the Chapter 3, *Description of Alternatives*, in Appendix A of this RDEIR/SDEIS. This alternative would include installation of temporary drainage bypass facilities, long-term cross drainage, and replacement of existing drainage facilities that would be disrupted due to construction of new facilities.

Construction-related activities would be conducted in accordance with the environmental commitment to develop and implement BMPs for all activities that may result in discharge of soil, sediment, or other construction-related contaminants to surface water bodies, and obtain authorization for the construction activities under the State Water Board's NPDES Stormwater General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ/NPDES Permit No. CAS000002). The General Construction NPDES Permit requires the preparation and implementation of SWPPPs, which are the principal plans within the required PRDs that identify the proposed erosion control and pollution prevention BMPs that would be used to avoid and minimize construction-related erosion and contaminant discharges. The development of the SWPPPs, and applicability of other provisions of this General Construction Permit depends on the "risk" classification for the construction which is determined based on the potential for erosion to occur as well as the susceptibility of the receiving water to potential adverse effects of construction. While the determination of project risk level, and planning and development of the SWPPPs and BMPs to be implemented, would be completed as a part of final design and contracting for the work, the responsibility for compliance with the provisions of the General Construction Permit necessitates that BMPs are applied to all disturbance activities. In addition to the BMPs, the SWPPPs would include BMP inspection and monitoring activities, and identify responsibilities of all parties, contingency measures, agency contacts, and training requirements and documentation for those personnel responsible for installation, inspection, maintenance, and repair of BMPs. The General Construction Permit contains NALs and for pH and turbidity, and specifies storm event water quality monitoring to determine if construction is resulting in elevated discharges of these constituents, and monitoring for any non-visible contaminants determined to have been potentially released. If an NAL is determined to have been exceeded, the General Construction Permit requires the discharger to conduct a construction site and run-on evaluation to determine whether contaminant sources associated with the site's construction activity may have caused or contributed to the exceedance and immediately implement corrective actions if they are needed.

The BMPs that are routinely implemented in the construction industry and have proven successful at reducing adverse water quality effects include, but are not limited to, the following broad categories of actions (letters refer to categories of specific BMPs identified in Appendix 3B, *Environmental Commitments*), for which Appendix 3B identifies specific BMPs within these categories:

- Waste Management and Spill Prevention and Response (BMP categories A.2 and A.3): Waste management BMPs are designed to minimize exposure of waste materials at all construction sites and staging areas such as waste collection and disposal practices, containment and protection of wastes from wind and rain, and equipment cleaning measures. Spill prevention and response BMPs involve planning, equipment, and training for personnel for emergency event response.
- Erosion and Sedimentation Control (BMP categories A.4 and A.5): Erosion control BMPs are designed to prevent erosion processes or events including scheduling work to avoid rain events, stabilizing exposed soils; minimize offsite sediment runoff; remove sediment from onsite runoff before it leaves the site; and slow runoff rates across construction sites. Identification of appropriate temporary and long-term seeding, mulching, and other erosion control measures as necessary. Sedimentation BMPs are designed to minimize offsite sediment runoff once erosion has occurred involving drainage controls, perimeter controls, detention/sedimentation basins, or other containment features.
- Good Housekeeping and Non-Stormwater Discharge Management (BMP category A.6 and A.7): Good housekeeping BMPs are designed to reduce exposure of construction sites and materials storage to stormwater runoff including truck tire tracking control facilities; equipment washing; litter and construction debris; and designated refueling and equipment inspection/maintenance practices Non-stormwater discharge management BMPs involve runoff measures for contaminants not directly associated with rain or wind including vehicle washing and street cleaning operations.
- Construction Site Dewatering and Pipeline Testing (BMP category A.8).Dewatering BMPs involve actions to prevent discharge of contaminants present in dewatering of groundwater during construction, discharges of water from testing of pipelines or other facilities, or the indirect erosion that may be caused by dewatering discharges.
- BMP Inspection and Monitoring (BMP category A.9): Identification of clear objectives for evaluating compliance with SWPPP provisions, and specific BMP inspection and monitoring procedures, environmental awareness training, contractor and agency roles and responsibilities, reporting procedures, and communication protocols.

In addition to the Category "A" BMPs for surface land disturbances identified in the environmental commitments (Appendix 3B, *Environmental Commitments*), BMPs implemented also would include the Category "B" BMPs for tunnel/pipeline construction that involves actions primarily to avoid and minimize sediment and contaminant discharges associated with RTM excavation, hauling, and RTM dewatering operations. Additionally, habitat restoration activities under CM2 and CM4–CM10 would be subject to implementation of the Category "C" BMPs (In-Water Construction BMPs) and Category "D" BMPs (Tidal and Wetland Restoration) designed to minimize disturbance and direct discharge of turbidity/suspended solids to the water during in-water construction activities. Category "E" BMPs identify general permanent post-construction actions that would be implemented for all terrestrial, in-water, and habitat restoration activities and would involve planning, design, and development of final site stabilization, revegetation, and drainage control features.

Finally, acquisition of applicable environmental permits may be required for specific conservation measures, which may include specific WDRs or CWA Section 401 water quality certifications from the appropriate Regional Water Boards, CDFW Streambed Alteration Agreements, and USACE CWA Section 404 dredge and fill permits. These other permit processes may include requirements to implement additional action-specific BMPs that may reduce potential adverse discharge effects of constituents of concern.

The potential construction-related contaminant discharges that could result from this alternative would not be anticipated to result in adverse water quality effects at a magnitude, frequency, or regional extent that would cause substantial adverse effects to aquatic life. Relative to Existing Conditions, this assessment indicates the following.

- Projects would be managed under state water quality regulations and project-defined actions to avoid and minimize contaminant discharges.
- Individual projects would generally be dispersed, and involve infrequent and temporary activities, thus not likely resulting in substantial exceedances of water quality standards or long-term degradation.
- Potential construction-related contaminant discharges would not cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Long-term water quality degradation is not anticipated, and hence would not be expected to adversely affect beneficial uses.
- By the intermittent and temporary frequency of construction-related activities and potential contaminant discharges, the constituent-specific effects would not be of substantial magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected.

Consequently, because the construction-related activities for the conservation measures would be conducted with implementation of environmental commitments, including but not limited to those identified in Appendix 3B, with respect to the No Action Alternative conditions, this alternative would not be expected to cause constituent discharges of sufficient frequency and magnitude to result in a substantial increase of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern, and thus would not adversely affect any beneficial uses in the Delta.

In summary, with implementation of environmental commitments in Appendix 3B, the potential construction-related water quality effects are considered to be not adverse.

CEQA Conclusion: As explained above, water quality effects resulting from construction-related activities would be less under Alternative 4A compared to Alternative 4, which was determined to be less than significant. Moreover, because environmental commitments would be implemented under Alternative 4A for construction-related activities along with agency-issued permits that also contain construction requirements to protect water quality, the construction-related effects, relative to Existing Conditions, would not be expected to cause or contribute to substantial alteration of existing drainage patterns which would result in substantial erosion or siltation on- or off-site, substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern on a long-term average basis, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. Moreover, because the construction-related activities would be temporary and intermittent in nature, the construction would involve negligible discharges, if any, of bioaccumulative or CWA Section 303(d) listed constituents to water bodies of the affected environment. As such, construction activities would not contribute measurably to bioaccumulation of contaminants in organisms or humans or cause CWA Section 303(d) impairments to be discernibly worse. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-32: Effects on *Microcystis* Bloom Formation Resulting from Facilities Operations and Maintenance

Upstream of the Delta

Adverse effects from *Microcystis* upstream of the Delta have only been documented in lakes such as Clear Lake, where eutrophic levels of nutrients give cyanobacteria a competitive advantage over other phytoplankton during the bloom season. Large reservoirs upstream of the Delta are typically characterized by low nutrient concentrations, where other phytoplankton outcompete cyanobacteria, including *Microcystis*. In the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta under Existing Conditions, bloom development is limited by high water velocity and low residence times. These conditions are not expected to change under Alternative 4A or the No Action Alternative (ELT and LLT). Consequently, any modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT).

Delta

Modeling that adequately accounted for the effects of water conveyance facilities operations and maintenance and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the six Delta sub-areas was not available for Alternative 4A, so the hydrodynamic effects of this alternative on *Microcystis* were determined qualitatively. For the assessment of Alternative 4, modeling scenarios included assumptions regarding how certain habitat restoration activities of the project alternative would affect Delta hydrodynamics, so the impacts due solely to operations and maintenance of the water conveyance facilities under Alternative 4 could not be determined. Because the assessment for Alternative 4A is qualitative, the effects discussed for the Delta under water conveyance facilities are related solely to operations and maintenance, not the hydrodynamic effects of restoration actions, which are discussed in Impact WQ-33.

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations in the Delta, relative to Existing Conditions, would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

Under the two operational scenarios of Alternative 4A, a portion of the Sacramento River water which would be conveyed through the Delta to the south Delta intakes under Existing Conditions would be replaced at various locations throughout the Delta by other source water due to diversion of Sacramento River water at the north Delta intake under Alternative 4A. The change in flow paths of water through the Delta that would occur under Alternative 4A could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 4A would result in a net increase in water residence times at various locations throughout the Delta relative to Existing Conditions. In contrast to Alternative 4A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta at the late long-term timeframe relative to Existing Conditions.

Besides the effects of operations and maintenance described above, substantial increases in water residence times due to factors unrelated to the project alternative, including habitat restoration (8,000 acres of tidal habitat and enhancements to the Yolo Bypass), sea level rise and climate change, are expected to occur in the Delta, relative to Existing Conditions. Although there is uncertainty regarding the degree to which operations and maintenance of the project alternative would affect water residence times in the Delta, it is likely that such effects would be small in comparison to the combined effects of restoration activities, sea level rise and climate change. Slight increases in ambient water temperatures (1.3–2.5°F), due to climate change in the ELT, are expected to occur in the Delta under Alternative 4A, relative to Existing Conditions. However, due to the combination of the effects of restoration activities unrelated to the project alternative, climate change, and sea level rise on increased residence times, as well as the effects of climate change on increased ambient water temperatures, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur, relative to Existing Conditions. The magnitude by which water temperatures and residence times would increase due to these factors would be less under Alternative 4A than under Alternative 4.

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations in the Delta relative to the No Action Alternative (ELT and LLT) would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

As described relative to Existing Conditions, operations and maintenance of Alternative 4A could alter source water flow paths through the Delta, which could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 4A would result in a net increase in water residence times at various locations throughout the Delta relative to the No Action Alternative (ELT and LLT).

The previously discussed influence of factors unrelated to implementation of the project alternative, including habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass), climate change and sea level rise on increased water residence times, as well as the influence of climate change on increased ambient water temperatures in the Delta, would occur under both Alternative 4A and No Action Alternative (ELT and LLT). In summary, operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, and thus result in adverse effects on *Microcystis*, relative to No Action Alternative (ELT and LLT).

SWP/CVP Export Service Area

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas relative to Existing Conditions would be less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described above for the Delta, source waters to the south Delta intakes could be adversely affected relative to Existing Conditions by *Microcystis* both from an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased Delta water residence times would be primarily related to habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur separate from Alternative 4A. The combined effect of these factors on *Microcystis* in source waters to the south Delta intakes would likely be much greater than the influence of operations and maintenance of Alternative 4A, the effects of which are uncertain. In contrast to Alternative 4A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta relative to Existing Conditions. Increases in ambient air temperatures due to climate change relative to Existing Conditions are expected under this alternative. Increases in ambient air temperatures are expected to result in warmer ambient water temperatures, and thus conditions more suitable to *Microcystis* growth, in the water bodies of the SWP/CVP Export Service Areas. The incremental increase in long-term average air temperatures would be less at the ELT (2.0°F), compared to the LLT (4.0°F).

The effects of Alternative 4A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT), are expected to be less than effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because effects of *Microcystis* on water exports from Banks and Jones pumping plants would be different between Alternative 4A and Alternative 4. Specifically, under Alternative 4A, the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (ELT and LLT), as discussed in the "Delta" section above; while under Alternative 4 this fraction of water is expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (LLT). Additionally, conditions in the SWP/CVP Export Service Areas under Alternative 4A are not expected to become more conducive to *Microcystis* bloom formation, relative to the No Action Alternative (ELT and LLT), because neither water residence time nor water temperatures are projected to increase in the SWP/CVP Export Service Areas.

NEPA Effects: Modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to the No Action Alternative (ELT and LLT). Similarly, operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, including at the Banks and Jones pumping plants, and thus result in adverse effects on *Microcystis* in the Delta, relative to No Action Alternative (ELT and LLT). Thus, the effects on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas from implementing water conveyance facilities are determined to be not adverse.

CEQA Conclusion: As with Alternative 4, modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta, relative to the Existing Conditions. The effects of operations and maintenance of water conveyance facilities under Alternative 4A on *Microcystis* in surface waters in the Delta and in the SWP/CVP Export Service Areas, relative to Existing Conditions, would be less than those described for the Alternative 4. Operations and maintenance of Alternative 4A is not expected to increase water residence times or ambient water temperatures throughout the Delta, including at the Banks and Jones pumping plants, and thus result in adverse effects on *Microcystis* in the Delta, relative to Existing Conditions. As such, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur under Alternative 4A for reasons unassociated with operations and maintenance of the project alternative, including tidal habitat restoration activities, climate change and sea level rise. While long-term water quality degradation may occur and, thus, impacts on beneficial uses could occur, these impacts are not related to implementation of Alternative 4A. Although there is considerable uncertainty regarding this impact, the effects on *Microcystis* from implementing water conveyance facilities are determined to be less than significant. No mitigation is required.

Impact WQ-33: Effects on *Microcystis* Bloom Formation Resulting from Environmental Commitments

Under Alternative 4A, Fisheries Enhancements to the Yolo Bypass would not be implemented, but under a plan separate and distinct from Alternative 4A, enhancements to the Yolo Bypass and 8,000 acres of tidal habitat restoration would be implemented in the ELT. These activities are assumed to occur under both Alternative 4A and the No Action Alternative. Implementation of Environmental Commitment 4 under Alternative 4A would result in a very small amount of tidal restoration within the Delta. In contrast, under Alternative 4, full implementation of Yolo Bypass enhancements would occur and 65,000 acres of tidal restoration would be developed. The implementation of Environmental Commitment 4 under Alternative 4A would have negligible effects compared to the development of 8,000 acres of tidal habitat and enhancements to the Yolo Bypass in the ELT that are unrelated to implementation of the alternative. These activities would create shallow backwater areas that could result in local warmer water and increased water residence time of magnitude and extent that would result in measurable changes on *Microcystis* levels in the Delta, relative to Existing Conditions.

The implementation of fisheries enhancements to the Yolo Bypass and the development of 65,000 acres of tidal restoration areas would be expected to result in widespread hydrodynamic effects that increase water residence times, and thus *Microcystis* levels, in the Delta under Alternative 4, relative to Existing Conditions and the No Action Alternative (LLT). Thus, the effects on *Microcystis* from implementing Environmental Commitment 4 under Alternative 4A, relative to Existing Conditions, would be substantially lower than expected under Alternative 4.

NEPA Effects: Based on the discussion above, the effects on *Microcystis* from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusions: Based on the discussion above, Environmental Commitments 3, 4, 6–12, 15, and 16 would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur at the early long-term for reasons unassociated with implementation of the Environmental Commitments, including tidal habitat restoration and enhancements to the Yolo Bypass. While long-term water quality degradation may occur and, thus, significant impacts on beneficial uses could occur, these impacts are not related to implementation of the Environmental Commitments. Therefore, the effects on *Microcystis* from implementing the Environmental Commitments are determined to be less than significant. No mitigation is required.

Impact WQ-34: Effects on San Francisco Bay Water Quality Resulting from Facilities Operations and Maintenance and Environmental Commitments

The effects analysis presented in the preceding impacts (Impact WQ-1 through WQ-33) concluded that Alternative 4A would have a less-than-significant impact/no adverse effect on the following constituents in the Delta:

- Boron
- Bromide
- Chloride
- DOC
- Dissolved oxygen
- Pathogens
- Pesticides
- Trace metals
- Turbidity and TSS
- *Microcystis*

Elevated concentrations of boron are of concern in drinking and agricultural water supplies. Chloride, DOC, and bromide concentrations also are of concern in drinking water supplies. However, waters in the San Francisco Bay are not designated to support municipal water supply (MUN) and agricultural supply (AGR) beneficial uses. Changes in Delta dissolved oxygen, pathogens, pesticides, trace metals, and turbidity and TSS are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the Delta. Changes in *Microcystis* would be primarily due to factors unassociated with the project alternative. Thus, changes in boron, bromide, chloride, DOC, dissolved oxygen, pathogens, pesticides, trace metals, turbidity and TSS, and *Microcystis* in Delta outflow associated with implementation of Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT) are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the of San Francisco Bay, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

Elevated EC is of concern for its effects on the agricultural beneficial use (AGR) and fish and wildlife beneficial uses. San Francisco Bay does not have an AGR beneficial use designation. As described for Alternative 4, salinity throughout San Francisco Bay is largely a function of the tides, as well as to some extent the freshwater inflow from upstream. However, the changes in Delta outflow due to Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would be minor compared to tidal flows, and thus no substantial adverse effects on salinity, or fish and wildlife beneficial uses, downstream of the Delta are expected.

Also, as described for Alternative 4, changes in nutrient loading would not be expected to contribute to adverse effects to beneficial uses. Changes in nitrogen (ammonia and nitrate) loading to Suisun and San Pablo Bays under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not adversely impact primary productivity in these embayments because light limitation and grazing current limit algal production in these embayments. Nutrient levels and ratios are not considered a direct driver of *Microcystis* and cyanobacteria levels in the North Bay. The only postulated effect of changes in phosphorus loads to Suisun and San Pablo Bays is related to the influence of nutrient stoichiometry on primary productivity. However, there is uncertainty regarding the impact of nutrient ratios on phytoplankton community composition and abundance. As described for Alternative 4, any effect on phytoplankton community composition would likely be small compared to the effects of grazing from introduced clams and zooplankton in the estuary. Therefore, changes in total nitrogen and phosphorus loading that would occur in Delta outflow to San Francisco Bay, relative to Existing Conditions and the No Action Alternative (ELT and LLT), are not expected to result in degradation of water quality with regard to nutrients that would result in adverse effects to beneficial uses.

Similar to Alternative 4, loads of mercury, methylmercury, and selenium from the Delta to San Francisco Bay are estimated to change relatively little due to changes in source water fractions and net Delta outflow that would occur under Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), because changes in Delta outflow would be similar.

NEPA Effects: Based on the discussion above, Alternative 4A, relative to the No Action Alternative (ELT and LLT), would not cause further degradation to water quality with respect to boron, bromide, chloride, dissolved oxygen, DOC, EC, mercury, pathogens, pesticides, selenium, nutrients (ammonia, nitrate, phosphorus), trace metals, turbidity and TSS, or *Microcystis* in the San Francisco Bay. Further, changes in these constituent concentrations in Delta outflow would not be expected to cause changes in Bay concentrations of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses. In summary, effects on the San Francisco Bay from implementation of water conveyance facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: As with Alternative 4, Alternative 4A would not be expected to cause long-term degradation of water quality in San Francisco Bay resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. Further, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria in the San Francisco Bay by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Any changes in boron, bromide, chloride, and DOC in the San Francisco Bay would not adversely affect beneficial uses, because the uses most affected by changes in these parameters, MUN and AGR, are not beneficial uses of the Bay. Further, no substantial changes in dissolved oxygen, pathogens, pesticides, trace metals, turbidity or TSS, and *Microcystis* are anticipated in the Delta due to the implementation of Alternative 4A, relative to Existing Conditions, therefore, no substantial changes to these constituents levels in the Bay are anticipated. Changes in Delta salinity would not contribute to measurable changes in Bay salinity, as the change in Delta outflow would be two to three orders of magnitude lower than (and thus minimal compared to) the Bay's tidal flow and thus, have minimal influence on salinity changes. Changes in nutrient load, relative to Existing Conditions, are expected to have minimal effect on water quality degradation, primary productivity, or phytoplankton community composition. As with Alternative 4, the change in mercury and methylmercury load (which is based on source water and Delta outflow), relative to Existing Conditions, would be within the level of uncertainty in the mass load estimate and not expected to contribute to water quality degradation, make the CWA Section 303(d) mercury impairment measurably worse or cause mercury/methylmercury to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Similarly, based on Alternative 4 estimates, the increase in selenium load would be minimal, and total and dissolved selenium concentrations would be expected to be the same as Existing Conditions, and less than the target associated with white sturgeon whole-body fish tissue levels for the North Bay. Thus, the change in selenium load is not expected to contribute to water quality degradation, or make the CWA Section 303(d) selenium impairment measurably worse or cause selenium to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

4.3.5 Geology and Seismicity

Impact GEO-1: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking of Water Conveyance Features during Construction

Earthquakes could be generated from local and regional seismic sources during construction of the Alternative 4A water conveyance facilities. Seismically induced ground shaking could cause injury of workers at the construction sites as a result of collapse of facilities.

As stated under Alternative 4, the results of the seismic study (California Department of Water Resources 2007a) show that the ground shakings in the Delta are not sensitive to the elapsed time since the last major earthquake (i.e., the projected shaking hazard results for 2005, 2050, 2100, and 2200 are similar).

The hazard of structural failure from seismic shaking under Alternative 4A resulting in loss of property, personal injury, or death during construction would be identical to Alternative 4.

NEPA Effects: Seismically-induced ground shaking could cause loss of property or personal injury at the Alternative 4A construction sites (including intake locations, pipelines from intakes to the intermediate forebay, the tunnels, the pumping plant, and the expanded Clifton Court Forebay) as a result of collapse of facilities. Facilities lying directly on or near active blind faults may have an increased likelihood of loss of property or personal injury in the event of seismically-induced ground shaking.

During construction, all active construction sites would be designed and managed to meet the safety and collapse-prevention requirements of the relevant state codes and standards listed under the Alternative 4 analysis, and discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, for the anticipated seismic loads. Generally, the applicable codes require that facilities be built so that they incur minimal damage in the event of a foreseeable seismic event and that they remain functional following such an event and that the facility is able to perform without catastrophic failure in the event of a maximum design earthquake (the greatest earthquake reasonably expected to be generated by a specific source on the basis of seismological and geological evidence).

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures).

Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce any potential risk such that construction of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals. Therefore, there would be no adverse effect.

***CEQA Conclusion*:** Seismically induced ground shaking that is estimated to occur and the resultant ground motion anticipated at Alternative 4A construction sites, including the intake locations, the tunnels, the pipelines and the forebays, could cause collapse or other failure of project facilities while under construction. As described under Alternative 4, DWR would conform to Cal-OSHA and other state code requirements, such as shoring, bracing, lighting, excavation depth restrictions, required slope angles, and other measures, to protect worker safety. Conformance with these standards and codes is an environmental commitment of the project (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce this risk and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 4A. This impact would be less than significant. No mitigation is required.

Impact GEO-2: Loss of Property, Personal Injury, or Death from Settlement or Collapse Caused by Dewatering during Construction of Water Conveyance Features

As with Alternative 4, settlement of excavations could occur as a result of dewatering at Alternative 4A construction sites with shallow groundwater. Dewatering can stimulate settlement in excavation and tunneling sites. The settlement could cause the slopes of excavations to fail. Locations where dewatering would occur during construction of Alternative 4A water conveyance features would be identical to that under Alternative 4 and the potential impacts are identical under both alternatives.

NEPA Effects: This potential effect could be substantial because settlement or collapse during dewatering could cause injury of workers at the construction sites as a result of collapse of excavations.

The hazard of settlement and subsequent collapse of excavations would be evaluated by assessing site-specific geotechnical and hydrological conditions at intake locations, as well as where intake and forebay pipelines cross waterways and major irrigation canals. A California-registered civil engineer or California-certified engineering geologist would recommend measures in a geotechnical report to address these hazards, such as seepage cutoff walls and barriers, shoring, grouting of the bottom of the excavation, and strengthening of nearby structures, existing utilities, or buried structures. As described in Section 9.3.1, *Methods for Analysis*, the measures would conform to applicable design and building codes, guidelines, and standards, as described under Alternative 4.

DWR has made an environmental commitment to also conform to appropriate code and standard requirements to minimize potential risks (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Generally, the applicable codes require that facilities be built in such a way that settlement is minimized. Mandatory worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures).

Conformance to these and other applicable design specifications and standards would ensure that construction of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals from settlement or collapse caused by dewatering. Therefore, there would be no adverse effect.

***CEQA Conclusion*:** Settlement or failure of excavations during construction could result in loss of property or personal injury. However, DWR would conform to Cal-OSHA and other state code requirements to protect worker safety as described under Alternative 4. DWR has also made an environmental commitment to conform to appropriate codes and standards to minimize potential risks (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Additionally, DWR has made an environmental commitment that a geotechnical report be completed by a California-certified engineering geologist, that the report's geotechnical design recommendations be included in the design of project facilities, and that the report's design specifications are properly executed during construction to minimize the potential effects from settlement and failure of excavations. Proper execution of these environmental commitments to minimize potential risks would result in no increased likelihood of loss of property, personal injury or death due to construction of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-3: Loss of Property, Personal Injury, or Death from Ground Settlement during Construction of Water Conveyance Features

The potential for ground settlement under Alternative 4A would be identical to that under Alternative 4. The geologic units in the area of the Alternative 4A modified pipeline/tunnel alignment are the same as those shown for Alternative 4 in Figure 9-3 and summarized in Table 9-26 of the Draft EIR/EIS. The characteristics of each unit would affect the potential for settlement during geotechnical investigation and tunneling operations. Segments 1 and 3, located in the Clarksburg area and the area west of Locke, respectively, contain higher amounts of sand than the other segments, so they pose a greater risk of settlement.

Given the likely design depth of the tunnels, the potential for excessive systematic settlement expressed at the ground surface caused by tunnel installation is thought to be relatively low. Operator errors or highly unfavorable/unexpected ground conditions could result in larger settlement. Large ground settlements caused by tunnel construction are almost always the result of using inappropriate tunneling equipment (incompatible with the ground conditions), improperly operating the machine, or encountering sudden or unexpected changes in ground conditions.

NEPA Effects: The potential effect could be substantial because ground settlement could occur during geotechnical investigations and the tunneling operation. During detailed project design, a site-specific subsurface geotechnical evaluation would be conducted along the modified pipeline/tunnel alignment to verify or refine the findings of the preliminary geotechnical investigation. These effects would be reduced with implementation of DWR's Environmental Commitments and Avoidance and Minimization Measures (Appendix 3B in Appendix A of this RDEIR/SDEIS). As required by DWR's Environmental Commitments, the results of the site-specific evaluation and the California-registered civil engineer or California-certified engineering geologist's recommendations would be documented in a detailed geotechnical report prepared in accordance with state guidelines, in particular *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (California Geological Survey 2008).

As described in Section 9.3.1*, Methods for Analysis,* the measures would conform to applicable design and building codes, guidelines, and standards, such as USACE design measures. See Alternative 4 for a specific list of applicable codes and standards DWR has made this conformance and monitoring process an environmental commitment (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

Generally, the applicable codes require that facilities be built so that they are designed for a landside slope stability and seepage/underseepage factors of safety greater than 1.0 (i.e., stable) and would therefore be less impacted in the event of ground settlement. The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures). Conformance to these and other applicable design specifications and standards would ensure that construction of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals from ground settlement. Therefore, there would be no adverse effect.

***CEQA Conclusion*:** Ground settlement above the tunneling operation could result in loss of property or personal injury during construction. However, DWR would conform to Cal-OSHA, USACE and other design requirements to protect worker safety as described under Alternative 4. DWR has made conformance to geotechnical design recommendations and monitoring an environmental commitment (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Hazards to workers and project structures would be controlled at safe levels and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-4: Loss of Property, Personal Injury, or Death from Slope Failure during Construction of Water Conveyance Features

Excavation of borrow material could result in failure of cut slopes and application of temporary spoils and RTM at storage sites could cause excessive settlement in the spoils, potentially causing injury of workers at the construction sites. The potential for slope failure under Alternative 4A would be identical to that under Alternative 4.

NEPA Effects: The potential effect could be substantial because excavation of borrow material and the resultant cutslopes and potential failure of spoils/RTM fill slopes could cause injury of workers at the construction sites. The potential for slope failure under Alternative 4A would be identical to that under Alternative 4.

During design, the potential for native ground settlement below the spoils would be evaluated by a geotechnical engineer using site-specific geotechnical and hydrological information. The use of shoring, seepage cutoff walls, and ground modifications to prevent slope instability, soil boiling, or excessive settlement would be considered in the design. As described in Section 9.3.1, *Methods for Analysis,* the measures would conform to applicable design and building codes, guidelines, and standards.

In addition to the risk of slope failure at borrow sites and spoils and RTM sites, there are also potential impacts on levee stability resulting from construction of Alternative 4A water conveyance facilities. All levee reconstruction/building pad construction would conform to applicable state and federal flood management engineering and permitting requirements.

DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications and are properly executed during construction to minimize the potential effects from failure of excavations. Conformance with relevant codes and standards would reduce the potential risk for increased likelihood of loss of property or personal injury from settlement/failure of cutslopes of borrow sites and failure of soil or RTM fill slopes during construction. The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures). The relevant codes and standards represent performance standards that must be met by contractors and these measures are subject to monitoring by state and local agencies. DWR has made this conformance and monitoring process an environmental commitment (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

Conformance to these and other applicable design specifications and standards would ensure that construction of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals from slope failure at borrow sites and spoils and RTM storage sites.

The reconstruction of levees would improve levee stability over existing conditions due to improved side slopes, erosion countermeasures (geotextile fabrics, rock revetments, riprap, or other material), seepage reduction measures, and overall mass. Therefore, there would be no adverse effect.

CEQA Conclusion: Settlement/failure of cutslopes of borrow sites and failure of soil/RTM fill slopes could result in loss of property or personal injury during construction. However, because DWR would conform with Cal-OSHA and other state code requirements and conform to applicable geotechnical design guidelines and standards, such as USACE design measures, the hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 4A at borrow sites and spoils and RTM storage sites. The reconstruction of levees would improve levee stability over existing conditions due to improved side slopes, erosion countermeasures, seepage reduction measures, and overall mass. The impact would be less than significant. No mitigation is required.

Impact GEO-5: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Construction-Related Ground Motions during Construction of Water Conveyance Features

Pile driving and other heavy equipment operations would cause vibrations that could initiate liquefaction and associated ground movements in places where soil and groundwater conditions are present to allow liquefaction to occur. The consequences of liquefaction could result in damage nearby structures and levees. The potential for liquefaction under Alternative 4A would be identical to that under Alternative 4.

NEPA Effects: The potential effect could be substantial because construction-related ground motions could initiate liquefaction, which could cause failure of structures during construction, which could result in injury of workers at the construction sites. The potential for liquefaction under Alternative 4A would be identical to that under Alternative 4.

During design, the facility-specific potential for liquefaction would be investigated by a geotechnical engineer. The investigations are an environmental commitment (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). In areas determined to have a potential for liquefaction, the California-registered civil engineer or California-certified engineering geologist would develop design strategies and construction methods to ensure that pile driving and heavy equipment operations do not cause liquefaction which otherwise could damage facilities under construction and surrounding structures, and could threaten the safety of workers at the site.

Design measures to avoid pile-driving induced levee failure may include predrilling or jetting, using open-ended pipe piles to reduce the energy needed for pile penetration, using CIDH piles/piers that do not require driving, using pile jacking to press piles into the ground by means of a hydraulic system, or driving piles during the drier summer months. Field data collected during design also would be evaluated to determine the need for and extent of strengthening levees, embankments, and structures to reduce the effect of vibrations. These construction methods would conform with current seismic design codes and requirements, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. Such design standards include USACE's *Engineering and Design—Stability Analysis of Concrete Structures* and *Soil Liquefaction during Earthquakes,* by the Earthquake Engineering Research Institute.

DWR has made the environmental commitment (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), that the construction methods recommended by the geotechnical engineer are included in the design of project facilities and construction specifications to minimize the potential for construction-induced liquefaction. DWR also has committed to ensure that these methods are followed during construction.

Generally, the applicable codes require that facilities be built so that if soil in the foundation or surrounding area are subject to liquefaction, the removal or densification of the liquefiable material should be considered, along with alternative foundation designs. Additionally, any modification to a federal levee system would require USACE approval under 33 USC 408 (a 408 Permit).

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures).

Conformance to construction method recommendations and other applicable specifications would ensure that construction of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals due to construction-related ground motion and resulting potential liquefaction in the work area. Therefore, there would be no adverse effect.

***CEQA Conclusion*:** Construction-related ground motions could initiate liquefaction, which could cause failure of structures during construction. However, because DWR would conform to Cal-OSHA and other state code requirements and conform to applicable design guidelines and standards, such as USACE design measures, the hazard would be controlled to a level that would protect worker safety (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Further, DWR has made an environmental commitment (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) that the construction methods recommended by the geotechnical engineer are included in the design of project facilities and construction specifications to minimize the potential for construction-induced liquefaction. DWR also has committed to ensure that these methods are followed during construction. Proper execution of these environmental commitments would result in no increased likelihood of loss of property, personal injury or death due to construction of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-6: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Rupture of a Known Earthquake Fault during Operation of Water Conveyance Features

NEPA Effects: Alternative 4A would include the same physical/structural components as Alternative 4, and therefore, the effects of Alternative 4A would be the same as Alternative 4. The effect would not be adverse because like Alternative 4, no active faults extend into the Alternative 4A alignment. Additionally, although the Thornton Arch and West Tracy blind thrusts occur beneath the Alternative 4A alignment, they do not present a hazard of surface rupture based on available information, including the AP Earthquake Fault Zone Map showing faults capable of surface rupture (Figure 9-5 of the Draft EIR/EIS).

However, because there is limited information regarding the depths of the Thornton Arch and West Tracy blind thrusts, seismic surveys would be performed on the blind thrust during the design phase to determine the depths to the top of the faults. More broadly, design-level geotechnical studies would be prepared by a geotechnical engineer licensed in the state of California during project design. Consistent with the environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), DWR would ensure that the geotechnical engineer's recommended measures to address adverse conditions would conform to applicable design codes, guidelines, and standards, would be included in the project design and construction specifications, and would be properly executed during construction. Generally, the applicable codes require that facilities be built so that they incur minimal damage in the event of a foreseeable seismic event and that they remain functional following such an event and that the facility is able to perform without catastrophic failure in the event of a maximum design earthquake (the greatest earthquake reasonably expected to be generated by a specific source on the basis of seismological and geological evidence). As described in Section 9.3.1, *Methods for Analysis* in Chapter 9*, Geology and Seismicity*, of the Draft EIR/EIS*,* such conformance with design codes, guidelines, and standards are considered environmental commitments by DWR (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from seismic events and the presence of adverse soil conditions. DWR would also ensure that the design specifications are properly executed during construction.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment).

Conformance to these and other applicable design specifications and standards would ensure that operation of Alternative 4 would not create an increased likelihood of loss of property, personal injury or death of individuals in the event of ground movement in the vicinity of the project. There would be no adverse effect.

***CEQA Conclusion*:** There are no active faults capable of surface rupture that extend into the Alternative 4A modified pipeline/tunnel alignment. Design-level geotechnical studies would be prepared by a geotechnical engineer licensed in the state of California during project design. The studies would further assess site-specific conditions at and near all the project facility locations, including seismic activity, soil liquefaction, and other potential geologic and soil-related hazards. This information would be used to verify assumptions and conclusions included in the EIR/EIS. Consistent with the project's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), DWR would ensure that the geotechnical engineer's recommended measures to address adverse conditions would conform to applicable design codes, guidelines, and standards, would be included in the project design and construction specifications, and would be properly executed during construction. Conformance to these and other applicable design specifications and standards would ensure that operation of Alternative 4 would not create an increased likelihood of loss of property, personal injury or death of individuals in the event of ground movement in the vicinity of the project. Therefore, such ground movements would not jeopardize the integrity of the surface and subsurface facilities along the Alternative 4A conveyance alignment or the proposed expanded Clifton Court Forebay and associated facilities adjacent to the existing Clifton Court Forebay. There would be no impact. No mitigation is required.

Impact GEO-7: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking during Operation of Water Conveyance Features

Earthquake events may occur on the local and regional seismic sources during operation of the Alternative 4A water conveyance facilities. The ground shaking could damage pipelines, tunnels, intake facilities, pumping plants, and other facilities disrupting the water supply through the conveyance system. In an extreme event of strong seismic shaking, uncontrolled release of water from damaged pipelines, tunnels, intake facilities, pumping plant, and other facilities could cause flooding, disruption of water supplies to the south, and inundation of structures. These effects are discussed more fully in Appendix 3E, *Potential Seismicity and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS.

NEPA Effects: This potential effect could be substantial because strong ground shaking could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities and result in loss of property or personal injury. The effects of Alternative 4A would be identical to Alternative 4. The damage could disrupt the water supply through the conveyance system. In an extreme event, an uncontrolled release of water from the conveyance system could cause flooding and inundation of structures. Please refer to Chapter 6, *Surface Water*, and Appendix 3E, *Potential Seismicity and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS for a detailed discussion of potential flood effects.

The structure of the underground conveyance facility would decrease the likelihood of loss of property or personal injury of individuals from structural shaking of surface and subsurface facilities along the Alternative 4A conveyance alignment in the event of strong seismic shaking.

In accordance with the DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), design-level geotechnical studies would be conducted by a licensed civil engineer who practices in geotechnical engineering. The California-registered civil engineer or California-certified engineering geologist's recommended measures to address this hazard would conform to applicable design codes, guidelines, and standards.

DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from seismic events and the presence of adverse soil conditions. Generally, the applicable codes require that facilities be built so that they incur minimal damage in the event of a foreseeable seismic event and that they remain functional following such an event and that the facility is able to perform without catastrophic failure in the event of a maximum design earthquake (the greatest earthquake reasonably expected to be generated by a specific source on the basis of seismological and geological evidence). DWR would also ensure that the design specifications are properly executed during construction. See Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment).

Conformance to these and other applicable design specifications and standards would ensure that operation of Alternative 4A would not create an increased likelihood of loss of property, personal injury or death of individuals from structural shaking of surface and subsurface facilities along the Alternative 4A conveyance alignment in the event of strong seismic shaking. Therefore, there would be no adverse effect.

***CEQA Conclusion*:** The impacts of Alternative 4A would be identical to Alternative 4. Seismically induced strong ground shaking could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities. The damage could disrupt the water supply through the conveyance system. In an extreme event, an uncontrolled release of water from the damaged conveyance system could cause flooding and inundation of structures. (Please refer to Chapter 6, *Surface Water*, of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, which would be supported by geotechnical investigations required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure that ground shaking risks are minimized as the water conveyance features are operated. The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-8: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction during Operation of Water Conveyance Features

NEPA Effects: The potential effect could be substantial because seismically induced ground shaking could cause liquefaction, and damage pipelines, tunnels, intake facilities, pumping plant, and other facilities. The damage could disrupt the water supply through the conveyance system. In an extreme event, an uncontrolled release of water from the damaged conveyance system could cause flooding and inundation of structures. The effects of Alternative 4A would be identical to Alternative 4. Please refer to Appendix 3E, *Potential Seismicity and Climate Change Risks to SWP/CVP Water Supplies*, of the Draft EIR/EIS for a detailed discussion of potential flooding effects.

In the process of preparing final facility designs, site-specific geotechnical and groundwater investigations would be conducted to identify and characterize the vertical (depth) and horizontal (spatial) extents of liquefiable soil. During final design, site-specific potential for liquefaction would be investigated by a geotechnical engineer. In areas determined to have a potential for liquefaction, a California-registered civil engineer or California-certified engineering geologist would develop design measures and construction methods to meet design criteria established by building codes and construction standards to ensure that the design earthquake does not cause damage to or failure of the facility. Such measures and methods include removing and replacing potentially liquefiable soil, strengthening foundations (for example, using post-tensioned slab, reinforced mats, and piles) to resist excessive total and differential settlements, and using *in situ* ground improvement techniques (such as deep dynamic compaction, vibro-compaction, vibro-replacement, compaction grouting, and other similar methods). The results of the site-specific evaluation and California-registered civil engineer or California-certified engineering geologist's recommendations would be documented in a detailed geotechnical report prepared in accordance with state guidelines, in particular *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (California Geological Survey 2008). Conformance with these design requirements is an environmental commitment by DWR to ensure that liquefaction risks are minimized as the water conveyance features are operated (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from liquefaction and associated hazards. DWR would also ensure that the design specifications are properly executed during construction.

Additionally, any modification to a federal levee system would require USACE approval under 33 USC 408 (a 408 Permit).

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment). Conformance to these and other applicable design specifications and standards would ensure that the hazard of liquefaction and associated ground movements would not create an increased likelihood of loss of property, personal injury or death of individuals from structural failure resulting from seismic-related ground failure along the Alternative 4A conveyance alignment during operation of the water conveyance features. Therefore, the effect would not be adverse.

***CEQA Conclusion*:** The impacts of Alternative 4A would be identical to Alternative 4. Seismically induced ground shaking could cause liquefaction. Liquefaction could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities, and thereby disrupt the water supply through the conveyance system. In an extreme event, flooding and inundation of structures could result from an uncontrolled release of water from the damaged conveyance system. (Please refer to Chapter 6, *Surface Water*, of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these design standards is an environmental commitment by DWR to ensure that liquefaction risks are minimized as the water conveyance features are operated. See Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-9: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability during Operation of Water Conveyance Features

Alternative 4A would involve excavation that creates new cut-and-fill slopes and construction of new embankments and levees. As a result of ground shaking and high soil-water content during heavy rainfall, existing and new slopes that are not properly engineered and natural stream banks could fail and cause damage to facilities. The effects of Alternative 4A would be identical to Alternative 4.

NEPA Effects: The potential effect could be substantial because levee slopes and stream banks may fail, either from high pore-water pressure caused by high rainfall and weak soil, or from seismic shaking. Structures built on these slopes could be damaged or fail entirely as a result of slope instability. As discussed in Impact SW-2 in Chapter 6, *Surface Water*, of the Draft EIR/EIS, operation of the water conveyance features under Alternative 4A would not result in an increase in potential risk for flood management compared to existing conditions. Peak monthly flows under Alternative 4A in the locations considered were similar to or less than those that would occur under existing conditions. Since flows would not be substantially greater, the potential for increased rates of erosion or seepage are low. For additional discussion on the possible exposure of people or structures to impacts from flooding due to levee failure, please refer to Impact SW-6 in Chapter 6, *Surface Water*, of the Draft EIR/EIS.

During project design, a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions. The design criteria would be documented in a detailed geotechnical report prepared in accordance with state guidelines, in particular *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (California Geological Survey 2008).

Site-specific geotechnical and hydrological information would be used, and the design would conform with the current standards and construction practices. The design requirements would be presented in a detailed geotechnical report. Conformance with these design requirements is an environmental commitment by DWR to ensure that slope stability hazards would be avoided as the water conveyance features are operated. See Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. DWR would ensure that the geotechnical design recommendations are included in the design of cut and fill slopes, embankments, and levees to minimize the potential effects from slope failure. DWR would also ensure that the design specifications are properly executed during construction.

Generally, the applicable codes require that facilities be built to certain factors of safety in order to ensure that facilities perform as designed for the life of the structure despite various soil parameters.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment). Conformance to the above and other applicable design specifications and standards would ensure that the hazard of slope instability would not create an increased likelihood of loss of property, personal injury of individuals along the Alternative 4A conveyance alignment during operation of the water conveyance features. Therefore, the effect would not be adverse.

***CEQA Conclusion*:** Unstable levee slopes and natural stream banks may fail, either from high pore-water pressure caused by high rainfall and weak soil, or from seismic shaking. Structures constructed on these slopes could be damaged or fail entirely as a result of slope instability.

However, during the final project design process, as required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions during facility operations.

DWR would also ensure that measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure cut and fill slopes and embankments will be stable as the water conveyance features are operated and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 4A. The impact would be less than significant. No mitigation is required.

Impact GEO-10: Loss of Property, Personal Injury, or Death from Seiche or Tsunami during Operation of Water Conveyance Features

The effects of Alternative 4A would be identical to Alternative 4.

NEPA Effects: The effect of a tsunami generated in the Pacific Ocean would not be adverse because the distance from the ocean and attenuating effect of the San Francisco Bay would likely allow only a low (i.e., less than 2 feet) tsunami wave height to reach the Delta (Contra Costa Transportation Agency 2009).

In most parts of the Plan Area, the effects of a seiche would not be adverse because the seismic hazard and the geometry of the water bodies (i.e., wide and shallow) near conveyance facilities are not favorable for a seiche to occur. However, assuming that the West Tracy fault is potentially active, a potential exists for a seiche to occur in the expanded Clifton Court Forebay. The effect could be adverse because the waves generated by a seiche could overtop the expanded Clifton Court Forebay embankments, causing erosion of the embankments and subsequent flooding in the vicinity.

However, design-level geotechnical studies would be conducted by a licensed civil engineer who practices in geotechnical engineering. The studies would determine the peak ground acceleration caused by movement of the West Tracy fault and the maximum probable seiche wave that could be generated by the ground shaking. The California-registered civil engineer or California-certified engineering geologist's recommended measures to address this hazard, as well as the hazard of a seiche overtopping the expanded Clifton Court Forebay embankment, would conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure that the adverse effects of a seiche are controlled to an acceptable level while the forebay facility is operated. See Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS.

DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from seismic events and consequent seiche waves. DWR would also ensure that the design specifications are properly executed during construction.

Generally, the applicable codes provide guidance on estimating the effects of climate change and sea level rise and associated effects when designing a project and ensuring that a project is able to respond to these effects.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment). Conformance to these and other applicable design specifications and standards would ensure that the embankment for the expanded portion of the Clifton Court Forebay would be designed and constructed to contain and withstand the anticipated maximum seiche wave height and would not create an increased likelihood of loss of property, personal injury or death of individuals along the Alternative 4A conveyance alignment during operation of the water conveyance features. Therefore, the effect would not be adverse.

CEQA Conclusion: The height of a tsunami wave reaching the Suisun Marsh and the Delta would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in most parts of the Plan Area is considered low because the seismic hazard and the geometry of the water bodies (i.e., wide and shallow) near conveyance facilities are not favorable for a seiche to occur. However, assuming the West Tracy fault is potentially active, a potential exists for a seiche to occur in the expanded Clifton Court Forebay (Fugro Consultants 2011).

However, design-level geotechnical studies would be conducted by a licensed civil engineer who practices in geotechnical engineering. The studies would determine the peak ground acceleration caused by movement of the West Tracy fault and the maximum probable seiche wave that could be generated by the ground shaking. The California-registered civil engineer or California-certified engineering geologist's recommended measures to address this hazard, as well as the hazard of a seiche overtopping the expanded Clifton Court Forebay embankment, would conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure that the adverse effects of a seiche are controlled to an acceptable level while the forebay facility is operated. DWR would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from seismic events and consequent seiche waves. DWR would also ensure that the design specifications are properly executed during construction.

The effect would not be adverse because the expanded Clifton Court Forebay embankment would be designed and constructed according to applicable design codes, guidelines, and standards to contain and withstand the anticipated maximum seiche wave height, as required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). There would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 4A from seiche or tsunami. The impact would be less than significant. No additional mitigation is required.

Impact GEO-11: Ground Failure Caused by Increased Groundwater Surface Elevations from Unlined Canal Seepage as a Result of Operating the Water Conveyance Facilities

NEPA Effects: Alternative 4A would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no effect caused by canal seepage. There would be no adverse effect.

***CEQA Conclusion*:** Alternative 4A would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no impact caused by canal seepage. The impact would be less than significant. No mitigation is required.

Impact GEO-12: Loss of Property, Personal Injury, or Death Resulting from Structural Failure Caused by Rupture of a Known Earthquake Fault at Restoration Opportunity Areas

According to the available AP Earthquake Fault Zone Maps, only the Suisun Marsh ROA could be affected by rupture of an earthquake fault. The active Green Valley fault crosses the southwestern corner of the ROA. The active Cordelia fault extends approximately 1 mile into the northwestern corner of the ROA. Rupture of these faults could damage levees and berms constructed as part of the restoration, which could result in failure of the levees and flooding of otherwise protected areas. Under Alternative 4A, no Environmental Commitments would occur in the Suisun Marsh ROA.

Within the Delta, active or potentially active blind thrust faults were identified in the seismic study (California Department of Water Resources 2007a). The extreme southeastern corner of the Suisun Marsh is underlain by the Montezuma blind thrust zone. Parts of the Cache Slough and Yolo Bypass ROAs are underlain by part of the North Midland blind thrust zone. The Cosumnes/Mokelumne River and East Delta ROAs are underlain by the Thornton Arch zone. Although these blind thrusts are not expected to rupture to the ground surface during earthquake events, they may produce ground or near-ground shear zones, bulging, or both. In the seismic study (California Department of Water Resources 2007a), the Thornton Arch blind thrust was assigned a 20% probability of being active. The depth to the Thornton Arch blind fault is unknown. Based on limited geologic and seismic survey information, it appears that the potential of having any shear zones, bulging, or both at the sites of the habitat levees is low because the depth to the blind thrust faults is generally deep.

NEPA Effects: Effects related to rupture of a known earthquake fault within an ROA under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS).

Because there is limited information regarding the depths of the blind faults mentioned above, seismic surveys would be performed in the vicinity of the faults as part of final design. These surveys would be used to verify fault depths where levees and other features would be constructed. Collection of this depth information would be part of broader, design-level geotechnical studies conducted by a geotechnical engineer licensed in the state of California to support all aspects of site-specific project design. The studies would assess site-specific conditions at and near all the project facility locations, including the nature and engineering properties of all soils and underlying geologic strata, and groundwater conditions. The geotechnical engineers' information would be used to develop final engineering solutions to any hazardous condition, consistent with the code and standards requirements of federal, state and local oversight agencies. Conformance with these design standards is an environmental commitment by the project proponents to ensure that risks from a fault rupture are minimized as levees for habitat restoration areas are constructed and maintained (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level by following the proper design standards.

The project proponents would ensure that the geotechnical design recommendations are included in the design of project facilities and construction specifications to minimize the potential effects from seismic events and the presence of adverse soil conditions. The project proponents would also ensure that the design specifications are properly executed during implementation.

Generally, the applicable codes require that facilities be built so that they incur minimal damage in the event of a foreseeable seismic event and that they remain functional following such an event and that the facility is able to perform without catastrophic failure in the event of a maximum design earthquake (the greatest earthquake reasonably expected to be generated by a specific source on the basis of seismological and geological evidence).

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures). Conformance to these and other applicable design specifications and standards would ensure that the hazard of ground movement in the vicinity of the blind thrusts underlying the ROAs would not jeopardize the integrity of the levees and other features constructed in the ROAs and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. This effect would not be adverse.

***CEQA Conclusion*:** As noted above, effects related to rupture of a known earthquake fault within an ROA under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the restoration activities proposed under Alternative 4A. Rupture of the Cordelia and Green Valley faults could occur at the Suisun Marsh ROA and damage ROA facilities, such as levees and berms. Damage to these features could result in their failure, causing flooding of otherwise protected areas. Environmental Commitments under Alternative 4A would not occur in the Suisun Marsh area.

However, through the final design process for conservation activities in the ROAs and because there is limited information regarding the depths of the blind faults mentioned above, seismic surveys would be performed in the vicinity of the faults as part of final designs. These surveys would be used to verify fault depths where levees and other features would be constructed. Collection of this depth information would be part of broader, design-level geotechnical studies conducted by a geotechnical engineer licensed in the state of California to support all aspects of site-specific project design. The studies would assess site-specific conditions at and near all the project facility locations, including the nature and engineering properties of all soils and underlying geologic strata, and groundwater conditions. The geotechnical engineer's information would be used to develop final engineering solutions and project designs to any hazardous condition, consistent with DWR's environmental commitments (see Appendix 3B, *Environmental Commitments,* in Appendix A of this RDEIR/SDEIS).

Additionally, measures to address the fault rupture hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these design codes, guidelines, and standards is an environmental commitment by the project proponents to ensure that fault rupture risks are minimized as the conservation activities are implemented. The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-13: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking at Restoration Opportunity Areas

Effects related to strong seismic shaking within an ROA under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS).

Earthquake events may occur on the local and regional seismic sources at or near the ROAs. Because of its proximity to these faults, the Suisun Marsh ROA would be especially subject to ground shaking caused by the Concord-Green Valley fault. The Cache Slough ROA would be subject to shaking from the Northern Midland fault zone, which underlies the ROA. Although more distant from these sources, the other ROAs would be subject to shaking from the San Andreas, Hayward–Rodgers Creek, Calaveras, Concord–Green Valley, San Gregorio, Greenville, and Mt. Diablo Thrust faults and the more proximate blind thrusts in the Delta.

Among all the ROAs, the Suisun Marsh ROA would be most subject to ground shaking because of its proximity to active faults. The Suisun Marsh ROA is subject to a PGA of approximately 0.31–0.35 g for 200-year return interval, while the PGA for the other ROAs ranges from approximately 0.11–0.26 g. The ground shaking could damage levees and other structures, and in an extreme event cause levees to fail such that protected areas flood. However, Environmental Commitments under Alternative 4A would not occur in the Suisun Marsh area.

NEPA Effects: All temporary facilities would be designed and built to meet the safety and collapse-prevention requirements for the above-anticipated seismic loads. Therefore, this effect is considered not adverse. No additional mitigation measures are required.

Site-specific geotechnical information would be used to further assess the effects of local soil on the OBE and MDE ground shaking and to develop design criteria that minimize the potential of damage. Design-level geotechnical studies would be prepared by a geotechnical engineer licensed in the state of California during project design. The studies would assess site-specific conditions at and near all the project facility locations and provide the basis for designing the levees and other features to withstand the peak ground acceleration caused by fault movement in the region. The geotechnical engineer's recommended measures to address this hazard would conform to applicable design codes, guidelines, and standards. Conformance with these design standards is an environmental commitment by the project proponents to ensure that strong seismic shaking risks are minimized as the conservation activities are implemented (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

The project proponents would ensure that the geotechnical design recommendations are included in the design of project features and construction specifications to minimize the potential effects from seismic events and the presence of adverse soil conditions. The project proponents would also ensure that the design specifications are properly executed during implementation.

Generally, the applicable codes require that facilities be built so that they incur minimal damage in the event of a foreseeable seismic event and that they remain functional following such an event and that the facility is able to perform without catastrophic failure in the event of a maximum design earthquake (the greatest earthquake reasonably expected to be generated by a specific source on the basis of seismological and geological evidence).

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures). Conformance to these and other applicable design specifications and standards would ensure that the hazard of seismic shaking would not jeopardize the integrity of levees and other features at the ROAs and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. This effect would not be adverse.

***CEQA Conclusion*:** Ground shaking could damage levees, berms, and other structures. Among all the ROAs, the Suisun Marsh ROA would be the most subject to ground shaking because of its proximity to active faults. However, Environmental Commitments under Alternative 4A would not occur in the Suisun Marsh area. Damage to these features could result in their failure, causing flooding of otherwise protected areas. Conformance with these design standards is an environmental commitment by the project proponents to ensure that strong seismic shaking risks are minimized as the conservation activities are operated and there would be no increased likelihood of loss of property, personal injury or death in the ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-14: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction) Beneath Restoration Opportunity Areas

Effects related to seismic-related ground failure beneath an ROA under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS).

New structural features are proposed at the ROAs, such as levees as part of Environmental Commitment 4, setback levees as part of Environmental Commitment 6. However, the amount of restoration being proposed under Alternative 4A is much smaller in breadth than under Alternative 4. Earthquake induced ground shaking could cause liquefaction, resulting in damage to or failure of these levees and other features constructed at the restoration areas. The consequences of liquefaction are manifested in terms of compaction or settlement, loss of bearing capacity, lateral spreading (horizontal soil movement), and increased lateral soil pressure. Failure of levees and other structures could result in flooding of otherwise protected areas in Suisun Marsh and behind new setback levees along the Sacramento and San Joaquin Rivers and in the South Delta ROA

The ROAs vary with respect to their liquefaction hazard (Figure 9-6 of the Draft EIR/EIS). All of the levees in the Suisun Marsh ROA have a medium vulnerability to failure from seismic shaking and resultant liquefaction. The liquefaction vulnerability among the other ROAs in which seismically-induced levee failure vulnerability has been assessed (Figure 9-6 of the Draft EIR/EIS) (i.e., in parts or all the Cache Slough Complex and South Delta ROAs) is medium or high.

NEPA Effects: The potential effect could be substantial because earthquake-induced liquefaction could damage ROA facilities, such as levees and berms. Damage to these features could result in their failure, causing flooding of otherwise protected areas.

During final design of conservation facilities, site-specific geotechnical and groundwater investigations would be conducted by a geotechnical engineer to identify and characterize the vertical (depth) and horizontal (spatial) extent of liquefiable soil.

In areas determined to have a potential for liquefaction, the engineer would develop design parameters and construction methods to meet the design criteria established to ensure that design earthquake does not cause damage to or failure of the facility. Conformance with these design standards is an environmental commitment by the project proponents to ensure that liquefaction risks are minimized as the conservation activities are implemented.

Generally, the applicable codes require that facilities be built so that if soil in the foundation or surrounding area are subject to liquefaction, the removal or densification of the liquefiable material should be considered, along with alternative foundation designs. The hazard would be controlled to a safe level.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment, practicing crane and scaffold safety measures). As required by the environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), the project proponents would ensure that the geotechnical design recommendations are included in the design of levees and construction specifications to minimize the potential effects from liquefaction and associated hazard. The project proponents would also ensure that the design specifications are properly executed during implementation and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. This effect would not be adverse.

CEQA Conclusion**:** Earthquake induced ground shaking could cause liquefaction, resulting in damage to or failure of levees, berms, and other features constructed at the restoration areas. Failure of levees and other structures could result in flooding of otherwise protected areas. As required by the environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), site-specific geotechnical and groundwater investigations would be conducted to identify and characterize the vertical (depth) and horizontal (spatial) extent of liquefiable soil. The project proponents would ensure that the geotechnical design recommendations are included in the design of levees and construction specifications to minimize the potential effects from liquefaction and associated hazard. The project proponents would also ensure that the design specifications are properly executed during implementation and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. Further, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these design standards is an environmental commitment by the project proponents to ensure that liquefaction risks are minimized as the water conservation features are implemented and there would be no increased likelihood of loss of property, personal injury or death in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-15: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability at Restoration Opportunity Areas

Effects related to landslides and slope instability at an ROA under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS).

Implementation of Environmental Commitments 3, 4, 6, and 7 could involve breaching, modification or removal of existing levees and construction of new levees and embankments. Levee modifications, including levee breaching or lowering, may be performed to reintroduce tidal exchange, reconnect remnant sloughs, restore natural remnant meandering tidal channels, encourage development of dendritic channel networks, and improve floodwater conveyance.

Levee modifications could involve the removal of vegetation and excavation of levee materials. Excess earthen materials could be temporarily stockpiled, then re-spread on the surface of the new levee slopes where applicable or disposed of offsite. Any breaching or other modifications would be required to be designed and implemented to maintain the integrity of the levee system and to conform to flood management standards and permitting processes. This would be coordinated with the appropriate flood management agencies. Those agencies may include USACE, DWR, CVFPB, and other flood management agencies. For more detail on potential modifications to levees as a part of conservation activities, please refer to Chapter 3, *Conservation Strategy*, of the Draft BDCP, and Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS

New and existing levee slopes and stream/channel banks could fail and could damage facilities as a result of seismic shaking and as a result of high soil-water content during heavy rainfall.

With the exception of levee slopes, natural stream banks, and part of the Suisun Marsh ROA the topography of ROAs is nearly level to gently sloping. The areas that may be susceptible to slope failure are along existing Sacramento and San Joaquin River and Delta island levees and stream/channel banks, particularly those levees that consist of non-engineered fill and those streambanks that are steep and consist of low strength soil.

The structures associated with conservation activities would not be constructed in, nor would they be adjacent to, areas that are subject to mudflows/debris flows from natural slopes.

NEPA Effects: The potential effect could be substantial because levee slopes and embankments may fail, either from high pore-water pressure caused by high rainfall and weak soil, or from seismic shaking. Failure of these features could result in loss, injury, and death as well as flooding of otherwise protected areas.

As outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, erosion protection measures and protection against related failure of adjacent levees would be taken where levee breaches were developed. Erosion protection measures would also be taken where levee lowering is done for the purposes of allowing seasonal or periodic inundation of lands during high flows or high tides to improve habitat or to reduce velocities and elevations of floodwaters. Neighboring levees could require modification to accommodate increased flows or to reduce effects of changes in water elevation or velocities along channels following inundation of tidal marshes. Hydraulic modeling would be used during subsequent analyses to determine the need for such measures.

New levees would be constructed to separate lands to be inundated for tidal marsh from non-inundated lands, including lands with substantial subsidence. Levees could be constructed as described for the new levees at intake locations. Any new levees would be required to be designed and implemented to conform to applicable flood management standards and permitting processes.

Additionally, during project design, a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions.

Site-specific geotechnical and hydrological information would be used, and the design would conform with the current standards and construction practices, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS.

The project proponents would ensure that the geotechnical design recommendations are included in the design of embankments and levees to minimize the potential effects from slope failure. The project proponents would also ensure that the design specifications are properly executed during implementation.

Generally, the applicable codes require that facilities be built to certain factors of safety in order to ensure that facilities perform as designed for the life of the structure despite various soil parameters.

The worker safety codes and standards specify protective measures that must be taken at construction sites to minimize the risk of injury or death from structural or earth failure (e.g., utilizing personal protective equipment). Conformance to the above and other applicable design specifications and standards would ensure that the hazard of slope instability would not jeopardize the integrity of levees and other features at the ROAs and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. This effect would not be adverse.

CEQA Conclusion: Unstable new and existing levee and embankment slopes could fail as a result of seismic shaking and as a result of high soil-water content during heavy rainfall and cause flooding of otherwise protected areas. However, during project design and as required by the project proponents' environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions. The project proponents would ensure that the geotechnical design recommendations are included in the design of embankments and levees to minimize the potential effects from slope failure. The project proponents would also ensure that the design specifications are properly executed during implementation.

Additionally, as required by the project proponents' environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), site-specific geotechnical and hydrological information would be used to ensure conformance with applicable design guidelines and standards, such as USACE design measures. Through implementation of these environmental commitments, the hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death in the ROAs. The impact would be less than significant. Therefore, no mitigation is required.

Impact GEO-16: Loss of Property, Personal Injury, or Death from Seiche or Tsunami at Restoration Opportunity Areas as a Result of Implementing the Conservation Actions

NEPA Effects: The distance from the ocean and attenuating effect of the San Francisco Bay would likely allow only a low tsunami wave height to reach the Suisun Marsh and the Delta. Conditions for a seiche to occur at the ROAs are not favorable. Therefore, the effect would not be adverse.

***CEQA Conclusion*:** Based on recorded tsunami heights at the Golden Gate, the height of a tsunami wave reaching the ROAs would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in the Plan Area that would cause loss of property, personal injury, or death at the ROAs is considered low because conditions for a seiche to occur at the ROAs are not favorable. The impact would be less than significant. No mitigation is required.

4.3.6 Soils

Impact SOILS-1: Accelerated Erosion Caused by Vegetation Removal and Other Soil Disturbances as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 4A would include the same physical/structural components as Alternative 4. These locations would be where soils have similar erosion hazards and would not substantially change the project effects on water soil erosion. The effects of Alternative 4A would, therefore, be the same as under Alternative 4. See the discussion of Impact SOILS-1 under Alternative 4.

NEPA Effects: Construction of the proposed water conveyance facility under Alternative 4A could cause substantial accelerated erosion. However, as described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper implementation of the requisite SWPPP and compliance with the General Permit (as discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would ensure that there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs as a result of construction of the proposed water conveyance facility, and therefore, there would not be an adverse effect.

Additionally, implementation of the environmental commitment Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material would help reduce wind blowing of excavated soils, particularly peat soils, during transport and placement at spoils storage, disposal, and reuse areas.

CEQA Conclusion: Vegetation removal and other soil disturbances associated with construction of water conveyance facilities could cause accelerated water and wind erosion of soil. However, DWR would seek coverage under the state General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. As a result of implementation of the requisite SWPPP, and compliance with the General Permit, there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs the effect would be less than significant. No mitigation is required.

Impact SOILS-2: Loss of Topsoil from Excavation, Overcovering and Inundation as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 4A would include the same physical/structural components as Alternative 4 and construction would be the same as under Alternative 4. Therefore, the effects on topsoil under Alternative 4A would be the same as Alternative 4. See the discussion of Impact SOILS-2 under Alternative 4.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., forebays, borrow areas, tunnel shafts, levee foundations, intake facilities, pumping plants): overcovering (e.g., levees and embankments, spoil storage, pumping plants); and water inundation (e.g., forebays, sedimentation basins, and solids lagoons). DWR has made an Environmental Commitment for Disposal Site Preparation which would require that a portion of the temporary sites selected for storage of spoils, RTM and dredged material will be set aside for topsoil storage and the topsoil would be saved for reapplication to disturbed areas, thereby lessening the effect.

However, this effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Construction of the water conveyance facilities would involve excavation, overcovering, and inundation of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil despite a commitment for Disposal Site Preparation. The impact on soils in the Plan Area would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts, but not to a less-than-significant level because topsoil would be permanently lost over extensive areas. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4.

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4.

Impact SOILS-3: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on or in Soils Subject to Subsidence as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 4A would include the same physical/structural components as Alternative 4 and therefore the effects from potential soil subsidence under Alternative 4A would be the same as Alternative 4. See the discussion of Impact SOILS-3 under Alternative 4.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. However, as described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, geotechnical studies (as described in the Geotechnical Exploration Plan—Phase 2 [California Department of Water Resources 2014]) would be conducted at all facilities to identify the types of soil avoidance or soil stabilization measures that should be implemented to ensure that the facilities are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards. These investigations would build upon the geotechnical data reports (California Department of Water Resources 2001a, 2010b, 2011) and the CERs (California Department of Water Resources 2010a, 2010b). As discussed under Alternative 4, conforming to state and federal design standards, including conduct of site-specific geotechnical evaluations, would ensure that appropriate design measures are incorporated into the project and any subsidence that takes place under the project facilities would not jeopardize their integrity. Therefore, there would not be an adverse effect.

***CEQA Conclusion*:** Some of the conveyance facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, DWR would be required to design and construct the facilities according to state and federal design standards and guidelines (e.g., California Building Code, American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures, ASCE-7-10, 2010) (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conforming to these codes would reduce the potential hazard of subsidence or settlement to acceptable levels by avoiding construction directly on or otherwise stabilizing the soil material that is prone to subsidence. Because these measures would reduce the potential hazard of subsidence or settlement to meet design standards, the impact would be less than significant. No mitigation is required.

Impact SOILS-4: Risk to Life and Property as a Result of Constructing the Proposed Water Conveyance Facilities in Areas of Expansive, Corrosive, and Compressible Soils

Alternative 4A would include the same physical/structural components as Alternative 4 and therefore the effects related to expansive, corrosive, and compressible soils under Alternative 4A would be the same as Alternative 4. See the discussion of Impact SOILS-4 under Alternative 4.

NEPA Effects: The integrity of the water conveyance facilities, including tunnels, pipelines, intake facilities, pumping plants, access roads and utilities, and other features could be adversely affected because they would be located on expansive, corrosive, and compressible soils. However, all facility design and construction would be executed in conformance with the CBC which specifies measures to mitigate effects of expansive soils, corrosive soils, and soils subject to compression and subsidence. By conforming to the CBC and other applicable design standards, potential effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). There would be no adverse effect.

CEQA Conclusion**:** Some of the project facilities would be constructed on soils that are subject to expansion, corrosion to concrete and uncoated steel, and compression under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression/settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, because DWR would be required to design and construct the facilities in conformance with state and federal design standards, guidelines, and building codes (e.g., CBC and USACE design standards). Conforming to these codes and standards is an environmental commitment by DWR to ensure that potential adverse effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, this impact would be less than significant. No mitigation is required.

Impact SOILS-5: Accelerated Bank Erosion from Increased Channel Flow Rates as a Result of Operations

Alternative 4A have operations similar to those under Alternative 4 and therefore the potential effects on accelerated bank erosion because the flow from the north Delta under Alternative 4A would be the same as Alternative 4. See the discussion of Impact SOILS-5 under Alternative 4.

NEPA Effects: The effect of increased channel flow rates on channel bank scour would not be adverse because, as described in Section 3.6.2, *Conservation Components*, of Appendix A of this RDEIR/SDEIS, as part of the Environmental Commitment 4, major channels could be dredged to create a larger cross-section that would offset increased tidal velocities. The effect would not be adverse because there would be no net increase in river flow rates and therefore no net increase in channel bank scour.

CEQA Conclusion**:** Changes in operational flow regimes could cause increases in flow rates in channels and sloughs, potentially leading to increases in channel bank scour. However, where such changes are expected to occur (i.e., at the mouths of tidal marsh channels), the project would also entail expansion of the channel cross-section to increase the tidal prism at these locations as described in Section 3.6.2, *Conservation Components*, of Appendix A of this RDEIR/SDEIS. The net effect would be to reduce the channel flow rates by 10–20% compared to Existing Conditions. Consequently, no appreciable increase in scour is anticipated. The impact would be less than significant. No mitigation is required.

Impact SOILS-6: Accelerated Erosion Caused by Clearing, Grubbing, Grading, and Other Disturbances Associated with Implementation of Proposed Environmental Commitments 3, 4, 6-11

Effects under Alternative 4A on accelerated erosion would be similar in mechanism to those described for Alternative 4, but to a substantially lesser magnitude based on the Environmental Commitments proposed under Alternative 4A (and as described in Section 4.1.2, *Description of Alternative 4A*, in this RDEIR/SDEIS). See the discussion of Impact SOILS-6 under Alternative 4.

Implementation of some of the Environmental Commitments would involve ground disturbance and construction activities that could lead to accelerated soil erosion rates and consequent loss of topsoil. Implementation of Environmental Commitments 3, 4, and 6–11 could involve breaching, modification or removal of existing levees and construction of new levees and embankments. Levee modifications, including levee breaching or lowering, may be performed to reintroduce tidal exchange, reconnect remnant sloughs, restore natural remnant meandering tidal channels, encourage development of dendritic channel networks, and improve floodwater conveyance. Some of the environmental commitments would also require constructing setback levees and cross levees or berms; raising the land elevation by excavating relatively high areas to provide fill for subsided areas or by importing fill material; surface grading; deepening and/or widening tidal channels; excavating new channels; modifying channel banks; and other activities. These activities could lead to accelerated soil erosion rates and consequent loss of topsoil.

Construction of conservation hatcheries and implementation of urban stormwater treatment are not part of Alternative 4A.

NEPA Effects: These effects could potentially cause substantial accelerated erosion. However, as described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments,* in Appendix A of this RDEIR/SDEIS, the project proponents would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper implementation of the requisite SWPPP, site-specific BMPs, and compliance with the General Permit would ensure that accelerated water and wind erosion as a result of implementing conservation measures would not be an adverse effect.

***CEQA Conclusion*:** Vegetation removal and other soil disturbances associated with construction of restoration areas could cause accelerated water and wind erosion of soil. However, the project proponents would seek coverage under the state General Permit for Construction and Land Disturbance Activities (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Permit conditions would include erosion and sediment control BMPs (such as revegetation, runoff control, and sediment barriers) and compliance with water quality standards. As a result of implementation of permit conditions, the impact would be less than significant. No mitigation is required.

Impact SOILS-7: Loss of Topsoil from Excavation, Overcovering and Inundation Associated with Restoration Activities as a Result of Implementing the Proposed Environmental Commitments 3–4, 6–11

Effects from implementation of Environmental Commitments under Alternative 4A on loss of topsoil would be similar in mechanism to those described for Alternative 4, but to a substantially lesser magnitude based on the smaller acreages of restoration proposed by the Environmental Commitments under Alternative 4A (and as described in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS). See the discussion of Impact SOILS-7 under Alternative 4.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., levee foundations, water control structures); overcovering (e.g., levees, embankments, application of fill material in subsided areas); and water inundation (e.g., aquatic habitat areas) over areas of the Plan Area. Based on ICF's calculations using a geographic information system, implementation of habitat restoration activities at the ROAs would result in excavation, overcovering, or inundation of a minimum of 1,176 acres of topsoil. This effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Significant impacts could occur if there is loss of topsoil from excavation, overcovering, and inundation associated with restoration activities as a result of implementing the proposed Environmental Commitments. Implementation of the Environmental Commitments would involve excavation, overcovering, and inundation (to create aquatic habitat areas) of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil. Therefore, the impact would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts to a degree by minimizing topsoil loss, but not to a less-than-significant level because topsoil would still be permanently lost over extensive areas. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4

Impact SOILS-8: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on Soils Subject to Subsidence as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 4A related to subsidence would be similar in mechanism to those described for Alternative 4, but to a substantially lesser magnitude based on the Environmental Commitments proposed under Alternative 4A (and as described in Section 4.1.2, *Description of Alternative 4A*, in RDEIR/SDEIS). Damage to or failure of the habitat levees could occur where these are constructed in soils and sediments that are subject to subsidence and differential settlement. These soil conditions have the potential to exist in the Suisun Marsh ROA Levee damage or failure could cause surface flooding in the vicinity. See the discussion of Impact SOILS-8 under Alternative 4.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. However, as described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments,* in Appendix A of this RDEIR/SDEIS, geotechnical studies would be conducted at all the ROAs to identify the types of soil stabilization that should be implemented to ensure that levees, berms, and other features are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards.

With construction of all levees, berms, and other conservation features designed and constructed to withstand subsidence and settlement and through conformance with applicable state and federal design standards, this effect would not be adverse.

CEQA Conclusion**:** Some of the restoration area facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, because the project proponents would be required to design and construct the facilities according to state and federal design standards and guidelines (which may involve, for example, replacement of the organic soil), the impact would be less than significant. No mitigation is required.

Impact SOILS-9: Risk to Life and Property from Construction in Areas of Expansive, Corrosive, and Compressible Soils as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 4A in areas of expansive, corrosive, or compressible soils would be similar in mechanism to those described for Alternative 4, but to a substantially lesser magnitude based on the environmental commitments proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS). See the discussion of Impact SOILS-9 under Alternative 1A.

Seasonal shrinking and swelling of moderately or highly expansive soils could damage water control structures or cause them to fail, resulting in a release of water from the structure and consequent flooding, which would cause unplanned inundation of aquatic habitat areas. Soils in all the ROAs possess high potential for corrosion of uncoated steel, and the Suisun ROA and portions of the West Delta ROA possess soils with high corrosivity to concrete.

Highly compressible soils are in the Cache Slough, Yolo Bypass Cosumnes/Mokelumne, and South Delta ROAs.

NEPA Effects: The Environmental Commitments could be located on expansive, corrosive, and compressible soils. However, ROA-specific geotechnical studies and testing would be completed prior to construction within the ROAs. The site-specific studies and testing would identify specific areas where engineering soil properties, including soil compressibility, may require special consideration during construction of specific features within ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conformity with USACE, CBC, and other design standards for construction on expansive, corrosive and/or compressible soils described in detail in Chapter 10, *Soils*, in the Draft EIR/EIS, would prevent adverse effects of such soils.

CEQA Conclusion**:** Some of the restoration facilities would be constructed on soils that are subject to expansion, corrosive to concrete and uncoated steel, and compress under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression or settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, as outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project proponents would be required to design and construct the facilities according to state and federal design standards, guidelines, and building codes (which may involve, for example, soil lime stabilization, cathodic protection of steel, and soil replacement), this impact would be considered less than significant. No mitigation is required.

4.3.7 Fish and Aquatic Resources

As described in Section 4.1 of Section 4, Alternative 4A would result in the same potential construction impact mechanisms as Alternative 4. Alternative 4A includes water conveyance operational criteria similar to Alternative 4 (Operational Scenario H), but will be limited to operations within the range of Scenarios H3 and H4, as fully described in Section 4.1. In addition, Alternative 4A would be implemented over a shorter period of time, similar to the ELT time frame. This results in somewhat different patterns of water withdrawals from the Delta, and potentially somewhat different effects on water quality and aquatic habitat conditions in the Plan Area, than analyzed for Alternative 4. Alternative 4A operations are represented by the Scenarios H3 and H4 as follows:

- Scenario H3 – Includes spring outflow consistent with D-1641 and fall outflow consistent with Fall X2 requirements of the FWS 2008 BiOp.
- Scenario H4 – Includes higher spring outflow requirements than D-1641, and Fall X2 requirements of the FWS 2008 BiOp.

H3 and H4 operational criteria differ in the spring outflow that is assumed, and are concluded to represent the range of operational effects of Alternative 4A (Appendix B, *Supplemental Modeling for Alternative 4A*, Section B.7). The operations impact analysis compares ELT Alternative 4A results over the range of outcomes from the operational sub-scenarios with Existing Conditions (CEQA) or the No Action Alternative Action in the ELT (NEPA, with the modeling scenario referred to as NAA_ELT). The Alternative 4A sub-scenarios are referred to as H3_ELT and H4_ELT; and are also occasionally referred to as Evaluated Starting Operations (ESO_ELT) and High Outflow Scenario (HOS_ELT), respectively. The analysis concludes with a single impact statement for each issue. Additionally, the effects of Alternative 4A in the LLT are similar to the effects of the alternative in the ELT, except where noted.

As described in Section 4.1, Alternative 4A differs from Alternative 4 in that it is not an HCP (it focuses instead on ESA Section 7 and CESA Section 2081(b) compliance) and does not include the full suite of conservation actions included in Alternative 4. Aside from the water conveyance facilities, the following Environmental Commitments relevant to fish and aquatic resources are included in Alternative 4A:

- *Environmental Commitment 4, Tidal Natural Communities Restoration* is would include up to 59 acres of restoration
- *Environmental Commitment 6, Channel Margin Enhancement* is would include 4.6 levee miles of enhancement
- *Environmental Commitment 7, Riparian Natural Community Restoration* includes 251 acres of restoration
- *Environmental Commitment 12, Methylmercury Management* would be focused on restored tidal wetland areas
- *Environmental Commitment 15, Localized Reduction of Predatory Fishes* is focused on two of the locations proposed for Alternative 4: the vicinity of the north Delta intakes and Clifton Court Forebay

- *Environmental Commitment 16, Nonphysical Fish Barriers* is focused on one of the locations proposed for Alternative 4: the divergence between the Sacramento River and Georgiana Slough

Each of these environmental commitments (Environmental Commitments) is described in more detail in Section 4.1.2.3 of Section 4. As described in Section 4.1.2.3, many of the actions that are not proposed to be implemented under Alternative 4A would continue to be pursued as part of existing but separate projects and programs associated with the 2009 and 2009 USFWS and NMFS BiOps (e.g., Yolo Bypass improvements, 8,000 acres of tidal habitat restoration) and the 2014 California Water Action Plan. Those actions are separate from, and independent of, Alternative 4A. The analysis of Alternative 4A presented below assumes that modeling conducted for the various *BDCP Effects Analysis* scenarios in the ELT time frame (i.e., NAA_ELT, H3_ELT, and H4_ELT) is representative of operations and resulting Delta flow-related conditions under Alternative 4A. Because it is assumed that the NAA_ELT scenario would include actions such as Yolo Bypass improvements pursued under separate projects and programs, additional discussion is included where these additional actions are not explicitly captured in the modeling and could result in differences from modeling results.

Reflecting the reduced suite of environmental commitments in Alternative 4A compared to Alternative 4 conservation measures, generally fewer impacts are discussed for Alternative 4A than for Alternative 4.

Delta Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-1: Effects of Construction of Water Conveyance Facilities on Delta Smelt

The potential effects of construction of the water conveyance facilities on delta smelt or critical habitat would be the same as described for Alternative 4 and are outlined in the discussion below.

The construction and maintenance activities of the new intakes and screens would occur entirely within designated critical habitat. Small numbers of delta smelt eggs, larvae, and adults could be present in the north Delta in June during a portion of the in-water construction period for the intake facilities. Small numbers could also be present in June or July during construction of the barge landings in the east Delta and south Delta and during construction at Clifton Court Forebay and the operable barrier at the Head of Old River (see Table 11-8 in Chapter 11, Section 11.3.1.1, in Appendix A of this RDEIR/SDEIS, [hereafter, Table 11-8]). The types of construction impacts are identical to Alternative 4, which draws on the analysis of Alternative 1A. In summary, those potential impacts include temporary increases in turbidity; accidental spills; disturbance of contaminated sediments; underwater noise; fish stranding; in-water work activities; loss of spawning, rearing, or migration habitat; and predation. Effects related to these are summarized below.

Temporary Increases in Turbidity

The construction of Alternative 4A would unavoidably result in the generation and release of suspended sediments to the water column, temporarily increasing water column turbidity and altering habitat conditions for delta smelt and other fish species. However, as noted for Alternative 1A, species such as delta and longfin smelt have evolved and adapted to life in turbid waters to avoid predators and to successfully forage on prey organisms, so increases in turbidity are expected to generally improve habitat conditions for these species.

Turbidity-producing construction activities in the Sacramento River, Clifton Court Forebay, at the Head of Old River barrier location, and other locations include bed and bank disturbance during cofferdam placement and removal, channel dredging adjacent to the new intake locations and at the Head of Old River operable barrier location, excavation within Clifton Court Forebay, and the placement of bed and bank armoring. Propeller wash associated with barge traffic at the tunnel shaft construction sites would also be expected to produce localized turbidity pulses. These effects would occur periodically wherever in-water construction activities and/or associated vessel traffic are taking place.

Although the construction of Alternative 4A would result in unavoidable turbidity effects, these effects would be minimized to the extent possible to minimize effects on other species and water quality by limiting the duration of in-water construction activities and through implementing the environmental commitments described below and in Appendix 3B, *Environmental Commitments.* These environmental commitments include *Conduct Environmental Training*; *Develop and Implement a Stormwater Pollution Prevention Plan* (SWPPP); *Develop and Implement an Erosion and Sediment Control Plan*; *Develop and Implement a Hazardous Materials Management Plan* (HMMP) that includes a *Spill Prevention, Containment, and Countermeasure Plan* (SPCCP); *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; *Develop and Implement a Fish Rescue and Salvage Plan*; and *Develop and Implement a Barge Operations Plan*. While delta smelt are not expected to be substantially exposed to any changes in turbidity during construction, and any exposure would not be adverse because of their preference for turbid conditions, construction activities would still need to comply with the standard terms and conditions for in-water work.

Accordingly, prior to the onset of construction activities, DWR and/or their contractors will conduct environmental training to inform field management and construction personnel of the need to avoid and protect sensitive resources during construction of the water conveyance facilities. Turbidity and sediment control measures that would be implemented by contractors as part of a SWPPP, Erosion and Sediment Control Plan, and the SPCCP include, but would not be limited to, the following, as described for Alternative 1A:

SWPPP

- Capture sediment via sedimentation and stormwater detention features.
- Implement concrete and truck washout facilities and appropriately sized storage, treatment, and disposal practices.
- Implement appropriate treatment and disposal of construction site dewatering from excavations to prevent discharges to surface waters.
- Prevent transport of sediment at the construction site perimeter, toe of erodible slopes, soil stockpiles, and into storm drains.
- Reduce runoff velocity on exposed slopes.
- Inspection and monitoring. A Qualified SWPPP Developer (QSD) would determine the combined Risk Level (Level 1, 2, or 3) of each construction site, which involves an evaluation of the site's "Sediment Risk" and "Receiving Water Risk." The SWPPP will also include a site and BMP inspection schedule. Performance standards will be met by implementing stormwater pollution

prevention BMPs that are tailored to specific site conditions, including the Risk Level of individual construction sites.

- Common to all Risk Levels:
  - Dischargers will ensure that all inspection, maintenance repair, and sampling activities at the construction site will be performed or supervised by a QSP representing the discharger.
  - Develop and implement a written site-specific Construction Site Monitoring Program (CSMP).
- Inspection, monitoring, and maintenance activities based on the Risk Level of the construction site (as defined in the SWRCB General Permit).
  - Risk Level 1 Sites:
    - Perform weekly inspections of BMPs, and at least once each 24-hour period during extended storm events.
    - At least two business days (48 hours) prior to each qualifying rain event (a rain event producing 0.5 inch or more of precipitation), visually inspect: (a) stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources; (b) all BMPs to identify whether they have been properly implemented in accordance with the SWPPP; and (c) stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.
    - Visually observe stormwater discharges at all discharge locations within two business days (48 hours) after each qualifying rain event and identify additional BMPs and revise the SWPPP accordingly.
    - Conduct minimum quarterly visual inspections of each drainage area for the presence of (or indications of prior) unauthorized and authorized non-stormwater discharges and their sources.
    - Collect one or more samples during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that will not be visually detectable in stormwater.
  - Risk Level 2 Sites:
    - Risk Level 2 dischargers will perform all of the same visual inspection, monitoring, and maintenance measure specified for Risk Level 1 dischargers.
    - Risk Level 2 dischargers will perform sampling and analysis of stormwater discharges to characterize discharges associated with construction activity from the entire disturbed area at all discharge points where stormwater is discharged off site.
    - At a minimum, Risk Level 2 dischargers will collect and analyze three samples per day for pH and turbidity of a qualifying rain event.
    - Dischargers who deploy an Active Treatment Systems (ATS) on their site, or a portion on their site, will collect ATS effluent samples and measurements from the discharge pipe or another location representative of the nature of the discharge.
  - Risk Level 3 Sites:
    - Risk Level 3 dischargers will perform all of the same visual inspection, monitoring, and maintenance measure specified for Risk Level 1 and Risk Level 2 dischargers.

- In the event that a Risk Level 3 discharger violates a numerical effluent limit (NEL) of the General Permit (i.e., pH and turbidity), and has a direct discharge into receiving waters, the discharger will subsequently sample receiving waters for all parameter(s) monitored in the discharge.
- Risk Level 3 dischargers disturbing 30 acres or more of the landscape and with direct discharges into receiving waters will conduct or participate in a benthic macroinvertebrate bioassessment of receiving waters prior to commencement of construction activity. The SWPPP will also specify the forms and records that must be uploaded to SWRCB online Stormwater Multiple Application and Report Tracking System (SMARTS), such as quarterly non-stormwater inspection and annual compliance reports. If the QSP determines the site is Risk Level 2 or 3, water sampling for pH and turbidity will be required and the SWPPP will specify sampling locations and schedule, sample collection and analysis procedures, and recordkeeping and reporting protocols. In accordance with the CGP numeric action level requirements, the project contractor will modify existing BMPs or implement new BMPs when effluent monitoring indicates that daily average runoff pH is outside the range of 6.5 to 8.5 and that the daily average turbidity is greater than 250 nephelometric turbidity units (NTUs). Additionally, if a given construction component is Risk Level 3, for that component will report to the SWRCB when effluent monitoring indicates that daily average runoff pH is outside the range of 6.0 to 9.0 and that the daily average turbidity is greater than 500 NTUs. In the event that the turbidity NEL is exceeded, it may also be required to sample and report to the SWRCB pH, turbidity, and suspended sediment concentration of receiving waters for the duration of construction.

- The project contractor will also conduct sampling of runoff effluent when a leak, spill, or other discharge of non-visible pollutants is detected.
- The CGP has specific monitoring and action level requirements for the Risk Levels, which are summarized in Table 3B-3 (Appendix 3B, *Environmental Commitments*).
- The QSP will be responsible for day-to-day implementation of the SWPPP, including BMP inspections, maintenance, water quality sampling, and reporting to SWRCB. If the water quality sampling results indicate an exceedance of allowable pH and turbidity levels, the QSD will modify the type and/or location of the BMPs by amending the SWPPP.

Erosion and Sediment Control Plan

- Install physical erosion control stabilization features (e.g., hydroseeding, mulch, silt fencing) to capture sediment and control both wind and water erosion.
- Design grading to be compatible with adjacent areas and result in minimal disturbance of the terrain and natural land features.
- Divert runoff away from steep, denuded slopes, or other critical areas with barriers, berms, ditches, or other facilities.
- Retain trees and natural vegetation to the extent feasible to stabilize hillsides, retain moisture, and reduce erosion.

- Limit construction, clearing of vegetation, and disturbance of soils to areas of proven stability.
- Implement construction management and scheduling measures to avoid exposure to rainfall events, runoff, or flooding at construction sites to the extent feasible.
- Use sediment ponds, silt traps, wattles, straw bale barriers or similar measures to retain sediment transported by runoff water onsite.
- Collect and direct surface runoff at non-erosive velocities to the common drainage courses.

SPCCP

- Absorbent pads, pillows, socks, booms, and other spill containment materials will be maintained at the hazardous materials storage sites for use in the event of spills.
- When transferring oil or other hazardous materials from trucks to storage containers, absorbent pads, pillows, socks, booms or other spill containment material will be placed under the transfer area.
- Absorbent pads and mats will be placed on the ground beneath equipment before refueling and maintenance.
- Equipment used in direct contact with water will be inspected daily to prevent the release of oil.
- Oil-absorbent booms will be used when equipment is used in or immediately adjacent to waters.
- Fuel transfers will take place a minimum distance from exclusion/drainage areas and streams, and absorbent pads will be placed under the fuel transfer operation.
- Equipment will be refueled only in designated areas.
- Staging areas will be designed to contain contaminants such as oil, grease, and fuel products so that they do not drain toward receiving waters or storm drain inlets.

By implementing measures and BMPs as part of these environmental commitments, the project would meet the requirements described in the Central Valley Regional Water Quality Control Board's *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan) for turbidity generation, which are as follows.

- Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20%.
- Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10%.

Turbidity levels would be monitored throughout construction as part of the SWPPP (see summary above and Appendix 3B, *Environmental Commitments*). In the event that any of these thresholds were exceeded, all turbidity-producing activities would be halted until turbidity levels subsided and/or appropriate corrective measures were taken. Turbidity effects in the Sacramento River and Clifton Court Forebay would be limited to the June 1 through October 31 in-water work period for the intake locations, a period with the least potential for most fish species to be in the vicinity of the in-water construction activities.

HMMP

Contractors working on the construction elements of Alternative 4A will develop and implement an HMMP before beginning construction. A specific protocol for the proper handling and disposal of hazardous materials will be established before construction activities begin and will be enforced by the project proponents. The HMMP will include, but not be limited to, the following measures or practices.

- Storage and transfer of hazardous materials will not be allowed within 100 feet of streams or sites known to contain sensitive biological resources except with the permission of CDFW.
- Soils contaminated by spills or cleaning wastes will be contained and removed to an approved disposal site.
- Storage or use of hazardous materials in or near wet or dry streams will be consistent with the Fish and Game Code and other state laws.

Dispose of Spoils, Reusable Tunnel Material, and Dredged Material

Contractors will properly handle, manage, and dispose of spoils, reusable tunnel material (RTM), and dredged material. Spoils and RTM will be stored in designated spoils and RTM areas, respectively. Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point. Spoils materials will not be placed in sensitive habitat areas, such as wetlands, vernal pools, alkali wetlands or grassland, native grasslands, riparian, or in floodplains identified by the Federal Emergency Management Agency (FEMA). Debris, rubbish, and other materials not directed to be salvaged will be removed from the work site as the contractor's property. Removed material will be disposed of in an approved disposal site and the contractor will obtain permits required for such disposal.

Following completion of construction, restoration of the RTM dewatering sites will be designed to prevent surface erosion and subsequent siltation of adjacent water bodies.

Dredged material will be disposed of in upland disposal sites to help ensure that the material will not be in contact with surface water. Handling and management of dredged material will include, but not be limited to, the following measures in addition to complying with applicable local, state and federal regulations.

- Conduct dredging activities in a manner that will not cause turbidity increases in the receiving water, as measured in surface waters 300 feet down-current from the construction site, to exceed the Basin Plan objectives beyond an approved averaging period by the Regional Water Quality Control Board (RWQCB) and CDFW.
- Silt curtains will be utilized to control turbidity if turbid conditions generated during dredging exceed the agreed-upon implementation requirements for compliance with the Basin Plan objectives.
- Design, construct, operate, and maintain the dredge material disposal site to prevent inundation or washout due to floods with a 100-year return frequency.
- Maintain 2 feet of freeboard in all dredge material disposal site settling pond(s) at all times when they may be subject to washout from a flooding event.
- Constructed DMD sites using appropriate BMPs to prevent discharges of contaminated stormwater to surface waters or groundwater.

Under Alternative 4A, five barge landings would be constructed and approximately 2,500 barge trips are projected to carry construction materials to the barge unloading facilities. The barge trips would take place continuously throughout construction, indicating that periodic turbidity pulses from propeller wash and wakes at the barge landings could occur year-round at the tunnel shaft locations. This potential impact would be minimized by implementing measures as part of a Barge Operations Plan (Appendix 3B, *Environmental Commitments*).

Barge Operations Plan

Construction contractors would implement the following avoidance measures to ensure that the goal of avoiding impacts on aquatic resources from tugboat and barge operations will be achieved.

- Training of tugboat operators.
- Prior to bringing equipment into the Delta, inspect and clean all in-water equipment such as barges and small work boats to prevent introduction of invasive aquatic species (plants, fish and animals)
- Dock approach and departure protocol
  - All vessels will approach and depart from the intake and barge landing sites at dead slow in order to reduce vessel wake and propeller wash at the sites frequented by tug and barge traffic.
  - In order to minimize bottom disturbance, anchors and barge spuds will be used to secure vessels only when it is not possible to tie up.
  - Barge anchoring will be pre-planned. Anchors will be lowered into place and not be allowed to drag across the channel bed.
  - Vessel operators will limit vessel speed as necessary to maintain wake of less than 2 feet (66 cm) at shore.
  - Vessel operators will avoid pushing stationary vessels up against the cofferdam, dock or other structures for extended periods since this could result in excessive directed propeller wash impinging on a single location. Barges will be tied up whenever possible to avoid the necessity of maintaining stationary position by tugboat or by the use of barge spuds.
  - Limiting vessel speed to minimize the effects of wake impinging on unarmored or vegetated banks and the potential for vessel wake to strand small fish; limiting the direction and\or velocity of propeller wash to prevent bottom scour and loss of aquatic vegetation; and prevention of spillage of materials and fluids from vessels, among other potential effects.
  - When transporting loose materials (e.g., sand, aggregate), barges will use deck walls or other features to prevent loose materials from blowing or washing off of the deck.

The plan would specify operating criteria during barge landing and departure designed to minimize erosion and turbidity generation associated with vessel wakes and propeller wash.

As noted above and for Alternative 1A, delta smelt evolved in environments with relatively high natural turbidity levels and are well-adapted to turbidity, which is generally higher in the west Delta and Suisun Bay than in the tidal freshwater environment where the proposed north Delta intakes would be constructed, modification of Clifton Court Forebay would occur, and the Head of Old River operable barrier would be constructed.

With environmental commitments, turbidity levels would be expected to be maintained within the natural range of variability likely to occur under baseline conditions. The environmental commitments summarized in this impact and contained in Appendix 3B, *Environmental Commitments* (*Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*) would be expected to effectively limit any increases in turbidity, such that any effects on delta smelt would be minimal, and not adverse.

Accidental Spills

Construction of Alternative 4A could result in accidental spills of contaminants, including cement, oil, fuel, hydraulic fluids, paint, and other construction-related materials, resulting in localized water quality degradation. As noted for Alternative 1A, such effects could in turn result in adverse effects on delta smelt, through direct injury and mortality or delayed effects on growth and survival, depending on nature and extent of the spill and the contaminants involved.

The greatest potential for an adverse water quality impact is associated with an accidental spill from construction activities occurring in or near surface waters. The north Delta intakes, construction and operation of the temporary barge landings at the tunnel shafts, and modification of Clifton Court Forebay all involve extensive in-water work. Other construction elements that occur in upland areas or are isolated from fish-bearing waters, have little potential for accidental spills that could affect fish. Implementation of environmental commitments (*Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; and Barge Operations Plan*), described in the summary below and specifically the *Spill Prevention, Containment, and Countermeasure Plan* (see of Appendix 3B, *Environmental Commitments*) would be expected to minimize the potential for introduction of contaminants to surface waters and provide for effective containment and cleanup should accidental spills occur. On this basis, the likelihood of adverse effects on delta smelt resulting from accidental spills is considered negligible. Therefore, there would not be an adverse impact to delta smelt from accidental spills.

SPCCP

Contractors involved in construction and maintenance of Alternative 4A will develop and implement SPCCPs. Multiple SPCCPs will be developed to take into account site-specific conditions, and implemented to minimize effects from spills of oil or oil-containing products during Alternative 4A construction and operation. The SPCCPs will include, but not be limited to, the following measures and practices in addition to those listed above under *Temporary Increases in Turbidity*.

- Personnel will be trained in emergency response and spill containment techniques, and will also be made aware of the pollution control laws, rules, and regulations applicable to their work.
- Petroleum products will be stored in non-leaking containers at impervious storage sites from which runoff is not permitted to escape.
- Contaminated absorbent pads, pillows, socks, booms, and other spill containment materials will be placed in non-leaking sealed containers until transport to an appropriate disposal facility.
- All reserve fuel supplies will be stored only within the confines of a designated staging area.

- All stationary equipment will be positioned over drip pans.
- In the event of a spill, personnel will identify and secure the source of the discharge and contain the discharge with sorbents, sandbags, or other material from spill kits and will contact appropriate regulatory authorities (e.g., National Response Center will be contacted if the spill threatens navigable waters of the United States or adjoining shorelines, as well as other response personnel).

Methods of cleanup may include the following.

- Physical—Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Mechanical—Mechanical methods could include the use of vacuum cleaning systems and pumps.
- Chemical—Cleanups of material can be achieved with the use of appropriate chemical agents such as sorbents, gels, and foams.

Disturbance of Contaminated Sediments

The construction footprint for Alternative 4A includes areas with known or potentially contaminated sediments, indicating the potential for release and dispersal of these contaminants if these sediments are disturbed during construction. As noted for Alternative 1A, individual delta smelt could be directly exposed to elevated levels of contaminants if they are in immediate proximity to construction activities that disturb contaminated sediments. Bed disturbance could also result in indirect effects on delta smelt. Toxins in river channel sediments can enter the food chain via benthic organisms. If contaminated sediments are disturbed and become suspended in the water column, they also become available directly to pelagic organisms, including covered fish species and planktonic food sources of covered species. The bioaccumulation of toxins can lead to lethal and sublethal effects.

The potential effects of toxins on fish such as delta smelt would depend on the types and concentrations of the toxins in disturbed sediments, but few chemical data are available related to sediments in the construction areas. Toxins that tend to bind to particulates do not mix homogeneously into the sediment, and concentrations can vary widely over a small area.

The three proposed water intakes would be located in the Sacramento River, downstream of the main urban area of the City of Sacramento, with sediments at these locations being affected by historical and current urban discharges from the city. Metals (lead and copper), hydrocarbons, organochlorine pesticides, and PCBs are common urban contaminants with the greatest affinity for sediments; these contaminants could be present in sediments that would be disturbed during installation of the cofferdams and dredging. In addition, mercury is present in the Sacramento River system and could be sequestered in bottom sediments. The barge landings would be constructed on smaller waterways, which are more likely to contain agricultural-related toxins such as copper and organochlorine pesticides; the same may be true for the modification of Clifton Court Forebay, which receives water conveyed through the smaller waterways surrounding it, as well as for the Head of Old River operable barrier area, which is downstream from major agricultural areas in the San Joaquin valley.

Metals, PCBs, and hydrocarbons (typically oil and grease) are common urban contaminants that are introduced to aquatic systems via nonpoint-source stormwater drainage, industrial discharges, and municipal wastewater discharges. Many of these contaminants readily adhere to sediment particles and tend to settle out of solution relatively close to the primary source of contaminants. PCBs are persistent, adsorb to soil and organics, and bioaccumulate in the food chain. Lead and other metals also will adhere to particulates and organics, and many metals will also bioaccumulate to levels sufficient to cause adverse biological effects. Hydrocarbons biodegrade over time in an aqueous environment and do not tend to bioaccumulate; thus, they are not persistent.

As noted for Alternative 1A, because the toxins are entering the water column attached to sediment, their movement is closely linked to turbidity, which is an indicator of the amount of particulates in the water column. Turbidity, and in turn suspension of sediments, would be minimized by implementation of environmental commitments described in the summary below and in Appendix 3B, *Environmental Commitments* (*Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). In addition, exposure of sensitive fish species such as delta smelt to any disturbed contaminated sediments would be minimized because in-water construction activities would occur between June 1 and October 31 when most covered fish species are least abundant in the in-water construction area (see Section 11.3.1.1, *Potential Impacts Resulting from Construction and Maintenance of Water Conveyance Facilities* in the Draft EIR/EIS).

Prior to the onset of construction activities, field management and construction personnel will be trained on the need to avoid and protect sensitive resources during construction of Alternative 4A. Turbidity and sediment control measures would be implemented by contractors as part of a SWPPP and an Erosion and Sediment Control Plan, as described above under *Temporary Increases in Turbidity*.

To avoid effects from disturbing contaminated sediments, the construction contractors will develop and implement an HMMP before beginning construction. Multiple HMMPs would be developed to take into account specific site conditions. In addition to the measures described under *Temporary Increases in Turbidity*, HMMP measures to address contaminated sediments will include, but not be limited to, the following.

- Soils contaminated by spills or cleaning wastes will be contained and removed to an approved disposal site.
- Storage or use of hazardous materials in or near wet or dry streams will be consistent with the Fish and Game Code and other state laws.
- Hazardous waste generated at work sites, such as contaminated soil, will be segregated from other construction spoils and properly handled, hauled, and disposed of at an approved disposal facility by a licensed hazardous waste hauler in accordance with state and local regulations. The contractor will obtain permits required for such disposal.

Proper handling, storage, and disposal of contaminated sediments would avoid and minimize the entry of contaminants into water bodies. In addition to measures described in *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material* under *Temporary Increases in Turbidity,* above, measures relevant to this impact include the following (see Appendix 3B for the complete plan).

- RTM and RTM decant liquid will undergo chemical characterization by the contractor(s) prior to reuse or discharge, respectively, to meet NPDES and the Central Valley Water Board requirements.

- Should RTM or RTM decant liquid constituents exceed discharge limits, these tunneling byproducts will be treated to comply with NPDES permit requirements. Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point.
- If RTM liquid requires chemical treatment, chemical treatment will be nontoxic to aquatic organisms.
- Hazardous materials excavated during construction will be segregated from other construction spoils and properly handled in accordance with applicable state and local regulations. Riverine or in-Delta sediment dredging and dredge material disposal activities involve potential contaminant discharges not addressed through typical NPDES or SWRCB General Permit processes. Construction of Dredge Material Disposal (DMD) sites will likely be subject to the SWRCB General Permit (Order No. 2009-0009-DWQ).
- Contractors undertaking construction of Alternative 4A will implement BMPs such as, but not limited to:
    - Prior to initiating any dredging activity, contractors will prepare and implement a pre-dredge sampling and analysis plan (SAP) (as part of the water plan required per standard DWR contract specifications Section 01570) to evaluate the presence of contaminants that may impact water quality from a variety of discharge routes.
    - The DMD will be designed to contain all of the dredged material to the extent practicable, and all systems and equipment associated with necessary return flows from the DMD site to the receiving water will be operated to maximize treatment of return water and optimize the quality of the discharge.
    - DMD sites will be constructed using appropriate BMPs to prevent discharges of contaminated stormwater to surface waters or groundwater.

To address contamination risk from barge operations, construction contractors will develop, submit, and implement a barge operations plan per standard DWR contract specifications as part of the traffic plans required in Section 01570. This plan is intended to protect aquatic species and habitat in the vicinity of barge operations. If and when avoidance is not possible, the plan will include provisions to minimize, reduce, or mitigate effects on aquatic species.

The barge operations plan will be part of a comprehensive traffic control plan coordinated with the Coast Guard for large channels, which will address traffic routes and machines used to deliver materials to and from the barges. The plan will address contamination risks such as the following:

- Accidental material spillage.
- Sediment and benthic (bottom-dwelling) community disturbance from accidental or intentional barge grounding or deployment of barge spuds (extendable shafts for temporarily maintaining barge position).
    - Hazardous materials spills (e.g., fuel, oil, hydraulic fluids).

The plan will serve as a guide to barge operations and to a Biological Monitor who will evaluate barge operations with respect to stated performance measures. Construction contractors operating barges as part of Alternative 4A facilities construction will be responsible for operating their vessels safely; developing and implementing the barge operations plan; reporting any spills, incidents or deviations from the plan that might pose risks to species or water quality to the Project Biological

Monitor and/or DWR; and following all other relevant plans. Therefore, there would not be an adverse impact to delta smelt from the disturbance of contaminated sediments.

Underwater Noise

The assessment of underwater noise impacts on fish is based on the overlap of construction activities (timing, location, duration) with the spatial and temporal distribution of sensitive species and life stages. An important measure for reducing the potential exposure of the population to pile driving noise is the restriction of in-water pile driving activities to June 1 through October 31, a period when most fish are not present in the construction area. The project proponents intend to construct sheetpile cofferdams at the intakes and at the head of Old River barrier using vibratory pile driving for at least 80–90% of the time, depending on the specific site conditions. In addition, the project proponents propose to install piles using vibratory methods or other non-impact driving methods for the intakes, wherever feasible, to minimize adverse effects on fish and other aquatic organisms (Mitigation Measure AQUA-1a). However, the degree to which vibratory driving can be performed effectively is unknown at this time due to as yet undetermined geologic conditions at the construction sites. The remaining pile driving would be conducted using an impact pile driver. Once constructed, if the foundation design for either the intakes or head of Old River barrier requires piles, pile driving to construct foundations would be conducted from within the cofferdam; it is still undetermined if the foundation will use piles or drill-shaft methods, which does not require pile driving. If piles are included in the design, project proponents will isolate pile driving activities within dewatered cofferdams as a means of minimizing noise levels and potential adverse effects on fish. However, some uncertainty also exists regarding the extent to which the cofferdams can be dewatered and therefore the magnitude at which this measure can minimize underwater noise. If the cofferdams cannot be dewatered, or if pile driving noise exceeds applicable thresholds, project proponents will construct a bubble curtain or other attenuation device to minimize underwater noise (Mitigation Measure AQUA-1b). Project proponents will work with contractors to minimize pile driving, particularly impact pile driving, by using floating docks instead of pile-supported docks, wherever feasible considering the load requirements of the landings and the site conditions. If pile supported docks are required, piles would be designed to safely support the docks and to minimize underwater noise. If dock piles for barge landings cannot be installed using vibratory methods, attenuation devices will be used to reduce the area that would be exposed to underwater sound levels (Mitigation Measure AQUA-1b). Since the specific construction mechanisms are currently under development, to address these uncertainties, this analysis presents worst-case impacts based on the use of an impact driver in open water with no attenuation measures. It should also be recognized that the computed distances over which pile driving sounds are expected to exceed the injury and behavioral thresholds assume an unimpeded open water propagation path. However, site conditions such as major channel bends and other in-water structures can reduce these distances by impeding the propagation of underwater sound waves.

Table 4.3.7-1 presents the computed impact areas and schedule for each facility or structure where pile driving is proposed to occur in open water or on land adjacent to open water (<200 feet). Sound monitoring data from similar pile driving operations (impact driving) indicate that single-strike peak SPLs and SELs exceeding the interim injury thresholds are expected to be limited to areas within 10–14 meters (33–46 feet) of the source piles (Table B.7-79 in Appendix B of this RDEIR/SDEIS), potentially causing direct injury or mortality of fish close to the source piles. This risk may extend up to 3,280 feet away for fish that remain within this distance of the source piles over the course of a full day of pile driving operations. Assuming that impact driving is the principal pile driving method, cumulative exposures of fish to underwater noise levels exceeding the injury thresholds could occur up to 2,814 feet away from the source piles during cofferdam installation, 3,280 feet away from the source piles during foundation pile installation, and 1,522 feet away from the source piles during bridge pile installation. Such exposures could occur over periods of 42 days during cofferdam installation, 8 days during foundation pile installation, and 5 days during bridge pile installation.

Table 4.3.7-1. Estimated Distances and Areas of Waterbodies Subject to Pile Driving Noise Levels Exceeding Interim Injury and Behavioral Thresholds, and Proposed Timing and Duration of Proposed Pile Driving Activities for Facilities or Structures in or Adjacent to Sensitive Rearing and Migration Corridors of the Covered Species (Alternative 4A)

Facility or Structure	Average Width of Water Body (feet)	Distance to Cumulative 187 and 183 dB SEL Injury Threshold[1, 2] (feet)	Potential Impact Area[3] (acres)	Distance to 150 dB RMS Behavioral Threshold[2] (feet)	Year of Construction	Duration of Pile Driving (days)
Intake 2						
Cofferdam	645	2,814	83	13,058	Year 4	42
Foundation		3,280	97	32,800	Year 5	8
SR-160 Bridge		1,522	45	7,065	Year 6	5
Intake 3						
Cofferdam	560	2,814	72	13,058	Year 3	42
Foundation		3,280	84	32,800	Year 4	8
SR-160 Bridge		1,522	39	7,065	Year 5	5
Intake 5						
Cofferdam	535	2,814	69	13,058	Year 2	42
Foundation		3,280	81	32,800	Year 3	8
SR-160 Bridge		1,522	37	7,065	Year 4	5
Barge Unloading Facilities						
Piers	300–1,350	1,774	24-110	9,607	Year 5	13
Clifton Court Forebay						
Cofferdams	10,500	2,814	364	13,058	Year 8	450
Siphon – N. Inlet		1,774	144	9,607	Year 9	72
Siphon – N. Outlet		1,774	144	9,607	Year 9	72
Head of Old River Operable Barrier						
Cofferdams	700	2,814	22	13,058	Year 7	37
Foundation		1,774	14	9,607	Year 7	7

[1] Distances to injury thresholds are governed by the distance to "effective quiet" (150 dB SEL).

[2] Distance to injury and behavioral thresholds assume an attenuation rate of 4.5 dB per doubling of distance and an unimpeded propagation path; on-land pile driving, vibratory driving or other non-impact driving methods, dewatering of cofferdams, and the presence of major river bends or other channel features can impede sound propagation and limit the extent of underwater sounds exceeding the injury and behavioral thresholds.

[3] Based on the area of open water subject to underwater sound levels exceeding the cumulative SEL thresholds for fish larger than 2 grams (187 dB) and smaller than 2 grams (183 dB); for open channels, this area is calculated by multiplying the average channel width by twice the distance to the injury thresholds, assuming an unimpeded propagation path upstream and downstream of the source piles.

Table 11-8 presents the life stages of delta smelt and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Delta smelt are considered highly vulnerable to pile driving noise because of their small size and inability of eggs and larvae to actively avoid elevated noise levels. Larval and juvenile delta smelt are smaller than 2 grams while adults are close to 2 grams in size (mature male and female delta smelt average 2.1 grams and 2.7 grams with a standard error of 0.3 and 0.6 grams, respectively [Foott and Bigelow 2010]); therefore, the interim threshold of 183 dB SEL is applicable to the majority of the population when evaluating the potential for injury or mortality of delta smelt due to pile driving noise.

Because delta smelt are generally found in the west Delta and Cache Slough/Liberty Island area during the spring and summer, the majority of individuals would not be exposed to construction-related underwater noise. However, delta smelt could be present at low abundance in the north, east, and south Delta during the period when in-water construction activity would occur, indicating some potential for exposure. Adults, which complete their spawning cycle and die by mid- to late June, could be exposed to pile driving noise following the onset of in-water pile driving in June. If a portion of the population spawns upstream of the construction areas, larvae could potentially drift through the areas affected by underwater sound. Thus, the potential exists for small numbers of spawning adults (during June) or larval delta smelt (during June and July) to occur in the vicinity of the intakes and the barge landings during the in-water construction period. With implementation of proposed timing restrictions on in-water pile driving activities (June 1 through October 31) and the use of vibratory pile driving methods whenever feasible (Mitigation Measure AQUA-1a), potential injury or mortality of delta smelt from pile driving noise is expected to be minimal and unlikely to have significant population-level effects.

Other construction activities that can generate underwater noise exceeding background levels (e.g., barge operations) are not expected to result in direct harm to delta smelt or other fish species. These kinds of activities typically produce noise levels below the behavioral effects threshold of 150 dB RMS, which may temporarily alter fish behavior but does not result in permanent harm or injury.

Fish Stranding

As described for Alternative 1A, in-water work activities have the potential to cause take of fish through the process of capturing and rescuing stranded or trapped fish from construction areas. In-water work activities at the north Delta intakes would include installation of sheet pile cofferdams at each intake location to isolate active construction activities from the Sacramento River and minimize the potential for increases in turbidity. In addition, sheet pile cofferdams and dewatering during modification of Clifton Court Forebay could result in stranding of delta smelt and other fish that would require capture and rescue.

Although delta smelt larval and adult life stages are potentially present in the vicinity of the intakes and Clifton Court Forebay from January through July, the timing of cofferdam installation (June through August) would avoid the majority of the spawning and larval recruitment season when delta smelt are most likely to be present (see Table 11-8). Potential effects of fish stranding typically result in direct or indirect injury or mortality from subsequent dewatering of work areas and other construction activities. These effects would be minimized by implementation of environmental commitments described in the summary below and in Appendix 3B, *Environmental Commitments* (*Fish Rescue and Salvage Plan*). Although fish would likely avoid the noise and activity of sheet pile installation, cofferdams have the potential to entrap some fish. While the number of fish affected is unknown, entrapment could include a few hundred fish (total of all species), potentially including a small number of delta smelt.

Fish Rescue and Salvage Plan

As noted for Alternative 1A, DWR will develop the Fish Rescue and Salvage Plan and submit it to the appropriate resource agencies (CDFW, USFWS, and NMFS) for their review and acceptance, and revise it accordingly. The plan will include detailed procedures for fish rescue and salvage to minimize the number of fish stranded during placement and removal of cofferdams at the intake construction sites. The plan will identify the appropriate procedures for removing fish from the construction zone, and preventing fish from re-entering the construction zone during construction, or prior to dewatering. The plan will include detailed fish collection, holding, handling, and release procedures.

Prior to construction site dewatering, fish will be captured and relocated to avoid direct mortality and to minimize take. The appropriate fish collection method will be determined by a qualified fish biologist, in consultation with the designated resource agency biologist, and based on site-specific conditions prior to dewatering the cofferdam. Collection methods may include use of seines (nets) and/or dip nets to collect and remove fish, and electrofishing techniques may also be permitted. Collection methods have varying degrees of effectiveness and may result in some trapped or stranded fish not being rescued. Although the use of these methods can also result in fish injury or mortality, these effects are typically minor, and often avoided by appropriate training. Therefore, there would not be an adverse impact to delta smelt from fish stranding.

The results of the fish rescue and salvage operations (including date, time, location, comments, method of capture, fish species, number of fish, approximate age, condition, release location, and release time) will be reported to the appropriate resource agencies, as specified in the pertinent permits.

In-Water Work Activities

As described for Alternative 1A, in-water work activities under Alternative 4A have the potential to injure or kill fish such as delta smelt through direct physical injury from construction activities. In-water work activities at the north Delta intakes would include installation of sheet pile cofferdams at each intake location, piles at each barge landing, placement of riprap to protect the stream banks adjacent to the intakes from erosion, and dredging. Modification of Clifton Court Forebay and construction of the Head of Old River operable barrier would include major in-water activities such as excavation, fill, and sheet pile cofferdam installation.

Although fish would likely avoid the noise and activity of pile installation and placement of riprap protection, these activities have the potential to result in direct and indirect injury or mortality; trapped or stranded fish would be susceptible to increased sound exposure effects from pile driving, riprap placement can crush or displace fish, and dredging activities can also crush or entrain fish. Delta smelt larval and adult life stages may potentially be present in the vicinity of the intakes, barge landings, and Clifton Court Forebay during January through July; however, the timing of cofferdam and riprap installation (June through October) would avoid most of the spawning season (January through June, with peak numbers in the north Delta during February through May) when delta smelt are most likely to be present (see Table 11-8). In-water work at the Head of Old River operable barrier would occur between August 1 and November 30, therefore minimizing potential for effects on delta smelt. In addition to these timing restrictions, potential in-water activity effects would be minimized by implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, including *Erosion and Sediment Control Plan*; *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; and *Barge Operations Plan*. Therefore, there would not be an adverse impact to delta smelt from in-work water activities. Pertinent aspects of these plans include, respectively the following.

- Install physical erosion control stabilization features (hydroseeding, mulch, silt fencing, fiber rolls, sand bags, and erosion control blankets) to capture sediment and control both wind and water erosion.
- Divert runoff away from steep, denuded slopes, or other critical areas with barriers, berms, ditches, or other facilities.
- Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point. If RTM liquid requires chemical treatment, chemical treatment will be nontoxic to aquatic organisms.
- Following completion of construction, restoration of the RTM dewatering sites will be designed to prevent surface erosion and subsequent siltation of adjacent water bodies.
- Conduct dredging within the allowable seasonal "work windows" established by the regulatory agencies.
- Conduct dredging activities in a manner that will not cause turbidity increases in the receiving water, as measured in surface waters 300 feet down-current from the construction site, to exceed the Basin Plan objectives beyond an approved averaging period by the RWQCB and CDFW.
- The DMD will be designed to contain all of the dredged material to the extent practicable, and all systems and equipment associated with necessary return flows from the DMD site to the receiving water will be operated to maximize treatment of return water and optimize the quality of the discharge.
- The Barge Operations Plan will include training of tugboat operators, limiting vessel speed to minimize the effects of wake impinging on unarmored or vegetated banks and the potential for vessel wake to strand small fish, limiting the direction and\or velocity of propeller wash to prevent bottom scour and loss of aquatic vegetation, and preventing spills of materials and fluids from vessels.
- In order to minimize bottom disturbance, anchors and barge spuds will be used to secure vessels only when it is not possible to tie up.
- Barges will not be anchored where they will ground during low tides.
- When transporting loose materials (e.g., sand, aggregate), barges will use deck walls or other features to prevent loose materials from blowing or washing off of the deck.

Loss of Spawning, Rearing, or Migration Habitat

As noted for Alternative 1A, in-water construction would temporarily or permanently alter habitat conditions in the vicinity of the construction activities, but the use of the affected habitats for delta smelt spawning and rearing is likely limited and therefore would not be expected to affect population productivity. Construction of the three intake structures and associated permanent bankline modifications would result in a permanent modification of 2.6 miles of Sacramento River channel margin within potential delta smelt migration, spawning, and rearing habitat. Cofferdams would isolate the work areas, temporarily reducing the width of riverine habitat available to fish for migration and rearing, but this will have an insignificant effect on upstream and downstream fish passage because the cofferdams would typically occupy only about 10% of the cross section of the river, and cumulatively occupy only a couple of miles of the overall river length. These isolated areas also represent a very small portion of the available migration and rearing habitat in the Delta, and there is no indication that these areas are uniquely important to the overall viability of the delta smelt population. Alternative 4A will result in the permanent loss of low-quality migration, spawning, and rearing habitat where the existing river banks and bed areas would be replaced with permanent in-water structures.

Each of the five proposed barge landings would include in-water and over-water structures, such as piling dolphins, docks, ramps, and possibly conveyors for loading and unloading materials; and vehicles and other machinery. As noted for Alternative 1A, the barge landings would each occupy approximately 15,000 square feet of nearshore habitat within their respective delta channels (see Mapbook M3-4 for locations). In addition to effects of the constructed barge landings on habitat, barge operations have the potential to affect bottom sediments and benthic habitat through propeller wash effects. This is most relevant in the vicinity of the barge landings and in narrow channels where tugboats will be near the channel bottom and could stir up bottom sediments and submerged aquatic vegetation, potentially resulting in temporary disturbance of rearing habitat. As described for Alternative 1A, tugboat and barge speeds in the narrow channels would be low enough that vessel wakes are not expected to affect shoreline habitat.

Potential effects of these in-water structures and activities would be minimized by limiting the size of the in-water structures where practicable, limiting the amount of dredging and other habitat disturbing activities, enhancing channel margin habitat through *Environmental Commitment 6 Channel Margin Enhancement*, adhering to the approved in-water construction window (expected to be June 1 through October 31), and implementing environmental commitments described in Appendix 3B, *Environmental Commitments*, including *Erosion and Sediment Control Plan*; *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; and *Barge Operations Plan*. Specific measures of those plans previously described for turbidity, accidental spills, and in-water work activities also would address the loss of habitat. Therefore, there would not be an adverse impact to delta smelt from the loss of spawning, rearing, and migration habitat. Additional potentially relevant elements of the Erosion and Sediment Control Plan include the following.

- Conduct frequent site inspections (before and after significant storm events) to ensure that control measures are working properly and to correct problems as needed.
- Deposit or store excavated materials away from drainage courses.
- Vegetative material from work site clearing will be chipped, stockpiled, and spread over the topsoil after earthwork is completed when practical and appropriate to do so.
- Rocks and other inorganic grubbed materials will be placed in the common backfill whenever possible. Debris, rubbish, and other materials not directed to be salvaged will be removed from the work site.

Predation

As noted for Alternative 1A, in-water pilings and over-water structures, such as those that would be constructed at the barge landings, have the potential to provide habitat for predatory fish that may prey on delta smelt. Pilings and other structures may provide perching habitat for avian predators and cover for introduced predacious fish species. While fish predators could use this cover to ambush prey, and potentially improve their foraging success, avian predators are unlikely to forage directly from the docks or piles. The overwater piers and support structures would represent a very small increase in the overall predator habitat the Delta and so it is unlikely that temporary structures associated with construction would increase habitat availability sufficiently to significantly increase the potential for predation relative to baseline conditions. This is particularly true given that several of the barge unloading sites are either outside the main distribution of delta smelt (i.e., Glannvale Tract on Snodgrass Slough) or are in south Delta channels where survival would be expected to be low in any case, because of entrainment by the south Delta export facilities and related predation (i.e., Old River at Victoria Island and Old River at the northeast corner of Clifton Court Forebay). In addition, all the barge landings would be removed after construction and thus any predation effects would be temporary.

This indicates that increased predation on delta smelt associated with project construction is likely to be low. Although it is plausible that localized increases in predation rates could occur because of in-water and over-water structures providing suitable predator habitat at places where delta smelt could occur, these localized increases are not expected to have wide-spread or population-level effects. Therefore, there would not be an adverse impact to delta smelt from increased predation.

Summary

Construction of Alternative 4A includes several elements with the potential to cause adverse effects on delta smelt through spills of hazardous materials or underwater noise. However, adverse effects will be effectively avoided and minimized by siting construction in areas that are minimally used by this species, and through the use of in-water work windows, activity-specific timing restrictions, and environmental commitments.

Alternative 4A includes several environmental commitments that will avoid and limit spills, potentially leading to adverse water quality effects on delta smelt. These include *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan;* and *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material* (see Appendix 3B, *Environmental Commitments* of the Draft EIR/EIS). These commitments would guide rapid and effective response in the case of inadvertent spills of hazardous materials. In combination with the species' natural tolerance to elevated turbidity levels, and limited occurrence in the construction areas, these environmental commitments would be expected to protect delta smelt from any adverse water quality effect resulting from project construction.

Delta smelt could be adversely affected by elevated underwater noise associated with impact pile driving and direct exposure to construction-related disturbance. The number of individuals affected is expected to be limited, based on the fact that delta smelt are typically present at low densities in the affected habitats during the in-water work window. The in-water work window will minimize, but perhaps not completely avoid, the potential for injury or mortality. Mitigation Measures AQUA-1a and AQUA-1b would further minimize adverse effects from impact pile driving. Implementation of environmental commitments *Fish Rescue and Salvage Plan* and *Barge Operations Plan* (as described in Appendix 3B, *Environmental Commitments*) would also minimize adverse effects from construction-related disturbance. As a result, while these construction activities could adversely affect individual delta smelt, these effects would not result in adverse population-level effects on delta smelt.

Construction would not be expected to measurably increase predation rates relative to baseline conditions because the locally increased predator habitat and predation from temporary construction structures would not have population-level effects.

Construction of Alternative 4A will result in both temporary and permanent alteration of migration, spawning, and rearing habitats used by delta smelt. However, these effects are not expected to be adverse from a population standpoint, because local water quality conditions (very low electrical conductivity and typically low turbidity) in the proposed north Delta intakes reach limits habitat suitability. In addition, changes to Clifton Court Forebay occur in a marginal environment within which delta smelt are trapped once entrained, with little prospect of effective salvage. The principal in-water work activities at the Head of Old River operable barrier will be conducted during August–November, and therefore would have minimal temporal overlap with delta smelt; the location of this site generally would be expected to result in minimal spatial overlap with delta smelt in any case. Moreover, any habitat losses will be offset by restoration of 59 acres of tidal habitat and the beneficial operational effects of Alternative 4A (described below) on the Delta as a whole.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-1, the effect would not be adverse for delta smelt.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-1, the impact of the construction of the water conveyance facilities on delta smelt or critical habitat would not be significant except for construction noise associated with pile driving outside the work window. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

BDCP proponents will include specification in any construction contracts involving the installation of in-water or nearshore pilings, that piles will be installed using vibratory methods, or other non-impact driving methods, wherever feasible, especially outside of the in-water work window. Such methods have been shown to effectively minimize physical or substantial behavioral effects on fish and other aquatic species. The method selected will be based on geotechnical studies that will be conducted to determine the feasibility of vibratory installation of sheet pile, intake pipe foundation piles, and dock piles for barge landings. Additionally, the vibratory hammer will be started gradually to alert fish in the area that vibration will occur.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

If Mitigation Measure AQUA-1a cannot be implemented during pile driving activities that occur in-water, project proponents will implement Mitigation Measure AQUA-1b, which would include the monitoring of noise and if necessary, the attenuation of noise through either the dewatering of the cofferdam area and/or the installation of a bubble curtain or other attenuation device to minimize underwater noise. This measure would not be applicable to sheet pile installations, where it would not be feasible to surround the entire sheet pile wall, and which are expected to be installed using a vibratory hammer for at least 80–90% of the time. Where impact pile driving is required, DWR will monitor underwater sound levels to determine compliance with the underwater noise effects thresholds at a distance appropriate for protection of the species (183 dB $SEL_{cumulative}$ for fish less than 2 grams; 187 dB $SEL_{cumulative}$ for fish greater than 2 grams). If noise is expected to exceed applicable thresholds, an attenuation device or other mechanism to minimize noise will be implemented.

Impact AQUA-2: Effects of Maintenance of Water Conveyance Facilities on Delta Smelt

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4 (see Impact AQUA-2). As concluded in Alternative 4, Impact AQUA-2, the impact would not be adverse for delta smelt or their designated critical habitat.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As described in Alternative 4, Impact AQUA-2 for delta smelt, the impact of the maintenance of water conveyance facilities on delta smelt or critical habitat would not be significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-3: Effects of Water Operations on Entrainment of Delta Smelt

Water Exports from SWP/CVP South Delta Facilities

Alternative 4A would result in lower overall entrainment of delta smelt than NAA_ELT. The predicted entrainment of larval/juvenile delta smelt at the south Delta export facilities was generally lowest under Scenario H4_ELT operations, and highest under the NAA_ELT and H3_ELT scenarios (Figure 11-4A-1). Both of the Alternative 4A subscenarios would result in lower entrainment of delta smelt in wet and above-normal water years; however, only H4_ELT provided for lower predicted larval/juvenile entrainment in below-normal and dry water years, and both of the subscenarios had similar entrainment to the NAA_ELT in critical water years.

The predicted entrainment of adult delta smelt was generally lower than NAA_ELT under Alternative 4A operations (Figure 11-4A-2). This pattern was most pronounced and most similar among subscenarios in wet and above-normal water years in which predicted entrainment was lowered by about one-third and one-quarter respectively. The predictions of adult delta smelt entrainment were lower than, but increasingly similar to, the NAA_ELT as modeled hydrology got drier (below-normal, dry, critical). Estimated entrainment under Scenario H3_ELT would be 0.02

less (21% lower in relative terms) than NAA_ELT for adults and similar to NAA_ELT for the larvae/juveniles (Table 11-4A-1). These differences represent 0.02 (2%) of the total population.

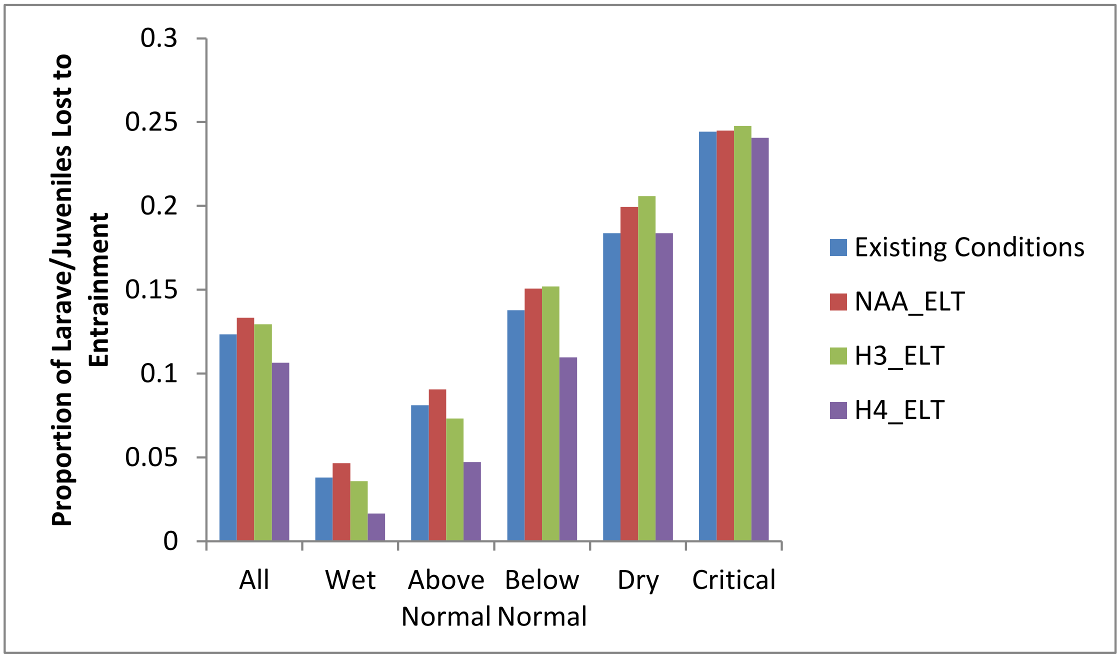

Figure 11-4A-1. Average Annual Estimated Proportion of the Larval/Juvenile Delta Smelt Population Lost to Entrainment at the SWP/CVP South Delta Facilities for Alternative 4A (Scenarios H3_ELT and H4_ELT), Based on the Proportional Entrainment Regression

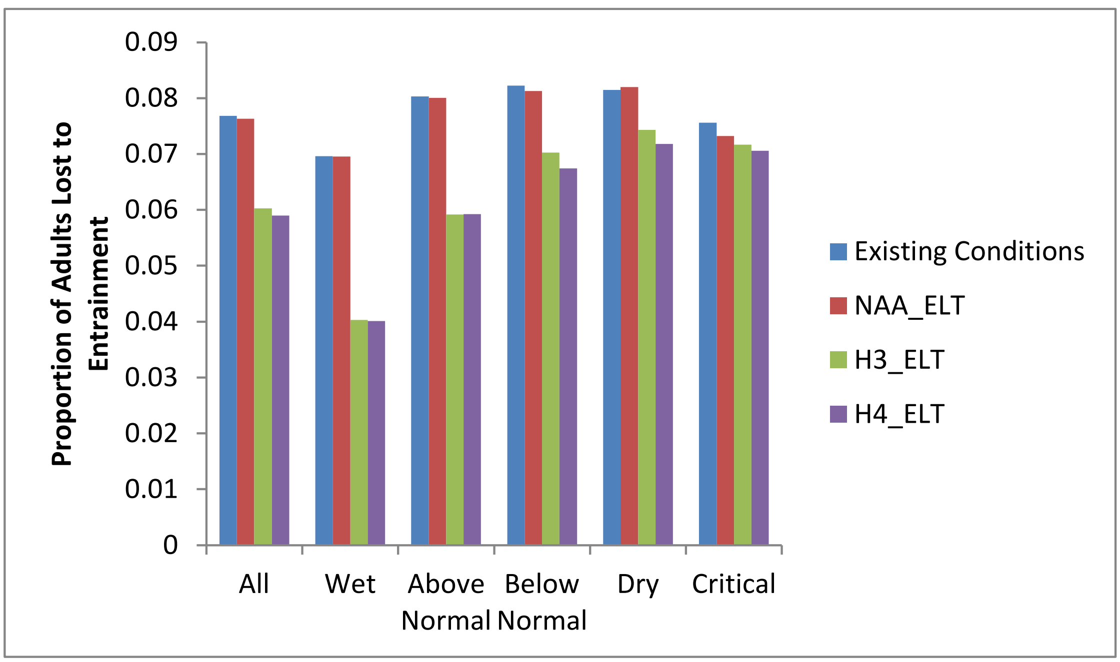

Figure 11-4A-2. Average Annual Estimated Proportion of the Adult Delta Smelt Population Lost to Entrainment at the SWP/CVP South Delta Facilities for Alternative 4A (Scenarios H3_ELT and H4_ELT), Based on the Proportional Entrainment Regression

Table 11-4A-1. Proportional Entrainment Index of Delta Smelt at SWP/CVP South Delta Facilities for Alternative 4A (Scenario H3_ELT)

	Proportional Entrainment[a] Difference in Proportions (Relative Change in Proportions)	
Water Year	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Total Population		
Wet	-0.032 (-29%)	-0.040 (-34%)
Above Normal	-0.029 (-18%)	-0.038 (-22%)
Below Normal	0.002 (1%)	-0.010 (-4%)
Dry	0.015 (6%)[b]	-0.001 (0%)
Critical	0.0 (0%)	0.001 (0%)
All Years	-0.011 (-5%)	-0.020 (-10%)
Juvenile Delta Smelt (March–June)		
Wet	-0.002 (-6%)	-0.011 (-23%)
Above Normal	-0.008 (-10%)	-0.017 (-19%)
Below Normal	0.014 (10%)[b]	0.001 (1%)
Dry	0.022 (12%)[b]	0.006 (3%)
Critical	0.004 (1%)	0.003 (1%)
All Years	0.006 (5%)	-0.004 (-3%)
Adult Delta Smelt[c] (December–March)		
Wet	-0.029 (-42%)	-0.029 (-42%)
Above Normal	-0.021 (-26%)	-0.021 (-26%)
Below Normal	-0.012 (-15%)	-0.011 (-14%)
Dry	-0.007 (-9%)	-0.008 (-9%)
Critical	-0.004 (-5%)	-0.002 (-2%)
All Years	-0.017 (-22%)	-0.016 (-21%)

Shading indicates >5% or more increased entrainment.

Note: Negative values indicate lower entrainment loss under Alternative 4A (Scenario H3_ELT) than under existing biological conditions.

[a] Proportional entrainment index calculated in accordance with USFWS BiOp (U.S. Fish and Wildlife Service 2008a).

[b] Results reflect influence of sea level rise on X2: Existing Conditions does not include sea level rise, whereas Alternative 4A includes 15 cm of sea level rise, which results in greater X2 and therefore greater estimated entrainment per the relationship from the USFWS BiOp (U.S. Fish and Wildlife Service 2008a).

[c] Adult proportional entrainment adjusted according to Kimmerer (2011).

Entrainment losses of delta smelt at the SWP/CVP south Delta facilities are related to OMR flows. Both Alternative 4A subscenarios include the same south Delta operational criteria, but the differences in spring outflow result in minor differences in actual operations, and resultant minor differences in entrainment effects on delta smelt (Figures 11-4A-1 and 11-4A-2). Scenario H4_ELT includes enhanced spring outflow, which is partly achieved by reducing exports, which increases OMR flows. Scenario H3_ELT does not include enhanced spring outflow, although it does include stricter south Delta operational criteria for OMR flows as compared to NAA_ELT. Because delta smelt entrainment occurs primarily in the winter and spring, Scenario H3 represents the greatest potential effects on delta smelt entrainment under Alternative 4A based on methods that correlate spring OMR flows and delta smelt entrainment.

Water Exports from SWP/CVP North Delta Intake Facilities

The impact would be the same as Impact AQUA-3 in Alternative 4 for north Delta intakes. Potential entrainment and impingement risks at the proposed north Delta facilities would be limited because it is outside the main range of delta smelt (see discussion for Alternative 1A). The intakes would be screened and would exclude delta smelt of around 22 mm and larger.

Predation Associated with Entrainment

Under Alternative 4A, pre-screen predation losses at the south Delta facilities would be reduced commensurate with the reductions in entrainment described above. Predation loss at the north Delta intakes may occur but would be limited because few delta smelt are anticipated to occur that far upstream.

NEPA Effects: Delta smelt entrainment under Alternative 4A would not be adverse relative to the NAA_ELT; model predictions indicate that notable reductions in entrainment would occur. Thus, Alternative 4A is likely to benefit delta smelt due to lower average entrainment and associated predation losses at the south Delta export facilities coupled with expectations of minimal entrainment risk at the north Delta facilities.

CEQA Conclusion: As described above (Table 11-4A-1), under Scenario H3_ELT entrainment at the south Delta SWP/CVP water export facilities averaged across all years would be 0.017 less (a 22% relative decrease) for adult delta smelt, and 0.006 more (a 5% relative increase) for larval/juvenile delta smelt compared to Existing Conditions. However, the percentage of the larval/juvenile population affected would be small (<1%). Contrary to the NEPA conclusion set forth above, these results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially increase larval/juvenile proportional entrainment in some water year types.

However, and as noted for Alternative 4, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. For a thorough discussion of the methodologies used to predict sea level rise and climate change as of 2060, see Chapter 29, *Climate Change*, in the Draft EIR/EIS, and Appendix 5A, *Modeling Methodology*, in the Draft EIR/EIS. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between Alternative 4A (H3_ELT) and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on delta smelt entrainment would be beneficial. Larval-juvenile delta smelt entrainment would be generally similar to conditions without Alternative 4a (entrainment is reduced by 3%). Scenarios H3 and H4 represent the range of conditions expected under Alternative 4A, and therefore entrainment is expected to be reduced under Alternative 4A. Pre-screen delta smelt predation losses at the south Delta facilities would be no greater and may be lower compared to Existing Conditions due to lower overall entrainment. Predation losses at the north Delta intakes would be minimal because delta smelt rarely occur in that vicinity. These results represent the increment of change attributable to the alternative having factored out differences across time periods (e.g., sea level rise giving greater X2), which addresses the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required because Alternative 4A would reduce delta smelt entrainment.

Impact AQUA-4: Effects of Water Operations on Spawning and Egg Incubation Habitat for Delta Smelt

NEPA Effects: Although there are operational differences between Alternative 4A and Alternative 4, the main points from the analysis from Alternative 4 also apply to all operational scenarios under Alternative 4A: there is no evidence that the delta smelt population is limited by availability of suitable spawning habitat and spawning is cued by water temperature, which would not be affected by water operations under Alternative 4A. However, as noted in the BDCP public draft Appendix 5.E (section 5.E.4.4.2), hereby incorporated by reference, under Alternative 4 (H3_LLT, i.e., ESO_LLT using the scenario nomenclature from the BDCP) there is the potential for salinity to be greater than is optimal for delta smelt egg/larvae in Suisun Marsh, during February-June in drier years (see Figure 5.E.4-49). This effect arises largely because of tidal restoration increasing the tidal prism in Suisun Marsh and Montezuma Slough Salinity Control Gate operations. Under Alternative 4A, both the amount of restoration and gate operations would be the same as NAA_ELT, therefore it would be expected that salinity would be more similar in Suisun Marsh. Therefore, there will be no adverse effect on delta smelt spawning.

CEQA Conclusion: As described above and for Alternative 4, operations under Alternative 4A would not reduce abiotic spawning habitat availability or change water temperatures for spawning delta smelt under any of the proposed flow scenarios. After accounting for climate change, there would be little difference in salinity during sensitive egg/larval time periods in Suisun Marsh, as discussed above in the NEPA Effects. Consequently, the impact would be less than significant, and no mitigation is required.

Impact AQUA-5: Effects of Water Operations on Rearing Habitat for Delta Smelt

Issues related to rearing habitat for delta smelt and the methods used to assess potential effects are described for Alternative 4; much of the same discussion applies for Alternative 4A, which includes Fall X2 per the 2008 Delta Smelt BiOp, as does the NAA_ELT scenario; the Existing Conditions scenario does not. To reiterate the issues related to methods presented in Alternative 4, and as described in the Low Salinity Zone discussion within Section 11.1.2.2, there are remaining uncertainties regarding the contribution of the survivorship of delta smelt in the fall period to interannual population variability, concerns regarding the current sampling data, and the need for investigation of the potential application of a habitat index that applies multiple habitat characteristics. The CAMT process is investigating these and other questions to better understand how summer and fall flow conditions influence the abundance of delta smelt. However, these CAMT efforts remain incomplete and while they can and will be applied in the future, this information is currently unavailable. Additionally, consistent with the existing RPA adaptive management the adaptive management and monitoring program described in Section 4.1, Alternative 4A would implement investigations to better understand all factors affecting delta smelt abundance.

However, to inform this current impact assessment, the analysis of rearing habitat effects on delta smelt relies on a technique based on the method of Feyrer and coauthors (2011) which estimates the extent of abiotic habitat for delta smelt in the fall (September–December, the older juvenile rearing and maturation period) as a function of changes in X2 (as detailed in *BDCP Effects Analysis – Appendix 5.C, Flow, Section 5C.5.4.5.1 Delta Smelt Fall Abiotic Habitat Index hereby incorporated by reference*; see also discussion in the Low Salinity Zone discussion within Section 11.1.2.2).

As described for Alternative 4, Feyrer and coauthors (2011) demonstrated that X2 in the fall correlates nonlinearly with an index of delta smelt abiotic habitat in the West Delta, Suisun Bay, and Suisun Marsh subregions, as well as smaller portions of the Cache Slough, South Delta, and North Delta subregions (see Figure 3 of Feyrer et al. 2011). Investigations in recent years have indicated that delta smelt occur year-round in the Cache Slough subregion, including Cache Slough, Liberty Island, and the Sacramento Deep Water Ship Channel (Baxter et al. 2010; Sommer et al. 2011). Whether the same individuals are residing in these areas for their full life cycles or different individuals are moving between upstream and downstream habitats is not known (Sommer et al. 2011). The delta smelt fall abiotic habitat index is the surface area of water in the west Delta, Suisun Bay, and Suisun Marsh (as well as smaller portions of the Cache Slough, South Delta, and North Delta subregions) weighted by the probability of presence of delta smelt based on water clarity (Secchi depth) and salinity (specific conductance) in the water. Feyrer and coauthors' (2011) method found these two variables to be significant predictors of delta smelt presence in the fall. They also concluded that water temperature was not a predictor of delta smelt presence in the fall, although it has been shown to be important during summer months (Nobriga 2008). Manly et al. (2015) commented on the analysis of Feyrer et al. (2011) and found that the amount of variability in delta smelt presence explained by water clarity and salinity decreased when a region factor was included in the analysis, and suggested that inclusion of a region factor and an independent abundance term could improve the original habitat index of Feyrer et al. (2011). Based on the observations of Manly et al. (2015), the analysis of Alternative 4A presented herein based on Feyrer et al. (2011) gives more weight to dynamic habitat effects (e.g., changes in salinity and the location of the low-salinity zone) than static habitat (geographic regions). Feyrer et al. (2015) responded to Manly et al. (2015) and noted that the additional independent abundance term did not add appreciable explanatory power; they also acknowledged that water clarity and salinity (i.e., Secchi depth and conductivity) could not match observed proportions of samples with delta smelt present in some regions, which suggests that factors other than water clarity and salinity affect delta smelt occurrence; however, they also noted that adding a region factor (as was done by Manly et al. 2015) does not provide any insight into what these other factors might be.

As noted for Alternative 4, the degree of individual movement between upstream and downstream habitats has not been confirmed (Sommer et al. 2011), although emerging evidence suggests that a substantial fraction of the fish occurring in the upstream areas are residing there throughout the year (Hobbs 2012.).

Disagreements regarding the relationship between Fall X2 and delta smelt abundance prompted the CAMT process, which is currently investigating these relationships through a multi-agency collaborative process which may yield additional or different insight regarding how fall habitat conditions affect rearing and overall success of delta smelt.

As described in *BDCP Effects Analysis–Appendix 5.C, Flow, Section 5C.4.5.2. Delta Smelt Fall Abiotic Habitat Index hereby incorporated by reference*, the method based on Feyrer et al. (2011) was applied to estimate delta smelt abiotic habitat indices. Adjustments to the Feyrer et al. (2011) method are not available to reflect the ELT timeframe that is pertinent to Alternative 4A, so the following analysis only includes quantitative results reflecting flow-based differences between scenarios; in any case, the extent of restoration proposed under Environmental Commitment 4 is small (59 acres) and would have minimal influence on the results.

The abiotic habitat index under Scenarios H3 and H4 operations, are virtually identical to each other and to NAA_ELT (Table 11-4A-3; Figure 11-4A-3). This reflects the inclusion of Fall X2 in all of these scenarios.

The effects of Alternative 4A in the LLT generally would be similar to effects described for Alternative 4A in the ELT. However, Fall X2 would be slightly further eastward in the years when the USFWS 2008 BiOp Fall X2 action is not implemented, because the lack of substantial restoration under Alternative 2D allows for slightly different operations. As shown in the sensitivity analysis modeling for Alternative 4A, this would result in Alternative 4A having similar fall X2 as NAA_LLT in drier years (see Figure 70 in Appendix B), which would result in a similar abiotic habitat index under Alternative 4A compared to NAA (as opposed to the small increase under A4A_ELT compared to NAA_ELT shown in Table 11-4A-3).

NEPA Effects: Alternative 4A includes Fall X2 per the FWS BiOp and therefore results in a similar (3% across all water year types) extent of abiotic rearing habitat as NAA_ELT, based on the abiotic habitat index method described above (Table 11-4A-3). As such, there would be no effect.

CEQA Conclusion: The average fall abiotic habitat index for Alternative 4A would be greater than Existing Conditions (Scenario H3_ELT: 29% greater; Scenario H4_ELT:30% greater) (Table 11-4A-3). Note that the CEQA analysis predicts a greater increase in the abiotic habitat index relative to baseline than the NEPA analysis. This reflects Existing Conditions not including the Fall X2 requirement. The NEPA analysis isolates the effect of the alternative from the effects of sea level rise, climate change, future water demands, and implementation of required actions such as the Fall X2 requirement.

When compared to NAA_ELT and informed by the NEPA analysis, the average delta smelt abiotic habitat index under Alternative 4A restoration would be similar to NAA_ELT with Fall X2 under Scenarios H3_ELT and H4_ELT. Overall, there would be a beneficial impact on the species compared to existing conditions without Fall X2. Therefore, since Alternative 4A would benefit rearing delta smelt because the abiotic habitat index would be greater than Existing Conditions, the impact is less than significant. No mitigation would be required.

Table 11-4A-3. Differences in Delta Smelt Fall Abiotic Index between Alternative 4A (Scenarios H3_ELT and H4_ELT) and Existing Biological Conditions Scenarios, Averaged by Prior Water Year Type

	EXISTING CONDITIONS vs. Alternative 4A		NAA_ELT vs. Alternative 4A	
Water Years	H3_ELT	H4_ELT	H3_ELT	H4_ELT
All	1,150 (29%)	1,184 (30%)	99 (2%)	132 (3%)
Wet	2,478 (53%)	2,485 (53%)	38 (1%)	46 (1%)
Above Normal	2,013 (53%)	2,032 (53%)	68 (1%)	88 (2%)
Below Normal	271 (7%)	354 (9%)	232 (6%)	316 (8%)
Dry	150 (4%)	212 (6%)	161 (5%)	222 (6%)
Critical	9 (0%)	11 (0%)	9 (0%)	11 (0%)

Note: Negative values indicate lower habitat indices under alternative scenarios. Water year 1922 was omitted because water year classification for prior year was not available.

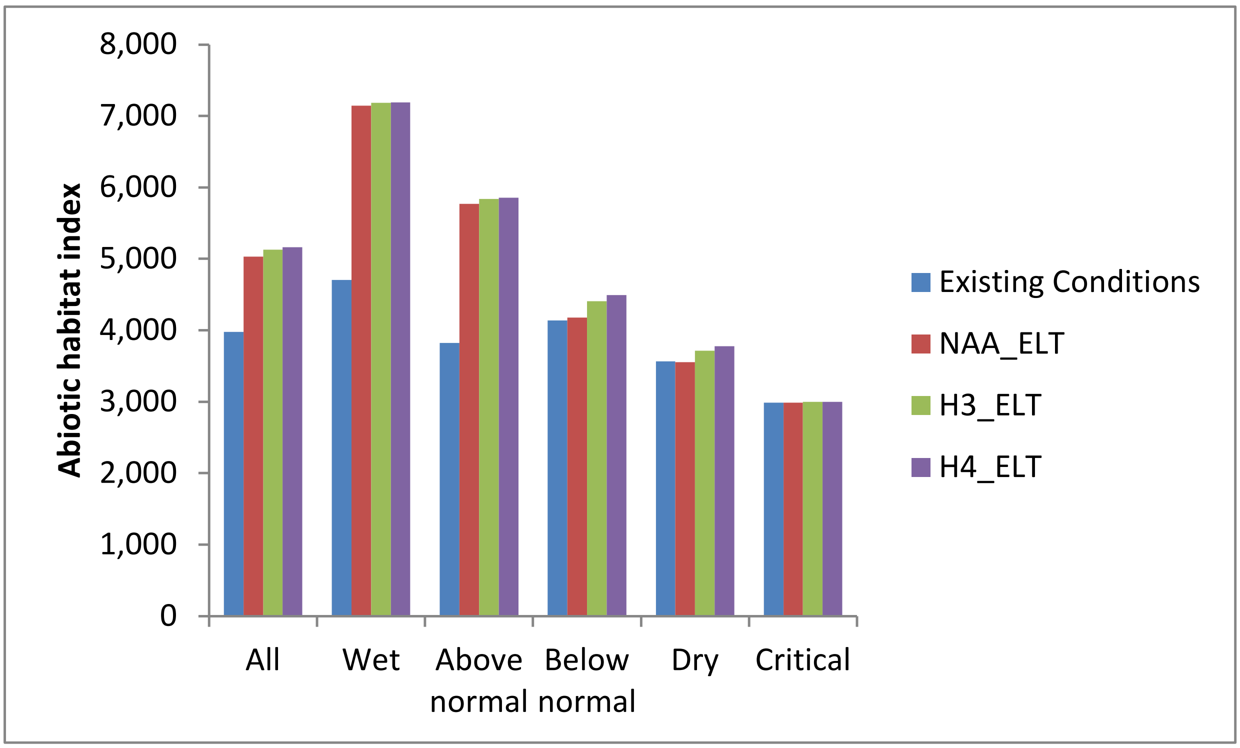

Figure 11-4A-3. Delta Smelt Fall Abiotic Habitat Index, Averaged By Water Year Type, without Restoration under Alternative 4A (Scenarios H3_ELT and H4_ELT).

Impact AQUA-6: Effects of Water Operations on Migration Conditions for Delta Smelt

As described for Alternative 4, the initiation of delta smelt upstream migration is associated with pulses of freshwater inflow, which are turbid, cool, and less saline (Grimaldo et al. 2009). Changes in flow under Alternative 4A could change turbidity, but are not expected to result in changes in water temperatures or pulses of local rainwater into the Delta. As described above in Impact AQUA-4 and in the discussion of Alternative 4, in-Delta water temperatures would not change in response to Alternative 4A flows. The modeling results indicate no biologically meaningful changes in water temperature within the Delta under Alternative 4, and this would also be the case for Alternative 4A.

As described in more detail for Alternative 4, turbid water is an important habitat characteristic for delta smelt (Nobriga 2008; Feyrer et al. 2011). Operation of the north Delta intakes (water conveyance facilities) is estimated to result in around 8 to 9% less sediment entering the Plan Area from the Sacramento River, the main source of sediment for the Delta and downstream subregions. In addition, sediment could be accreted (captured) in restored areas (*Environmental Commitment 4 Tidal Natural Communities Restoration*). These actions could limit sediment supply to areas currently important to delta smelt, such as Suisun Bay, which would result in less seasonal deposition of sediment that could be resuspended by wind-wave action to make/keep the overlying water column turbid. Therefore, there is a potential for a slight increase in water clarity, and a corresponding reduction in habitat quality for delta smelt. However, Alternative 4A is not expected to affect suspended sediment concentration during the first flush of precipitation that cues delta smelt migration. As such, turbidity cues associated with adult delta smelt migration should not change. With regard to suspended sediment concentrations at other times of the year, any effect will be minimized through the reintroduction of sediment collected at the north Delta intakes into tidal natural communities restoration projects (Environmental Commitment 4), consistent with the Environmental Commitment addressing Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material.

NEPA Effects: Alternative 4A may decrease sediment supply to the estuary by 8 to 9 percent, with the potential for decreased habitat suitability for delta smelt in some locations, but there would not be an adverse effect during the migration period and water temperature would not be affected by Alternative 4A water operations. These minor potential changes in turbidity are not likely affect migration cues and therefore the impact on migration conditions for delta smelt would not be adverse relative to NAA_ELT.

CEQA Conclusion: As described above, operations for all flow operating scenarios under Alternative 4A would not substantially alter the turbidity cues associated with winter flush events that may initiate migration, nor would there be appreciable changes in water temperatures. Consequently, the impact on adult delta smelt migration conditions would be less than significant, and no mitigation is required.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small. The mechanisms of impacts of tidal habitat restoration on delta smelt are anticipated to be similar under Alternative 4A compared to those described in detail for Alternative 1A, although would be considerably reduced in magnitude in proportion to the difference in restoration. The effects of restoration measures described for delta smelt under Alternative 1A (Impacts AQUA-7 through AQUA-9) appropriately disclose the nature of the anticipated effects of habitat restoration in Alternative 4A.

The following impacts are those presented under Alternative 4 and Alternative 1A that are anticipated to be similar in nature for Alternative 4A, but would occur to a lesser extent because of the reduced extent of the restoration measures under Alternative 4A.

Impact AQUA-7: Effects of Construction of Restoration Measures on Delta Smelt

The effects of construction of restoration measures on delta smelt under Alternative 4A are similar in nature to those discussed in more detail under Alternative 1A: temporary increases in turbidity; increased exposure to mercury and methylmercury; accidental spills; disturbance of contaminated sediments; in-water work activities; and predation. In-water and shoreline restoration construction activities may result in short-term effects on delta smelt through direct disturbance, short-term water quality impacts, and increased exposure to contaminants associated with the incidental disturbance of contaminated sediments. Overall and as noted for Alternative 1A, the effect of restoration construction activities on the bioavailability of contaminants is expected to be minimal, as they would likely be localized, sporadic, and of low magnitude. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on delta smelt. The relevant environmental commitments are: Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Pertinent details of these plans are provided under Impact AQUA-1 for Alternative 1A. Given the reduced extent of restoration under Alternative 4A relative to Alternative 1A, the effects of construction of restoration measures on delta smelt would be expected to be less than for Alternative 1A.

NEPA Effects**:** The effects of short-term construction activities would not be adverse to delta smelt because in-water work would occur when they are not present and environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion**:** Habitat restoration activities under Alternative 4A could result in short-term effects on delta smelt but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce delta smelt habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-8: Effects of Contaminants Associated with Restoration Measures on Delta Smelt

Effects of implementing the habitat restoration measures on delta smelt will depend on the life stage present in the area of elevated toxins and the duration of exposure. Formation and release of toxic constituents from sediments (e.g., in restored areas) is tied to inundation. The highest concentrations will occur during seasonal high water and to a lesser extent for short time periods on a tidal cycle in marshes. A complete analysis can be found in the *BDCP Effects Analysis – Appendix 5D, Contaminants.* Because the extent of tidal habitat restoration is reduced to a relatively small acreage (59 acres) under Alternative 4A compared to Alternative 1A, any effects of contaminants associated with restoration measures on delta smelt would be expected to be orders of magnitude less for Alternative 4A than for Alternative 1A. As discussed for Alternative 1A, potential effects to delta smelt could occur as a result of exposure to mercury; selenium; copper; ammonia; and pyrethroids, organophosphate pesticides, and organochlorine pesticides.

NEPA Effects**:** Overall the effects of contaminants associated with restoration measures under Alternative 4A would not be adverse for delta smelt with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of *Environmental Commitment 12*

Methylmercury Management) because restoration activities would be minimal and delta smelt do not bioaccumulate contaminants.

***CEQA Conclusion*:** As described in more detail for Alternative 1A, methylmercury could be generated by inundation of restoration areas under Alternative 4A. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury at restoration areas. Alternative 4A is not expected to substantially increase the potential exposure of fish because elevated bioavailability likely would be localized near restored areas and over a relatively short time period. Because of the relatively small extent of restoration, the potential impact of contaminants is considered less than significant. No mitigation is required.

Impact AQUA-9: Effects of Restored Habitat Conditions on Delta Smelt

Of the various habitat restoration measures proposed under Alternative 4A, *Environmental Commitment 4 Tidal Natural Communities Restoration*, is most relevant to delta smelt. Tidal habitat restoration under Alternative 4A is intended to offset any loss/modification of suitable habitat for delta smelt (for spawning and rearing) because of construction of the water facilities, in addition to restoring any function such habitat has for prey production and export to open-water areas used more extensively by delta smelt.

NEPA Effects: It is concluded that the effect of restoration activities under Alternative 4A relative to NAA_ELT would not be adverse because restoration is intended to provide habitat benefits to delta smelt.

CEQA Conclusion: The impacts associated with habitat restoration actions are considered less than significant because they are intended to restore suitable habitat and habitat functions lost to construction of water facilities. Consequently, this impact would be less than significant and no additional mitigation is required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

Alternative 4A includes three Environmental Commitments which are reduced in their extent compared to the conservation measures proposed under Alternative 4. While the extent of these environmental commitments for Alternative 4A are less than under Alternative 4 the nature of the mechanisms remains the same. Alternative 4A includes environmental commitments related to methylmercury management, reduction of predatory fish, and the installation of a non-physical barrier. The effects of each are described below.

Impact AQUA-10: Effects of Methylmercury Management on Delta Smelt (Environmental Commitment 12)

As noted under Impact AQUA-8, Environmental Commitment 12 will, where practicable, attempt to minimize conditions that promote production of methylmercury in restored areas and its subsequent introduction to the foodweb, and to covered species such as delta smelt in particular. As described for Alternative 1A, Environmental Commitment 12 describes pre-design characterization, design elements, and best management practices to attempt to minimize methylation of mercury, and requires monitoring and reporting of observed methylmercury levels.

NEPA Effects: The effects of methylmercury management on delta smelt would not be adverse because it is designed to improve water quality and habitat conditions.

CEQA Conclusion: Effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant. Consequently, no mitigation is required.

Impact AQUA-13: Effects of Localized Reduction of Predatory Fish on Delta Smelt (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish is intended to reduce localized abundance of fish predators of salmonids at the north and south Delta export facilities. Active capture methods could include boat electrofishing, hook-and-line fishing, predator lottery fishing tournaments, and other means of passive and active capture. The methods would be developed to most efficiently target predatory fishes and to minimize the potential for bycatch of delta smelt and any other covered species. In addition, the two locations at which Environmental Commitment 15 would be undertaken are either outside the main range of delta smelt (i.e., the north Delta intakes) or are in a low-survival environment (Clifton Court Forebay and the fish salvage facilities of the south Delta export facilities)

NEPA Effects: There would be no effect on delta smelt from localized reduction of predatory fish because the target species are salmonid predators and, as discussed above, the methods used would aim to avoid bycatch of other species such as delta smelt.

CEQA Conclusion: *Environmental Commitment 15 Localized Reduction of Predatory Fish* is intended to reduce localized abundance of fish predators of salmonids in the Delta, as discussed above. Therefore there would be no impact on delta smelt.

Impact AQUA-14: Effects of Nonphysical Fish Barriers on Delta Smelt (Environmental Commitment 16)

As described for Alternative 1A, nonphysical barriers (NPBs) are designed to alter juvenile salmon migration routes using sound, light, and bubbles and are not intended for delta smelt. Alternative 4A proposes only one location for a NPB, at the divergence of Georgiana Slough from the Sacramento River. The in-water structures associated with this barriers may attract fish predators, increasing localized predation risk for delta smelt migrating past the barriers, but the extent of this effect is highly uncertain and, given the geographic location of the barrier, would have low overlap with delta smelt's typical distribution. The 2011 pilot study for an NPB at Georgiana Slough did not find that predation of juvenile salmonids was greater near the barrier than locations further away (California Department of Water Resources 2012).

NEPA Effects: NPBs would not have adverse effects on delta smelt because the barrier would be outside the main range of the species and the potential for predation of delta smelt around the barriers is low.

CEQA Conclusion: As discussed above, there would be no demonstrable effect of this conservation measure on delta smelt. Consequently, this impact is less than significant and no mitigation would be required.

Longfin Smelt

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to longfin smelt, although the potential for longfin smelt to overlap construction and maintenance periods is even more limited than for delta smelt (Table 11-8).

Impact AQUA-19: Effects of Construction of Water Conveyance Facilities on Longfin Smelt

The potential effects of construction of the water conveyance facilities on longfin smelt would be the same as described for Alternative 4 because they include the same construction activities for the water conveyance facilities. This section provides additional detail on underwater noise impacts which are also applicable to Alternative 4.

Table 11-8 presents the life stages of longfin smelt and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Construction of the barge landings, CCF cofferdams, CCF siphons, and HOR operable barrier in the south Delta and east Delta would be the primary locations where longfin smelt could be affected by pile driving, as longfin smelt are only expected to occur at the intake construction sites during the early portion of the in-water work window. As discussed for delta smelt, implementation of Mitigation Measures AQUA-1a and AQUa-1b would minimize potential adverse effects associated with pile driving noise outside the work window.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-19, the effect would not be adverse for longfin smelt.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-19, the impact of the construction of water conveyance facilities on longfin smelt would not be significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-20: Effects of Maintenance of Water Conveyance Facilities on Longfin Smelt

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. The potential effects of water conveyance facilities maintenance under Alternative 4A would be the similar to those described for Alternative 4, Impact AQUA-20. As concluded in Alternative 4, Impact AQUA-20, the impact would not be adverse for longfin smelt.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As described in Alternative 4, Impact AQUA-20, the impact of the maintenance of water conveyance facilities on longfin smelt would not be significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-21: Effects of Water Operations on Entrainment of Longfin Smelt

Water Exports from SWP/CVP South Delta Facilities

For larval longfin smelt, entrainment risk was simulated using particle tracking modeling for wetter and drier starting distributions. Alternative 4A would result in reduced longfin smelt larvae entrainment compared to the NAA_ELT. Average particle entrainment by the south Delta facilities was 1.4–1.6% under Scenario H3_ELT, which does not include enhanced spring outflow, and was lower than the 1.5–1.9% entrainment under NAA_ELT (Table 11-4A-4). Under Scenario H4_ELT for Alternative 4A, which includes enhanced spring outflow, larval longfin smelt entrainment would be lower than H3_ELT and therefore even less than NAA_ELT, because of the enhanced spring outflow criteria that results in a further reduction in south Delta exports.

Table 11-4A-4. Percentage of Particles (and Difference) Representing Longfin Smelt Larvae Entrained by the South Delta Facilities under Alternative 4A (Scenario H3_ELT) and Baseline Scenarios

	Percent Particles Entrained			Difference (and Relative Difference)	
Starting Distribution	EXISTING CONDITIONS	NAA_ELT	H3_ELT	H3_ELT vs. EXISTING CONDITIONS	H3_ELT vs. NAA_ELT
Wetter	1.7	1.5	1.4	-0.31 (-19%)	-0.16 (-11%)
Drier	2.1	1.9	1.6	-0.53 (-25%)	-0.32 (-17%)

Note: 60-day DSM2-PTM simulation of wetter and drier starting distributions. Negative values indicate lower entrainment under the alternative compared to the baseline scenario.

For juveniles and adults, entrainment at the south Delta facilities (entrainment index based on the salvage-density method[1], averaged across all water year types) under H3_ELT would be 37% lower

[1] Although the salvage-density method gives estimates of entrainment loss or salvage in numbers of fish and there are a number of factors included in the calculations such as multipliers applied for prescreen loss and normalization to population size, it is most appropriate to view the results comparatively, i.e., to compare relative differences between scenarios as opposed to examining the estimates of total number of fish lost to entrainment or salvaged. In essence, the salvage-density method provides an entrainment index that reflects export pumping

for juveniles and 52% lower for adults compared to baseline conditions (Table 11-4A-5). Scenario H4_ELT would result in even greater reductions in entrainment, due to higher spring outflows and the associated reduction in south Delta exports. Under all Alternative 4A scenarios, the predicted average adult and juvenile entrainment would be less in all five water year types.

Table 11-4A-5. Longfin Smelt Entrainment Index at the SWP and CVP Salvage Facilities—Differences (Absolute and Percentage) between Model Scenarios for Alternative 4A (Scenario H3_ELT)

		Absolute Difference (Percent Difference)	
Life Stage	Water Year Types	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Juvenile (March–June)	Wet	-34,106 (-53%)	-37,987 (-56%)
	Above Normal	-785 (-17%)	-1062 (-22%)
	Below Normal	-486 (-16%)	-484 (-16%)
	Dry	8,921 (2%)	-38,267 (-7%)
	Critical	-198,499 (-35%)	-173,992 (-32%)
	All Years	-86,038 (-32%)	-108,770 (-37%)
Adult (December–March)	Wet	-72 (-56%)	-78 (-58%)
	Above Normal	-251 (-39%)	-302 (-43%)
	Below Normal	-815 (-42%)	-907 (-45%)
	Dry	-320 (-27%)	-336 (-28%)
	Critical	-6,112 (-25%)	-3,991 (-18%)
	All Years	-1,854 (-51%)	-1,924 (-52%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Water Exports from SWP/CVP North Delta Intake Facilities

As described under Alternative 1A for Impact AQUA-22, longfin smelt are not known to spawn in the reach of the Sacramento River where the north Delta diversions will be built. Therefore, entrainment of longfin smelt at the proposed north Delta intakes would be extremely low because this species is only expected to occur occasionally in very low numbers this far upstream on the Sacramento River.

Predation Associated with Entrainment

Pre-screen predation losses of longfin smelt at the SWP/CVP south Delta water export facilities are believed to be high and proportional to entrainment. It is assumed that pre-screen predation losses of longfin smelt would be similar to delta smelt based on their similar size, shape, and pelagic nature. Predation losses of both juvenile and adult longfin smelt under Alternative 4A would be no greater than baseline and may be lower, given the much lower entrainment losses at the south Delta facilities (32–37% lower for juveniles and 51–52% lower for adults) compared to NAA (Table 11-4A-5). Predation loss at the proposed north Delta intakes would be unlikely because longfin smelt do not generally occur that far upstream on the Sacramento River. Under the range of flow operating

weighted by each covered species' seasonal pattern of abundance in the Plan Area, as reflected by historical salvage data.

scenarios for Alternative 4A, entrainment-related predation loss would be reduced relative to NAA_ELT, with the greatest decreases in entrainment occurring under Scenario H4_ELT.

NEPA Effects: Entrainment and entrainment-related predation of juvenile and adult longfin smelt would be reduced substantially under Alternative 4A compared to NAA_ELT across all water years (Table 11-4A-5). Entrainment and associated predation loss of longfin smelt at the proposed north Delta intakes would be unlikely since longfin smelt are not expected to occur in that area of the Sacramento River. Alternative 4A would not have an adverse effect on entrainment and entrainment-related predation and would likely provide a benefit to the species because of substantial reductions in juvenile and adult entrainment at the south Delta facilities.

CEQA Conclusion: Entrainment and entrainment-related predation of all life stages of longfin smelt at the south Delta facilities would be reduced under Alternative 4A compared to Existing Conditions. Particle entrainment, representing larval longfin smelt, was lower under Alternative 4A for both drier and wetter starting distributions (refer to *BDCP Appendix 5.B* for further details). Entrainment loss would be substantially lower for both juvenile (32% less) and adult longfin smelt (51% less) (Table 11-4A-5). Entrainment to the north Delta intakes would be unlikely because longfin smelt are not expected to occur in the vicinity of the intakes. Therefore, Alternative 4A would not have a significant impact on entrainment and entrainment-related predation and would likely provide a benefit to the species because of the substantial reductions in south Delta entrainment.

Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt

Background on the general distribution of longfin smelt and the evidence for relationships between longfin smelt abundance with freshwater outflow is provided in detail in the discussion for Alternative 4. The mechanisms of this correlation are not well understood, and efforts are underway to determine what flow-related factors, if any, have a causal relationship with longfin smelt abundance, and how that relates to the various life stages present in the Delta in the winter and spring months. Additionally, sample biases related to when and where longfin smelt are sampled may influence these correlations, and the regional contribution to the overall longfin smelt population is unknown; this is a large focus of the study plan resulting from the Settlement Agreement between DFW and DWR/State Water Contractors related to longfin smelt. However, at this time, the best available relationship between longfin smelt abundance and changes in water facility operations is based on Kimmerer et al. (2009), the application of which shows that outflow in January through June correlates to longfin smelt abundance. As such, the X2–longfin smelt abundance relationship provided by Kimmerer et al. (2009) was used to evaluate the effects of the alternatives on longfin smelt, following the historical observation that lower X2 (farther downstream) correlates with increased recruitment (represented by abundance indices in trawl surveys), although it is not understood if or how this would affect spawning, egg incubation, and/or rearing longfin smelt. Consistent with the adaptive management and monitoring program described in Section 4.1, Alternative 4A would implement investigations to better understand all factors affecting longfin smelt abundance. However, for purposes of this impact assessment, the relationships between X2 and longfin smelt abundance developed by Kimmerer et al. (2009) were used to determine how the changes in winter-spring X2 position described above might influence longfin smelt abundance the following fall.

Table 11-4A-7. Differences in Mean Monthly Delta Outflow (cfs) between NAA_ELT and Alternative 4A Scenarios H3_ELT and H4_ELT, by Water Year Type, for Winter-Spring (December–June)

Month	Water-Year Type	NAA_ELT vs. H3_ELT	NAA_ELT vs. H4_ELT
January	Wet	-2,114 (-2.3%)	-2,143 (-2.4%)
	Above Normal	-2,256 (-4.6%)	-1,507 (-3.1%)
	Below Normal	112 (0.5%)	98 (0.4%)
	Dry	751 (5.1%)	1,033 (7%)
	Critical	-138 (-1.1%)	-237 (-2%)
	All	-837 (-1.9%)	-691 (-1.5%)
February	Wet	-1,048 (-1%)	-1,595 (-1.5%)
	Above Normal	271 (0.4%)	-1,018 (-1.6%)
	Below Normal	-2,540 (-6.8%)	-1,359 (-3.6%)
	Dry	-1,347 (-6.4%)	-1,397 (-6.7%)
	Critical	30 (0.2%)	107 (0.85%)
	All	-1,018 (-1.8%)	-1,178 (-2.1%)
March	Wet	-1,113 (-1.4%)	1,155 (1.4%)
	Above Normal	-1,144 (-2.1%)	222 (0.4%)
	Below Normal	-1,901 (-8.4%)	1,909 (8.5%)
	Dry	-2,234 (-11.5%)	-623 (-3.2%)
	Critical	-352 (-2.9%)	-167 (-1.4%)
	All	-1,387 (-3.2%)	563 (1.3%)
April	Wet	-5,630 (-10.3%)	-633 (-1.2%)
	Above Normal	-5,805 (-18.6%)	71 (0.2%)
	Below Normal	-2,792 (-13.2%)	4,872 (23%)
	Dry	-1,507 (-11.2%)	-202 (-1.5%)
	Critical	-246 (-2.8%)	-51 (-0.6%)
	All	-3,478 (-11.7%)	590 (2%)
May	Wet	-4,587 (-12%)	206 (0.5%)
	Above Normal	-3,126 (-13.5%)	1,560 (6.7%)
	Below Normal	-1,140 (-7.7%)	1,810 (12.3%)
	Dry	-325 (-3.3%)	352 (3.6%)
	Critical	-254 (-4%)	-182 (-2.9%)
	All	-2,215 (-10.5%)	653 (3.1%)
June	Wet	-311 (-1.7%)	-609 (-3.4%)
	Above Normal	648 (6.4%)	509 (5%)
	Below Normal	757 (9.4%)	269 (3.3%)
	Dry	319 (4.5%)	345 (4.8%)
	Critical	-14 (-0.3%)	-13 (-0.2%)
	All	193 (1.8%)	1 (0%)
December	Wet	-1,728 (-3.5%)	-2,143 (-2.4%)
	Above Normal	-36 (-0.2%)	-1,507 (-3.1%)
	Below Normal	-174 (-1.3%)	98 (0.4%)
	Dry	500 (5.9%)	1,033 (7%)
	Critical	-216 (-3.9%)	-237 (-2%)
	All	-505 (-2.1%)	-691 (-1.5%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Under Scenario H3_ELT, which does not include enhanced spring outflow, modeled average Delta spring outflow is often lower than NAA_ELT. The spring outflow under H4_ELT, which includes enhanced spring outflow, was greater than NAA_ELT in a number of years, as illustrated by differences in water-year-type average Delta outflow (see Table 11-4A-7 above). Based on Kimmerer et al. 2009, the longfin smelt abundance for H3_ELT ranged from a reduction of 19-22% compared to Existing Conditions, to a reduction of 11% to an increase of 7% compared to NAA_ELT (Table 11-4A-8). For H4_ELT, which includes enhanced spring outflow and climate change effects, the predicted longfin smelt abundance ranged from a reduction of 10% to 12% compared to Existing Conditions to an increase of 18% to 22% when compared to NAA_ELT, based on the X2-abundance equations in Kimmerer et al. (2009). In addition, the method does not articulate the potential changes in spawning, egg incubation, or rearing habitat as a result of changes in X2 because no specific correlations between these life stages and X2 has been established. Studies examining the relationship between flow and longfin smelt abundance would be undertaken as part of the Adaptive Management and Monitoring Program in order to address the current uncertainty that exists surrounding the mechanism through which higher Delta outflow improves the production and survival of early life stages of longfin smelt. Results of these investigations will continue to be reviewed and considered in the coming years, in making management decisions regarding outflows necessary for longfin smelt.

NEPA Effects: Under Alternative 4A, water operations would result in a potential decrease in longfin smelt abundance if spring outflows are not at least as high as the NAA_ELT, based on the application of the Kimmerer et al. 2009 flow-abundance regression. As such, Scenario H3_ELT has the potential to be adverse. However, as described above and in Section 4.1, Alternative 4A operations will be subject to adjustment via adaptive management, which is intended to allow for further evaluation of spring outflow, and adjustments necessary to ensure that longfin smelt are not adversely affected by project operations. Scenario H4_ELT generally increases abundance and therefore would not be adverse. Further, Mitigation Measure AQUA-22d would ensure January through June delta outflows do not result in changes in longfin smelt abundance. Therefore, under Alternative 4A, this impact would not be adverse.

Table 11-4A-8. Estimated Differences Between Alternative 4A (Scenarios H3_ELT and H4_ELT) and Baseline for Longfin Smelt Relative Abundance in the Fall Midwater Trawl or Bay Midwater Trawl Based on the X2-Relative Abundance Regression of Kimmerer et al. (2009)

	Fall Midwater Trawl Relative Abundance		Bay Midwater Trawl Relative Abundance	
Water Year Type	EXISTING CONDITIONS vs. Alternative 4A	NAA_ELT vs. Alternative 4A[1]	EXISTING CONDITIONS vs. Alternative 4A	NAA_ELT vs. Alternative 4A[1]
Scenario H3_ELT				
All	-1,502 (-17%)	-475 (-6%)	-4,686 (-19%)	432 (3%)
Wet	-3,195 (-17%)	-909 (-5%)	-10,611 (-19%)	2,268 (7%)
Above Normal	-1,684 (-17%)	-685 (-8%)	-5,014 (-20%)	-700 (-4%)
Below Normal	-855 (-19%)	-331 (-8%)	-2,168 (-22%)	-717 (-11%)
Dry	-396 (-17%)	-134 (-7%)	-904 (-21%)	-235 (-7%)
Critical	-65 (-6%)	-7 (-1%)	-132 (-8%)	-74 (-5%)
Scenario H4_ELT				
All	-622 (-7%)	404 (5%)	-2,120 (-9%)	1,167 (6%)
Wet	-1,882 (-10%)	404 (2%)	-6,625 (-12%)	1,210 (3%)
Above Normal	-50 (0%)	949 (10%)	(0%)	2,960 (13%)
Below Normal	176 (4%)	699 (18%)	510 (5%)	1,812 (22%)
Dry	-187 (-8%)	75 (4%)	-414 (-9%)	180 (5%)
Critical	-52 (-5%)	6 (1%)	-107 (-6%)	10 (1%)

Shading indicates relative abundance decrease of 10% or greater under H3_ELT.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[1] Note that longfin smelt abundance has been declining and is expected to continue to decline under the NAA such that increases in longfin smelt abundance shown in the comparison of NAA_ELT vs. Alternative 4A may not reflect absolute increases of longfin smelt abundance."

CEQA Conclusion: Under Alternative 4A scenario H3_ELT, average Delta outflow during winter/spring generally would be similar to Existing Conditions during December-March, with some exceptions by water year type, and lower in April–June (Table 11-4A-9). Under Scenario H4_ELT, average Delta outflows generally would be similar to Existing Conditions, but would be lower in June.

Table 11-4A-9. Differences in Mean Monthly Delta Outflow (cfs) between Existing Conditions and Alternative 4A Scenarios H3_ELT and H4_ELT, by Water Year Type, for Winter-Spring (December–June)

Month	Water-Year Type	EXISTING CONDITIONS vs. H3_ELT	EXISTING CONDITIONS vs. H4_ELT
January	Wet	3,144 (3.7%)	3,115 (3.6%)
	Above Normal	-2,744 (-5.5%)	-1,996 (-4%)
	Below Normal	-594 (-2.6%)	-607 (-2.6%)
	Dry	769 (5.2%)	1,051 (7.1%)
	Critical	693 (6.1%)	593 (5.2%)
	All	764 (1.8%)	909 (2.1%)
February	Wet	6,650 (6.9%)	6,103 (6.3%)
	Above Normal	2,112 (3.4%)	824 (1.3%)
	Below Normal	-2,040 (-5.5%)	-859 (-2.3%)
	Dry	-1,327 (-6.3%)	-1,376 (-6.6%)
	Critical	-408 (-3.1%)	-332 (-2.6%)
	All	1,718 (3.3%)	1,558 (3%)
March	Wet	1,624 (2.1%)	3,891 (4.9%)
	Above Normal	439 (0.8%)	1,806 (3.3%)
	Below Normal	-3,408 (-14.2%)	403 (1.7%)
	Dry	-2,727 (-13.7%)	-1,115 (-5.6%)
	Critical	-315 (-2.6%)	-130 (-1.1%)
	All	-647 (-1.5%)	1,303 (3%)
April	Wet	-5,164 (-9.5%)	-166 (-0.3%)
	Above Normal	-6,598 (-20.6%)	-722 (-2.3%)
	Below Normal	-3,502 (-16%)	4,162 (19%)
	Dry	-2,199 (-15.5%)	-894 (-6.3%)
	Critical	-418 (-4.6%)	-224 (-2.5%)
	All	-3,745 (-12.4%)	323 (1.1%)
May	Wet	-7,351 (-17.9%)	-2,558 (-6.2%)
	Above Normal	-4,195 (-17.3%)	491 (2%)
	Below Normal	-2,699 (-16.6%)	251 (1.5%)
	Dry	-1,076 (-10.3%)	-399 (-3.8%)
	Critical	87 (1.5%)	160 (2.7%)
	All	-3,629 (-16.1%)	-760 (-3.4%)
June	Wet	-5,682 (-24.2%)	-5,980 (-25.5%)
	Above Normal	-976 (-8.3%)	-1,115 (-9.4%)
	Below Normal	820 (10.2%)	332 (4.1%)
	Dry	806 (12.1%)	832 (12.5%)
	Critical	10 (0.2%)	10 (0.2%)
	All	-1,626 (-12.7%)	-1,818 (-14.2%)
December	Wet	-154 (-0.3%)	1,192 (2.5%)
	Above Normal	1,334 (7.4%)	1,433 (8%)
	Below Normal	1,161 (9.7%)	1,314 (11%)
	Dry	82 (0.9%)	35 (0.4%)
	Critical	-241 (-4.4%)	-320 (-5.8%)
	All	327 (1.4%)	773 (3.4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Average relative abundance of longfin smelt, as estimated by the Kimmerer et al. (2009) method which directly correlates winter-spring Delta outflow to longfin smelt abundance, is up to 19% to 22% lower under Scenario H3_ELT compared to Existing Conditions (17–19% lower across all water year types; Table 11-4A-8). For H4_ELT, which includes enhanced spring outflow, the longfin smelt abundance is up to 10% to 12% lower compared to Existing Conditions (5–7% lower across all water year types), based on Kimmerer et al. (2009).

Contrary to the NEPA conclusion set forth above, these results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce relative abundance based on Kimmerer et al. (2009).

However, and as noted for Alternative 4, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed above and in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the second NOP for the BDPC was prepared (2009). Both the action alternative and the NEPA baseline (NAA) models anticipated future conditions that would occur at 2025, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the NEPA analysis, which compares results between the alternative and NAA_ELT, is a better approach with respect to these issues because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis, above, the average longfin smelt abundance, based on Kimmerer et al. (2009), was up to 8–11% less under H3_ELT (across all water years: 6% decrease to 3% increase; Table 11-4A-8). Abundance relative to NAA_ELT increased up to 18% to 22% (across all water years: 5–6% increase) for H4_ELT, which includes enhanced spring outflow compared to NAA_ELT (Table 11-4A-7). These results represent the increment of change attributable to the alternative, and addressing the limitations of the comparison based on the CEQA baseline (Existing Conditions). Furthermore, the Adaptive Management and Monitoring Program included in Alternative 4A would allow for an evaluation of the necessary volume and timing of spring outflow. However, based on the Kimmerer et al. regression applied for this analysis, H3 would result in a significant impact on longfin smelt due to a substantial decrease in abundance, while H4 would have a beneficial impact because the abundance would be increased. Because of the potential for this alternative to substantially reduce longfin smelt abundance, this impact is considered significant. Implementing Mitigation Measure AQUA-22d would reduce this impact to a less-than-significant level.

Mitigation Measure AQUA-22d: Ensure January through June Delta Outflows do Not Result in Changes in Longfin Smelt Abundance

Initial operations would set delta outflow such that longfin smelt abundance would not be reduced. This could be accomplished by reducing SWP/CVP exports, transferring water from non-CVP/SWP sources to increase outflow, or using water stored in Oroville. Science developed through the Adaptive Management Program (described in Section 4.1) will be used to make appropriate adjustments to operations, including outflow, to minimize effects on longfin smelt. These operations would be implemented consistent with applicable biological opinions, incidental take statements, and other permits.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for delta smelt, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts related restoration construction would be extremely small. The mechanisms for potential effect of habitat restoration on longfin smelt are very similar to those for delta smelt (see Impacts AQUA-7, AQUA-8, and AQUA-9), although longfin smelt would be expected to have less temporal and spatial overlap with restored areas, during and after construction, than delta smelt.

Impact AQUA-25: Effects of Construction of Restoration Measures on Longfin Smelt

Please refer to discussion of Impact AQUA-7 under Alternative 4A for delta smelt.

***NEPA Effects*: The effects of short-term construction activities would not be adverse to longfin smelt because in-water work would occur when they are not present and environmental commitments would limit the potential for construction-related effects.**

CEQA Conclusion: As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on longfin smelt but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce longfin smelt habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-26: Effects of Contaminants Associated with Restoration Measures on Longfin Smelt

Please refer to discussion of Impact AQUA-8 under Alternative 4A for delta smelt.

NEPA Effects: Overall and consistent with the conclusion for Alternative 1A, the effects of contaminants associated with restoration measures under Alternative 4A would not be adverse for longfin smelt with respect to selenium, copper, ammonia, pesticides, and methylmercury because longfin smelt would have relatively little opportunity to bioaccumulate these contaminants (because of their diet, the duration they spend in the Delta, and their relatively short life spans) and because of implementation of *Environmental Commitment 12 Methylmercury Management*.

CEQA Conclusion: As noted for delta smelt and as described in more detail for Alternative 1A, methylmercury could be generated by inundation of restoration areas under Alternative 4A. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury at restoration areas. Alternative 4A is not expected to substantially increase the potential exposure of fish because elevated bioavailability likely would be localized near restored areas and over a relatively short time period. Because of the relatively small extent of restoration, the potential impact of contaminants is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-27: Effects of Restored Habitat Conditions on Longfin Smelt

The potential effects of restored habitat conditions on longfin smelt would be similar to those discussed for delta smelt (see the discussion under Impact AQUA-9), although longfin smelt occupy such areas for shorter time periods than delta smelt and therefore would not be affected to as great an extent.

NEPA Effects: The effect of restoration activities would not be adverse for longfin smelt because restoration will increase habitat availability.

CEQA Conclusion: The impacts associated with habitat restoration actions are considered less than significant because they are intended to restore suitable habitat and habitat functions lost to construction of water facilities. No additional mitigation is required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As described for delta smelt, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms remains the same.

Impact AQUA-28: Effects of Methylmercury Management on Longfin Smelt (Environmental Commitment 12)

As noted for delta smelt under Impact AQUA-10, Environmental Commitment 12 is intended to minimize conditions that promote production of methylmercury in restored areas and its subsequent introduction to the foodweb, and to covered species such as longfin smelt. As described for Alternative 1A, Environmental Commitment 12 describes pre-design characterization, design elements, and best management practices to attempt to minimize methylation of mercury, and requires monitoring and reporting of observed methylmercury levels.

NEPA Effects: The effects of methylmercury management on longfin smelt would not be adverse because it is designed to improve water quality and habitat conditions.

CEQA Conclusion: Effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant to longfin smelt. Consequently, no mitigation is required.

Impact AQUA-31: Effects of Localized Reduction of Predatory Fish on Longfin Smelt (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish is intended to reduce localized abundance of fish predators of salmonids in the Delta.

NEPA Effects: There is a potential for incidental benefit to longfin smelt from localized reduction of predatory fish, although the target species are salmonid predators.

CEQA Conclusion: *Environmental Commitment 15 Localized Reduction of Predatory Fish* is intended to reduce localized abundance of fish predators of salmonids in the Delta. Therefore there would be no impact on longfin smelt.

Impact AQUA-32: Effects of Nonphysical Fish Barriers on Longfin Smelt (Environmental Commitment 16)

Potential impacts on longfin smelt from the installation of an NPB at the divergence of Georgiana Slough from the Sacramento River are expected to be similar to those for delta smelt (see Impact AQUA-14), with even less potential for any effect because of even lower overlap of longfin smelt distribution with the proposed location of the NPB.

NEPA Effects: There would be no demonstrable effect of the NPB on longfin smelt because they are not likely to be in the area of the barrier and the potential for predation of longfin smelt around the barriers is low.

CEQA Conclusion: As discussed above, there would be no demonstrable effect of this conservation measure on longfin smelt. Consequently, the impact is less than significant and no mitigation would be required.

Winter-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to winter-run Chinook salmon because the same types of impact mechanisms would apply. However, adult and juvenile winter-run Chinook salmon would have somewhat greater potential to overlap construction and maintenance than delta smelt (Table 11-8).

Impact AQUA-37: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

The potential effects of construction of the water conveyance facilities on winter-run Chinook salmon would be the same as described for Alternative 4 (Impact AQUA-37). This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-37 in Alternative 4.

Table 11-8 presents the life stages of the four runs of Chinook salmon and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction period (June 1–October 31). Winter-run, spring-run, fall-run, and late fall–run Chinook salmon eggs and fry would not be exposed to underwater noise from pile driving activities because the proposed construction activities are located in areas that do not provide suitable habitat for these life stages or because these life stages would not be present during the proposed in-water construction period.

Under Alternative 4A, the potential for exposure of adult and juvenile winter-, spring-, and late fall-run Chinook salmon to pile driving noise is highest in the north Delta (Sacramento River in the vicinity of the three proposed intakes) which serves as the primary migration route utilized by adults to access upstream spawning areas, and the primary migration route for juveniles entering the Delta and estuary from upstream spawning and rearing areas. Restricting in-water pile driving to June 1 to October 31 avoids the peak migration periods of winter-, spring-, and late fall-run adults and juveniles. Some overlap with winter-run and spring-run adults may occur at the end of the migration season in June or July, and with late fall-run adults at the beginning of the migration season in October. Adult fall-run Chinook salmon, which migrate through the north, east, and south Delta on their way to upstream spawning areas in the Sacramento, San Joaquin, and east Delta tributaries, may be present in the vicinity of the intake structures and barge unloading facilities during in-water pile driving activities from August through October. Most juvenile Chinook salmon occur in the Delta from late fall through spring (November through May) although some fall- and spring-run smolts may encounter pile driving noise at the end of the outmigration season in June.

To minimize potential adverse effects when adult and juvenile salmon may be present, DWR proposes to use vibratory driving to the extent feasible to minimize both the area and duration of potentially harmful underwater noise levels associated with impact driving in open water. In addition, construction of the intake facilities would be spread out over a period of five years, limiting the number of sites and duration of pile driving encountered by adults and juveniles in any given year (Table 4.3.7-1 under Delta Smelt). Although pile driving activities could occur 42 to 55 days per season at each intake location, in-water pile driving will not be continuous and limited to daylight hours only, resulting in 12-16 hour periods each day for migrating fish to pass the construction sites undisturbed.

It is unlikely that pile driving sounds will cause injury or mortality of adult salmon based on the large size, mobility, and anticipated behavior during their migration through the affected areas. Adult Chinook salmon are large (typically 9–10 kilograms) and presumably much less vulnerable to pile driving noise than smaller fish targeted for protection by the SPL and SEL injury criteria (approximately 2 grams or smaller). In addition, migrating adult salmon are expected to readily avoid or swim away from areas of elevated noise. Similar pile driving operations indicate that single-strike peak SPLs and SELs exceeding the injury criteria would be limited to small areas immediately adjacent to source piles (<33–46 feet) and thus would affect only a small portion of the total channel width available for adults to pass (Table 4.3.7-1 under Delta Smelt). However, the potential for injury still exists because migrating adults would be faced with passing through larger channel reaches (spanning the entire channel width at most locations) subject to noise levels exceeding the cumulative thresholds for >2-gram fish (187 dB SEL). The potential for injury is considered low due to the large size of adults and rapid migration rates to upstream holding and spawning areas. While limited evidence suggests that pile driving operations may disrupt normal migratory behavior in salmonids (Feist et al. 1992), any delays in migration are expected to be minor because of the intermittent nature of pile driving and the daily cessation of pile driving at night.

Juvenile salmon are at higher risk of injury and mortality than adults because of their small size. However, the June 1 through October 31 pile driving period will avoid the primary juvenile outmigration period for all runs of Chinook salmon (November through May), and thus minimize the potential for adverse effects. Most juvenile Chinook salmon migrating through the Delta after June 1 or before October 31 are large, actively migrating smolts (> 2 grams) that are known to move rapidly through the Delta and estuary during their seaward migration (Williams 2006). These larger juveniles may be exposed to noise levels exceeding the injury thresholds for >2-gram fish (187 dB SEL) as they pass through the affected channel reaches. However, exposure is expected to be limited by their rapid migration rate and opportunities to pass the affected reaches at night after daily pile driving operations have ceased. In general, downstream movement of juvenile Chinook salmon occurs mainly at night or during the hours between dusk and dawn, limiting exposure of juveniles to pile driving noise to daylight hours; for example, Chapman et al. (2013) found that late fall-run Chinook salmon migrating through the Delta were ~70% nocturnal. For winter-run Chinook salmon, juveniles migrating in October may be smaller individuals < 60 mm, which would be more susceptible to pile-driving noise, but the proportion of all juveniles occurring in October is very small; the main migration into the Delta typically begins in November or December (del Rosario et al. 2013), outside the pile driving period. As discussed above, limited evidence suggests that pile driving noise may disrupt normal migratory behavior in salmonids. For juveniles, these behavioral effects may include responses that disrupt normal feeding, resting, and sheltering behavior, resulting in potential adverse effects on growth and survival (e.g., increased vulnerability to predation). Thus, pile driving activities could lead to indirect mortality if juveniles are exposed to a range of noise levels that could cause behavioral effects.

Based on the foregoing analysis, the potential exists for some injury and mortality of juvenile Chinook salmon from pile driving noise but only a small proportion of the population is at risk based on the low degree of overlap of pile driving activities with outmigration timing, and the relatively large size and mobility of juveniles that may encounter pile driving noise (migrating smolts). Implementation of Mitigation Measures AQUA-1a and AQUA-1b will further reduce this risk.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-37, the effect would not be adverse for winter-run Chinook salmon. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity, would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by Chinook salmon. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin habitat. The direct effects of underwater construction noise on Chinook salmon that may be present could be adverse if Chinook salmon are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-37, the impact of the construction of water conveyance facilities on winter-run Chinook salmon would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect winter-run Chinook salmon. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-38: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect Chinook salmon. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on Chinook salmon from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. The potential effects of water conveyance facilities maintenance under Alternative 4A would be similar to those described for Alternative 4, Impact AQUA-38. As concluded in Alternative 4, Impact AQUA-38, the impact would not be adverse for winter-run Chinook salmon.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As described in Alternative 4, Impact AQUA-38, the impact of the maintenance of water conveyance facilities on Chinook salmon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-39: Effects of Water Operations on Entrainment of Chinook Salmon (Winter-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

The proportion of juvenile winter-run Chinook salmon subject to entrainment is low under Existing Conditions and NAA_ELT (annual index of abundance average 1.4%) and Alternative 4A would further reduce entrainment of juvenile winter-run Chinook salmon at the south Delta facilities. For example, Scenario H3_ELT would reduce the proportion of juvenile winter-run Chinook entrained in the south Delta export facilities (average of 0.6%). As such, average entrainment under Scenario H3_ELT would be reduced by 54% (~3,800 fish[2]: Table 11-4A-10) across all water years compared

[2] As noted for longfin smelt, although the salvage-density method gives estimates of entrainment loss or salvage in numbers of fish and there are a number of factors included in the calculations such as multipliers applied for prescreen loss and normalization to population size, it is most appropriate to view the results comparatively, i.e., to compare relative differences between scenarios as opposed to examining the estimates of total number of fish lost

to NAA_ELT. Entrainment would be substantially reduced in wet and above normal water year types (65–72% less than NAA_ELT) and would be moderately reduced in below normal, dry, and critical water year types (14–44% less than NAA_ELT).

Scenario H4_ELT would be expected to have similar or slightly lower entrainment of winter-run Chinook salmon as Scenario H3_ELT because south Delta exports during the spring (March–May) under H4_ELT would be less compared to H3_ELT.

Table 11-4A-10. Juvenile Winter-Run Chinook Salmon Annual Entrainment Index at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-7,947 (-70%)	-8,670 (-72%)
Above Normal	-4,246 (-64%)	-4,396 (-65%)
Below Normal	-3,044 (-42%)	-3,230 (-44%)
Dry	-928 (-24%)	-793 (-22%)
Critical	-260 (-21%)	-170 (-14%)
All Years	-3,625 (-53%)	-3,773 (-54%)

Note:
Estimated annual number of fish lost, based on normalized data.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Water Exports from SWP/CVP North Delta Intake Facilities

As noted for Alternative 4, the effect of Alternative 4A on entrainment and impingement at the north Delta intakes would be the same as described for Alternative 1A (Impact AQUA-39), but the degree would be less because Alternative 4A would have fewer intakes. State-of-the-art[3] fish screens operated with an adaptive management plan would be expected to eliminate entrainment and impingement risk for juvenile winter-run Chinook salmon. Biologically-based triggers to minimize effects on salmonids and sturgeon during their migration past the intakes are being developed through the ESA consultation process.

Predation Associated with Entrainment

Entrainment-related predation loss of winter-run Chinook salmon at the south Delta facilities under this alternative would be no greater than loss under NAA_ELT and may be lower than loss under NAA_ELT due to a decrease in entrainment loss. Entrainment-related predation losses at the south

to entrainment or salvaged. In essence, the salvage-density method provides an entrainment index that reflects export pumping weighted by each covered species' seasonal pattern of abundance in the Plan Area, as reflected by historical salvage data. This same caveat applies to the other salmonids, the sturgeons, and the lampreys, which all use the salvage-density method.

[3] The fish screens would be state of the art by incorporating the best available technology and operating to fishery agency standards of protection for fishes. The features of the fish screens are described in more detail in Section 3.6.1.1 of Chapter 3, Description of Alternatives.

Delta under Scenario H4_ELT may be similar or slightly lower than under Scenario H3_ELT as spring outflow is increased and south Delta exports are decreased under Scenario H4_ELT.

Predation at the north Delta would be increased due to the installation of the proposed SWP/CVP North Delta intake facilities on the Sacramento River. Bioenergetics modeling with a median predator density predicts increased predation loss of about 4,200 juveniles, or 0.16% of the winter-run Chinook salmon juvenile index of abundance under Alternative 4A (Table 11-4A-11). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 4A. See additional discussion under Impact AQUA-42.

Table 11-4A-11. Winter-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes (Three Intakes for Alternative 4A)

Striped Bass at NDD (Three Intakes)			Winter-Run Chinook Consumed	
Density Assumption	Bass per 1,000 Feet of Intake	Total Number of Bass	Number	Percentage of Annual Juvenile Production Entering the Delta[1]
Low	18	86	633	0.02%
Median	119	571	4,182	0.16%
High	219	1,051	7,696	0.30%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 2.6 million juveniles. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

NEPA Effects: In conclusion, Alternative 4A would reduce overall entrainment and associated predation losses of juvenile winter-run Chinook salmon relative to NAA_ELT. This effect would not be adverse and would provide a benefit to the species because of the reductions in entrainment loss and mortality.

CEQA Conclusion: As described above, entrainment and associated predation losses of juvenile winter-run Chinook salmon at the south Delta facilities would decrease under Alternative 4A compared to Existing Conditions (Table 11-4A-10). Overall, impacts of water operations on entrainment of juvenile Chinook salmon (winter-run ESU) would be less than significant and may be beneficial. No mitigation would be required.

Impact AQUA-40: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Winter-Run ESU)

In general, the effects of Alternative 4A on spawning and egg incubation habitat for winter-run Chinook salmon relative to the NAA are not adverse.

H3_ELT/ESO_ELT[4]

Flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam were examined during the May through September winter-run spawning and incubation period

[4] H3_ELT/ESO_ELT is the acronym used for Alternative 4A, Scenario H3 in the early long-term implementation period.

(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation. Mean flows under H3_ELT at Keswick would generally be similar to flows under NAA_ELT, with flows under H3_ELT up to 12% higher than under NAA_ELT during May through July and up to 15% lower during August and September. Mean flows upstream of Red Bluff would generally be more similar between H3_ELT and NAA_ELT than those at Keswick. Based on these flow results, it is expected that H3_ELT would have little effect on flow-related winter-run Chinook salmon spawning and egg incubation habitat due to their low magnitude and frequency.

Shasta Reservoir storage volume at the end of May influences flow rates below the dam during the May through September winter-run spawning and egg incubation period. Mean Shasta May storage under H3_ELT would be similar (<5% difference) to storage under NAA_ELT for all water year types (Table 11-4A-12).

Table 11-4A-12. Difference and Percent Difference in Mean May Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Alternative 4A (Scenario H3_ELT)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-13 (-0.3%)	0 (0%)
Above Normal	-73 (-2%)	-46 (-1%)
Below Normal	-83 (-2%)	13 (0.3%)
Dry	-223 (-6%)	-19 (-1%)
Critical	-205 (-8%)	92 (4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean water temperatures for each water year type in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between H3_ELT and NAA_ELT for all months and water year types throughout the period at both locations, except for August of critical years at Keswick, which would be 7% warmer under H3_ELT. If extreme drought conditions occur again in the future, DWR and Reclamation would work in close coordination with regulatory agencies to manage reservoir operations to avoid negative impacts to fish, as is currently being done.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between H3_ELT and baselines in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-15. There would be 4 (5%) more years with a "red" level of concern under H3_ELT. These differences would not be biologically meaningful to winter-run Chinook salmon spawners and eggs, as the 4 years constitute a small proportion of the 82 year period used for this analysis, as long as the years were not consecutive, which they were not in this case. If multiple years of drought occurs in the future, DWR and Reclamation would work in close coordination with regulatory agencies to manage reservoir operations to avoid negative impacts to fish, as is currently being done.

Table 11-4A-13. Maximum Water Temperature Thresholds for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Location	Period	Maximum Water Temperature (°F)	Purpose
Upper Sacramento River			
Bend Bridge	May–Sep	56	Winter- and spring-run spawning and egg incubation
		63	Green sturgeon spawning and egg incubation
Red Bluff	Oct–Apr	56	Spring-, fall-, and late fall–run spawning and egg incubation
Hamilton City	Mar–Jun	61 (optimal), 68 (lethal)	White sturgeon spawning and egg incubation
Feather River			
Robinson Riffle (RM 61.6)	Sep–Apr	56	Spring-run (Sep-Jan) and steelhead (Jan-Apr) spawning and incubation
	May–Aug	63	Spring-run and steelhead rearing
Gridley Bridge	Oct–Apr	56	Fall- and late fall–run spawning and steelhead rearing
	May–Sep	64	Green sturgeon spawning, incubation, and rearing
American River			
Watt Avenue Bridge	May–Oct	65	Juvenile steelhead rearing

Table 11-4A-14. Number of Days per Month Required to Trigger Each Level of Concern for Water Temperature Exceedances in the Sacramento River for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Exceedance above Water Temperature Threshold (°F)	Level of Concern			
	None	Yellow	Orange	Red
1	0–9 days	10–14 days	15–19 days	≥20 days
2	0–4 days	5–9 days	10–14 days	≥15 days
3	0 days	1–4 days	5–9 days	≥10 days

Table 11-4A-15. Differences between H3_ELT and NAA_ELT in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Red	28 (55%)	4 (5%)
Orange	-14 (-82%)	-3 (-50%)
Yellow	-11 (-100%)	-1 (-100%)
None	-3 (-100%)	0 (NA)

Note: For definitions of levels of concern, see Table 11-4A-14.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-4A-16). The monthly total degree-days under H3_ELT would be up to 8% lower than under NAA_ELT during May and June, up to 9% higher during August and September, and similar for July. However, the CALSIM modeling used for this analysis assumed a change in release patterns between May and September compared to NAA_ELT that is driving this increase in temperatures later in the summer. In reality, Shasta reservoir would not be operated differently from NAA_ELT, using real time operations and adaptive management, and temperatures are expected to be similar to those under NAA_ELT.

Table 11-4A-16. Differences between H3_ELT and NAA_ELT in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
May	Wet	502 (133%)	3 (0.3%)
	Above Normal	130 (61%)	-105 (-23%)
	Below Normal	270 (123%)	-18 (-4%)
	Dry	186 (100%)	-99 (-21%)
	Critical	212 (96%)	-6 (-1%)
	All	1,300 (107%)	-225 (-8%)
June	Wet	336 (88%)	-29 (-4%)
	Above Normal	94 (64%)	-20 (-8%)
	Below Normal	121 (87%)	-19 (-7%)
	Dry	147 (78%)	-62 (-16%)
	Critical	185 (46%)	-59 (-9%)
	All	883 (70%)	-189 (-8%)
July	Wet	166 (32%)	-56 (-8%)
	Above Normal	105 (130%)	29 (18%)
	Below Normal	156 (106%)	-28 (-8%)
	Dry	340 (121%)	83 (15%)
	Critical	735 (89%)	-49 (-3%)
	All	1,502 (81%)	-21 (-1%)
August	Wet	952 (137%)	16 (1%)
	Above Normal	279 (68%)	-7 (-1%)
	Below Normal	465 (175%)	-27 (-4%)
	Dry	1,119 (167%)	311 (21%)
	Critical	1,209 (81%)	-67 (-2%)
	All	4,024 (114%)	226 (3%)
September	Wet	92 (12%)	83 (11%)
	Above Normal	146 (20%)	266 (45%)
	Below Normal	742 (99%)	289 (24%)
	Dry	1,368 (107%)	119 (5%)
	Critical	981 (47%)	-49 (-2%)
	All	3,329 (60%)	708 (9%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be lower or similar to mortality under NAA_ELT except in below normal water years (23% greater), although the absolute increase in mortality for this water year type would be less than 1% (Table 11-4A-17). Therefore, the increase in mortality from NAA_ELT to H3_ELT, although large on a relative scale, would be negligible at an absolute scale to the winter-run population. If multiple years of drought occurs in the future, DWR and Reclamation would work in close coordination with regulatory agencies to manage reservoir operations to avoid negative impacts to fish, as is currently being done.

Table 11-4A-17. Difference and Percent Difference in Percent Mortality of Winter-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0.4 (100%)	0 (0%)
Above Normal	0.4 (80%)	0 (0%)
Below Normal	0.6 (60%)	0.3 (23%)
Dry	2 (107%)	0 (0%)
Critical	18 (68%)	-4 (-9%)
All	3 (72%)	-1 (-7%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

SacEFT predicts that there would be a 20% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT compared to NAA_ELT (Table 11-4A-18). On an absolute scale, this reduction would be small (i.e., 9% lower). SacEFT predicts that the percentage of years with good (lower) redd scour risk would be similar to the percentage of years under NAA_ELT. SacEFT predicts that the percentage of years with good egg incubation conditions under H3_ELT would be 9% lower than under NAA_ELT. SacEFT predicts that the percentage of years with good (lower) redd dewatering risk under H3_ELT would be 7% lower than the percentage of years under NAA_ELT. These results indicate that Alternative 4A would cause a modest reduction in spawning WUA, egg incubation conditions, and red dewatering risk.

The biological significance of a 9% reduction in available suitable spawning habitat varies at the population level in response to a number of factors, including adult escapement. For those years when adult escapement is less than the carrying capacity of the spawning habitat, a reduction in area would have little or no population level effect. In years when escapement exceeds carrying capacity of the reduced habitat, competition among spawners for space (e.g., increased redd superimposition) would increase, resulting in reduced reproductive success. The reduction in the frequency of years in which spawning habitat availability is considered to be good by SacEFT could result in reduced reproductive success and abundance of winter-run Chinook salmon if the number of spawners is limited by spawning habitat quantity. However, it is unlikely that spawning habitat is limiting to winter-run Chinook salmon due to their small spawning adult population sizes in recent years relative to historical numbers.

Table 11-4A-18. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Winter-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Spawning WUA	-21 (-36%)	-9 (-20%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-9 (-9%)	-9 (-9%)
Redd Dewatering Risk	2 (8%)	-2 (-7%)
Juvenile Rearing WUA	-5 (-10%)	8 (22%)
Juvenile Stranding Risk	-8 (-40%)	-20 (-63%)

WUA = Weighted Usable Area.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

H4_ELT/HOS_ELT

Flows in the Sacramento River between Keswick and Red Bluff Diversion Dam under H4_ELT between May and September would generally be similar to flows under NAA_ELT (Appendix B, Section B.7). May storage in Shasta Reservoir under H4_ELT would be similar to storage under NAA_ELT, except in critical water years in which storage would be 11% greater under H4_ELT (Table 11-4A-19).

Table 11-4A-19. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Shasta Reservoir for H4_ELT Scenario

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-10 (-0.2%)	2 (-0%)
Above Normal	-53 (-1.2%)	-26 (-0.6%)
Below Normal	-67 (-1.6%)	29 (0.7%)
Dry	-141 (-3.7%)	62 (1.7%)
Critical	-53 (-2.2%)	244 (11.4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean water temperatures for each water year type in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between H4_ELT and NAA_ELT in any month or water year type throughout the period at either location.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between H4_ELT and NAA_ELT in the levels of concern across all months and all 82 modeled years are presented in Table 11-4A-20. There would be little difference in the highest level of concern between H4_ELT and NAA_ELT. There would be 1 (17%) more year with an "orange" level of concern and 1 more year with a "yellow" level of concern under H4_ELT, which would not be biologically meaningful to winter-run Chinook salmon spawners and eggs.

Total degree-days exceeding 56°F at Bend Bridge were summed by month and water year type during May through September (Table 11-4A-21). The monthly total degree-days under H4_ELT would be lower than under NAA_ELT for all 5 months, with up to 13% lower total degree-days (August). Total degree-days under H4_ELT would be most similar to that under NAA_ELT for the months of June and September.

Table 11-4A-20. Differences between H4_ELT and NAA_ELT in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Red	21 (41%)	-3 (-4%)
Orange	-10 (-59%)	1 (17%)
Yellow	-9 (-82%)	1 (100%)
None	-2 (-67%)	1 (NA)

Note: For definitions of levels of concern, see Table 11-4A-14.

Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Table 11-4A-21. Differences between H4_ELT and NAA_ELT in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
May	Wet	502 (133%)	3 (0%)
	Above Normal	149 (70%)	-86 (-19%)
	Below Normal	291 (133%)	3 (1%)
	Dry	244 (131%)	-41 (-9%)
	Critical	188 (85%)	-30 (-7%)
	All	1,374 (113%)	-151 (-6%)
June	Wet	362 (94%)	-3 (0%)
	Above Normal	150 (101%)	36 (14%)
	Below Normal	144 (104%)	4 (1%)
	Dry	202 (107%)	-7 (-2%)
	Critical	141 (35%)	-103 (-16%)
	All	999 (79%)	-73 (-3%)
July	Wet	175 (34%)	-47 (-6%)
	Above Normal	63 (78%)	-13 (-8%)
	Below Normal	158 (107%)	-26 (-8%)
	Dry	345 (122%)	88 (16%)
	Critical	569 (69.1%)	-215 (-13%)
	All	1,310 (71%)	-213 (-6%)
August	Wet	853 (122%)	-83 (-5%)
	Above Normal	199 (49%)	-87 (-13%)
	Below Normal	406 (153%)	-86 (-11%)
	Dry	673 (100%)	-135 (-9%)
	Critical	709 (48%)	-567 (-21%)
	All	2,840 (81%)	-958 (-13%)
September	Wet	47 (6%)	38 (5%)
	Above Normal	9 (1%)	129 (22%)
	Below Normal	737 (99%)	284 (24%)
	Dry	1,138 (89%)	-111 (-4%)
	Critical	514 (25%)	-516 (-17%)
	All	2,445 (44%)	-176 (-2%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NEPA Effects: Alternative 4A does not propose any changes in Shasta Reservoir operating criteria, and CALSIM results show that Reclamation could operate Shasta in such a manner that it does not affect upstream storage or flows substantially as compared to the NAA_ELT. However, the CALSIM modeling used for this analysis assumed a change in release patterns between May and September, compared to NAA. This resulted in the available analytical tools showing conflicting results regarding the temperature effects of relatively small changes in predicted summer and fall flows.

Several models (CALSIM, SRWQM, and Reclamation Egg Mortality Model) generally show no change in upstream conditions as a result of Alternative 4A. However, one model, SacEFT, shows adverse effects under some conditions, primarily in the later summer. After extensive investigation of these modeling results, they appear to be a function of high model sensitivity to relatively small changes in estimated upstream conditions combined with the assumed CALSIM release patterns, which may or may not accurately predict adverse effects. Temperature and end of September storage criteria from the NMFS (2009a) BiOp for Shasta reservoir are maintained, in order to minimize adverse effects to spawning and incubating salmonids including winter-run Chinook salmon. Review of modeling results by FWS and NMFS has confirmed that no additional upstream criteria are necessary to meet the NMFS BiOp criteria under Alternative 4A and, because operations of Alternative 4A will require continued compliance with the NMFS BiOp for Shasta operations, regardless of Delta operations, this effect would not be adverse.

CEQA Conclusion: Collectively, the results of the Impact AQUA-40 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to the Existing Conditions.

H3_ELT/ESO_ELT

CALSIM flows in the Sacramento River between Keswick and Red Bluff Diversion Dam were examined during the May through September winter-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)*.* Mean flows between Keswick and Red Bluff Diversion Dam under H3_ELT would be similar to or up to 15% lower than flows under Existing Conditions during May through August. Mean flows during September would be up to 24% lower (dry years) and 34% higher (above normal years) than flows under Existing Conditions.

Shasta Reservoir mean storage volume at the end of May under H3_ELT would be similar to storage under Existing Conditions in wet, above normal, and below normal water years and 6% and 8% lower than storage under Existing Conditions in dry and critical water years, respectively (Table 11-4A-12). This indicates that there would be a small effect of H3_ELT on flows during the spawning and egg incubation period in drier water years.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between H3_ELT and Existing Conditions during May and June. Mean water temperature at Keswick would be up to 14% higher under H3_ELT in July through September. Higher temperatures are persistent throughout the two months of August and September at Keswick, which would cause a negative effect on winter-run Chinook salmons spawning and egg incubation. Mean temperature at Bend Bridge would be 5% higher under H3_ELT than under Existing Conditions in August of critical year types. There would be no other differences (<5%) at Bend Bridge.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. The number of years classified as "red" would increase by 55% (28 years) under H3_ELT relative to Existing Conditions (Table 11-4A-15). This would cause a negative effect to winter-run Chinook salmon spawning and egg incubation.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-4A-16). The monthly total degree-days would be 60% to 107% higher under H3_ELT than under Existing Conditions depending on month. This would cause a negative effect to winter-run Chinook salmons spawning and egg incubation.

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be 60% to 107% greater (relative scale) than mortality under Existing Conditions depending on water year type (Table 11-4A-17). However, the increase would be more than 5% of the winter-run population on an absolute scale, and therefore be biologically meaningful, only in critical years (18% higher). Overall, these results indicate that H3_ELT, in combination with climate change effects, would cause increased winter-run Chinook salmon mortality in the Sacramento River in critical years.

SacEFT predicts that there would be a 36% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT compared to Existing Conditions (Table 11-4A-18) as a result of the combined effects of climate change and Alternative 4A. SacEFT predicts that the percentage of years with good (lower) redd scour risk under H3_ELT and climate change would be similar to the percentage of years under Existing Conditions. SacEFT predicts that the percentage of years with good egg incubation conditions under H3_ELT and climate change would be 9% lower than under Existing Conditions. SacEFT predicts that the percentage of years with good (lower) redd dewatering risk under H3_ELT and climate change would be 8% greater than the percentage of years under Existing Conditions. These results indicate that Alternative 4A, in combination with climate change effects, which are the primary driver for these changes, would cause large reductions in spawning WUA. However, due to the highly suppressed population size of winter-run Chinook salmon relative to historical population sizes, it is unlikely that spawning habitat is currently limiting.

H4_ELT/HOS_ELT

Mean flows in the Sacramento River between Keswick and Red Bluff Diversion Dam under H4_ELT between May and August would generally be similar to or up to 14% lower than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows during September would be up to 20% lower (dry years) and 53% higher (above normal years) than flows under Existing Conditions. Mean May storage in Shasta Reservoir under H4_ELT would be similar to storage under Existing Conditions in all water year types (Table 11-4A-19). Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions at either location.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-20. There would be a 41% increase in the number of years with a red level of concern under H4_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F at Bend Bridge were summed by month and water year type during May through September (Table 11-4A-21). The monthly total degree-days under H4_ELT would range from 44% to 113% higher than under Existing Conditions depending on month.

Summary of CEQA Conclusion

Under Alternative 4A, egg mortality (according to the Reclamation egg mortality model) in drier water years, during which winter-run Chinook salmon would already be stressed due to reduced flows and increased temperatures, would be up to 18% greater (absolute difference) than egg mortality under the CEQA baseline. The extent of spawning habitat and egg incubation conditions according to the SacEFT model are predicted to be 21% and 9% lower, respectively, on an absolute scale. Years with water temperatures at the red level of concern and exceedances above NMFS temperature thresholds would be substantially greater under Alternative 4A relative to the CEQA baseline. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of winter-run as a result of egg mortality, although, due to the highly suppressed population size of winter-run Chinook salmon relative to historical population sizes, it is unlikely that spawning habitat is currently limiting.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 4A. SacEFT predicts that the extent of spawning habitat and egg incubation conditions in the Sacramento River would result in adverse effects under some conditions. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-41: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Winter-Run ESU)

In general, Alternative 4A would not adversely affect rearing habitat for fry and juvenile winter-run Chinook salmon relative to the NAA_ELT.

H3_ELT/ESO_ELT

Sacramento River flows between Keswick and upstream of Red Bluff Diversion Dam were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can lead to reduced extent and quality of fry and juvenile rearing habitat. Mean flows under H3_ELT during August through October and December would generally be similar to flows under NAA_ELT, with minor exceptions. Flows during November under H3_ELT would be up to 23% lower than flows under NAA_ELT. The biological implications of this reduction during November is analyzed below in the SALMOD and SacEFT analyses, which analyze the effects of flow changes on weighted usable rearing area for winter-run Chinook salmon in the Sacramento River.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between H3_ELT and NAA_ELT in any month or water year type throughout the period at either location, except a 7% increase for August of critical years.

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under H3_ELT would be 22% greater on a relative scale (8% on an absolute scale) than the percentage of years under NAA_ELT (Table 11-4A-18). However, the percentage of years with good (low) juvenile stranding risk under H3_ELT is predicted to be 63% lower on a relative scale (20% on an absolute scale) than under NAA_ELT. These results indicate that while the quantity of juvenile rearing habitat in the Sacramento River would slightly increase under H3_ELT, its quality, with respect to stranding risk, would be reduced. However, although there would be an improvement in rearing weighted usable area, it would not likely result in a benefit to the population due to the highly suppressed population sizes in recent years.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under H3_ELT would be 7% lower than under NAA_ELT. These results are inconsistent with SacEFT results, which indicate that juvenile stranding risk would increase under H3_ELT (Table 11-4A-18).

Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about winter-run Chinook salmon rearing conditions. Although SALMOD does not parse out stranding effects specifically, the model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile stranding risk may increase under H3_ELT, when combined with all early life stage effects in SALMOD, the effects of H3_ELT would be marginally beneficial to winter-run Chinook salmon survival. Further, these results indicate that the November flow reductions in the Sacramento River identified above would not have a biological effect on winter-run Chinook salmon rearing.

H4_ELT/HOS_ELT

Mean flows in the Sacramento River between Keswick and Red Bluff Diversion Dam under H4_ELT during August through October and December would be similar to flows under NAA_ELT, with minor exceptions, but flows in November would be lower for all water year types (11% to 20% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in this reach of the Sacramento River under H4_ELT during November are very similar to those under H3_ELT. As described above, under H3_ELT, further biological modeling indicated that these November flow reductions would not cause a biologically meaningful effect on winter-run Chinook salmon. Although no further biological modeling was conducted for H4_ELT, it can be concluded, based on the similar nature of these results, that these reductions under H4_ELT would also not cause a biologically meaningful effect on winter-run Chinook salmon rearing.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between H4_ELT and NAA_ELT in any month or water year type throughout the period at either location.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 4A is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat or substantially interfere with winter-run Chinook salmon rearing. Differences in flows and temperatures are generally small and inconsistent among months and water year types. SALMOD and SacEFT predicted contradicting results regarding habitat-related mortality. SacEFT found that juvenile stranding risk is expected to increase. However, SALMOD results include the effects to all early life stages combined and, therefore, are more representative of the overall effects to winter-run Chinook salmon in the upper Sacramento River. The SALMOD model found that Alternative 4A would provide a minor beneficial effect (7% reduction in habitat-related mortality) to early life stages of winter-run Chinook salmon. Flow and temperature results are predominantly similar between H3 and H4.

CEQA Conclusion: In general, Alternative 4A would not reduce the quantity and quality of fry and juvenile rearing habitat for winter-run Chinook salmon relative to Existing Conditions.

H3_ELT/ESO_ELT

Sacramento River flows between Keswick and Red Bluff Diversion Dam were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can lead to reduced extent and quality of fry and juvenile rearing habitat. Mean flows under H3_ELT during August and October through December would generally be similar to or up to 20% lower than flows under Existing Conditions. Flows under H3_ELT during September would be up to 24% lower (dry years) and 34% higher (above normal years) than flows under Existing Conditions.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature at Keswick would be higher (by up to 14%, but generally less than 8%) under H3_ELT than under Existing Conditions in August through October, depending on month and water year type. There would be an increase of 6% in mean water temperature at Bend Bridge for August of critical years, but no other differences in water temperature at this location, and no differences (<5%) between Existing Conditions and H3_ELT in mean water temperature during November and December for any of the water year type at either location.

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under H3_ELT, combined with climate change, would be 10% lower on a relative scale (5% on an absolute scale) than under Existing Conditions (Table 11-4A-18). The percentage of years with good (low) juvenile stranding risk under H3_ELT is predicted to be 40% lower on a relative scale (8% on an absolute scale) than the percentage under Existing Conditions. These results indicate that the quantity and quality, with respect to stranding risk, of juvenile rearing habitat in the Sacramento River would be marginally lower under H3_ELT relative to Existing Conditions.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under H3_ELT would be 28% lower than under Existing Conditions. These results are somewhat inconsistent with SacEFT results, which indicate that the number of years with good juvenile rearing WUA and with good (low) stranding risk would both marginally increase under H3_ELT (Table 11-4A-18). Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP. Therefore, results of both models were used to draw conclusions about winter-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile stranding risk may increase under H3_ELT, when combined with all early life stage effects in SALMOD, the effects of H3_ELT would be marginally beneficial to winter-run Chinook salmon.

H4_ELT/HOS_ELT

Mean flows in the Sacramento River between Keswick and Red Bluff Diversion Dam under H4_ELT in August and October through December would generally be similar to or up to 19% lower than flows under Existing Conditions. Flows under H4_ELT during September would be up to 53% higher (above normal years) and up to 20% lower (dry years) than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*) There would be no differences (<5%) in mean monthly water temperature between H4_ELT and Existing Conditions in any month or water year type throughout the period at either location.

Summary of CEQA Conclusion

These modeling results indicate that the impact would be less than significant because it does not have the potential to substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish, and no mitigation is necessary. Flows under Alternative 4A would be highly variable relative to Existing Conditions and there would be small increases under the alternative in water temperatures during some of the period of presence. SALMOD and SacEFT predicted contradicting results regarding habitat-related mortality, although because SALMOD incorporates more of the life cycle of winter-run Chinook salmon, its results are more representative of overall effects to winter-run Chinook salmon in the upper Sacramento River. Overall, the impact would be less than significant and no mitigation is required. Flow and temperature results are predominantly similar between H3 and H4.

Impact AQUA-42: Effects of Water Operations on Migration Conditions for Chinook Salmon (Winter-Run ESU)

In general, the effects of Alternative 4A on winter-run Chinook salmon migration conditions relative to the NAA are not adverse because the primary impact mechanism is the change in flow past the proposed NDD, and as described in Chapter 3, the operations of the NDD would take into account triggers developed by DFW and NMFS that would allow for adjustments in NDD operations to minimize and avoid effects on Chinook salmon and steelhead.

Upstream of the Delta

H3_ELT/ESO_ELT

Flows in the Sacramento River upstream of Red Bluff were examined for the July through November juvenile emigration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). A substantial reduction in flow may reduce the ability of juvenile winter-run to migrate effectively through the Sacramento River due to a reduction in olfactory cues, although there is little empirical evidence supporting this. Mean flows under H3_ELT would be up to 18% lower than under NAA_ELT during November and generally similar to NAA_ELT during the rest of the juvenile winter-run Chinook salmon migration period (July through October), with minor exceptions.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature would be 7% higher under H3_ELT than under NAA_ELT for August of critical years. There would be no other differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

Flows in the Sacramento River upstream of Red Bluff during the adult winter-run Chinook salmon upstream migration period (December through August) under H3_ELT would generally be similar to those under NAA_ELT.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location, except a 7% increase in water temperature under H3_ELT at Bend Bridge for August of critical years.

H4_ELT/HOS_ELT

Flows in the Sacramento River upstream of Red Bluff during the July through November juvenile emigration period under H4_ELT would generally be similar to flows under NAA_ELT, except in November, in which flows would be lower for all water year types (up to 15% lower for below normal years) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These flow reductions would not be of sufficient frequency or magnitude to cause biologically meaningful effects on migrating juveniles.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

Mean flows in the Sacramento River upstream of Red Bluff during the adult winter-run Chinook salmon upstream migration period (December through August) under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

Through-Delta

H3_ELT/ESO_ELT

Juveniles

Plan Area flows have considerable importance for downstream migrating juvenile salmonids (primarily for those remaining in the Sacramento River as opposed to entering the Yolo Bypass at Fremont Weir) and would be affected by the north Delta diversions, as discussed above for winter-run Chinook (Impact AQUA-42 for Alternative 1A). Average monthly Sacramento River flows below the NDD under H3_ELT for juvenile winter-run migrants (November through May) would be reduced 4% to 30% compared to NAA_ELT, depending on water year type (Appendix B, *Supplemental Modeling for Alternative 4A,* Section B.7), assuming that NDD operations are based solely on operations described in Table 3-16 in Chapter 3 of Appendix A of this RDEIR/SDEIS. Note that the modeling of NAA_ELT does not account for any flow entering the Yolo Bypass because of Fremont Weir modifications that would occur separately from Alternative 4A (but which are included in the modeling of H3_ELT and H4_ELT; see also Section 4.1.2.2 of Section 4); this would slightly decrease the amount of water in the Sacramento River under NAA_ELT, so the above comparison of H3_ELT vs. NAA_ELT is conservative. As noted for Alternative 4 and described in more detail for Alternative 1A, *CM1 Water Facilities and Operation* includes bypass flow criteria that will be managed in real time, based on triggers developed by DFW and NMFS, to minimize adverse effects of diversions at the north Delta intakes on downstream-migrating salmonids. Additional detail is provided in Chapter 3, Section 3.6.4.2.

Potential predation effects at the north Delta intakes for juvenile salmonids remaining in the Sacramento River (as opposed to entering the Yolo Bypass) could occur if predatory fish aggregated along the screens as has been observed at other long screens in the Central Valley (Vogel 2008). Baseline levels of predation are uncertain, however. Analysis by a bioenergetics model (Appendix 5.F, *Biological Stressors on Covered Fish,* Section 5.F.3.2.1) suggests that considerably less than 0.3% of winter-run juveniles could be preyed upon (Table 11-4A-11). Using another scenario of predation that assumes a 5% loss per intake (based on GCID losses, Vogel 2008) would yield a cumulative loss of about 12% of the annual production that reaches the north Delta. The three intake structures and associated permanent bankline modifications would result in a permanent loss of up to 13.7 acres aquatic habitat and the permanent modification of 2.6 miles of shoreline along the migration route. There are appreciable uncertainties in the analysis of predation loss, including unknown baseline levels of predation[5], uncertainty in the bioenergetics model parameters, and the comparability of the GCID intakes for estimating loss rates. As discussed for Alternative 1A, the GCID screen and the proposed north Delta diversion intake screens are substantially different. The GCID is located along a relatively narrow oxbow channel (about 10 to 50 meters wide) while the north Delta intakes would be located on the much wider channel of the mainstem lower Sacramento River (about 150 to 180 meters wide). In addition, the fish tested at GCID were relatively small (average length generally less than 70 mm; Vogel 2008) in comparison to the size of winter-run Chinook salmon that would generally occur near the north Delta intakes (average length generally greater than 70 mm; del Rosario et al. 2013), which could have resulted in different susceptibility to predation. For the purposes of the analysis of Alternative 4A, it is assumed that all juvenile salmon migrating down the mainstem Sacramento River would come in close proximity to the intakes, although there is high uncertainty with this assumption. However, the estimates of predation loss at GCID are for a single large diversion intake, while Alternative 4A would have three north Delta intakes. Thus, while factors unique to the GCID screen may increase predation loss estimates relative to the north Delta, the cumulative amount of intake structure proposed under the Plan would be much larger than the GCID screen, increasing exposure of juvenile salmon to screen-related impacts. Overall, a fixed 5% loss per intake represents a conservative upper bound on predation loss.

Through-Delta survival by juvenile winter-run Chinook salmon, as estimated by the Delta Passage Model under Scenario H3_ELT, averaged 32.8% across all years, 25.5% in drier years, and 45.0% in wetter years (for further details, refer to *BDCP Appendix 5.C, Section 5C.5.3.1.3.1 herby incorporated by reference*). Average juvenile through-Delta survival under H3_ELT was similar or slightly lower than NAA_ELT (1.6% less, a 4.7% relative decrease), based on operations assuming no adjustments made in real-time in response to actual presence of fish (Table 11-4A-23). However, as noted previously in the introduction to the impact assessment for Alternative 4A and above, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. To provide perspective on the potential for such changes to influence the results of the DPM, a modification to the NAA_ELT results (termed NAA_ELT (mod.) in Table 11-4A-23) was created by post-processing the outputs of the NAA_ELT scenario. The post-processing consisted of substituting year-specific Yolo Bypass entry percentages and Yolo Bypass survival from the H3_ELT scenario into the results from the NAA_ELT scenario; this was done to represent the Fremont Weir

[5] Data from the GCID study by Vogel (2008) for releases made in 2007—this being the only year of the study in which flow-control blocks at the weir at the downstream end of the fish screen were removed, to reduce predatory fish concentration—indicate that the proportion of tagged juvenile Chinook salmon released at the upstream end of the fish screen that were recaptured at a downstream location was similar or slightly greater than for fish released at the downstream end of the fish screen, when standardized for the distance that these fish had to travel to the release point. These data suggest that survival along the screen was at least similar to survival in the portion of the channel without the screen (i.e., screen survival was similar to baseline survival, if the latter is assumed to be represented by the channel downstream of the screen). However, test fish were released at the downstream end of the screen (below the flow-control weir) prior to the fish that were at the upstream end of the fish screen, which could have confounded comparisons of relative survival between these groups if predatory fishes became partly satiated prior to the arrival of the fish released at the upstream end of the screen (thus making their survival relatively higher).

modifications that would occur under NAA_ELT through a separate Yolo Bypass improvements program that is assumed to occur irrespective of Alternative 4A. These results illustrated that there would be a slightly larger incremental difference in survival under H3_ELT when considering incorporating Yolo Bypass improvements as part of NAA_ELT: across all years, the mean through-Delta survival under H3_ELT was 1.6% less (a 4.7% relative decrease) than NAA_ELT compared to 2.0% less (a 5.8% relative decrease) compared to NAA_ELT (mod.). The overall difference was driven mostly by the relatively larger difference in drier years, for which the mean through-Delta survival under H3_ELT was 1.7% less (a 6.3% relative decrease) than NAA_ELT, compared to 2.5% less (an 8.9% relative decrease) than NAA_ELT (mod.). The post-processing of the NAA_ELT outputs to give the NAA_ELT (mod.) results does not account for the resulting slightly lower flow in the Sacramento River (which would slightly reduce through-Delta survival outputs from the DPM because of the flow-survival relationships included in the model) because of increased flow entering the Yolo Bypass. The post-processing of the NAA_ELT outputs to give the NAA_ELT (mod.) results also does not account for changes in hydraulics at important channel divergences, particularly between the Sacramento River and Georgiana Slough, that would occur with the 8,000 acres of tidal habitat restoration under the NAA_ELT; as illustrated in the Draft BDCP (See *BDCP Appendix 5.C, Sections 5C.4.3.2.6 and 5C.5.3.8 incorporated by reference*), habitat restoration in the north Delta and the resulting dampening of tidal influence in the Sacramento River would tend to result in less fish entering the low-survival interior Delta, slightly increasing survival. It is assumed in this analysis that these opposing factors balance each other out, so that for the purposes of this analysis, the difference between H4_ELT and NAA_ELT (mod.) provides a reasonable indication of the difference in through-Delta survival between NAA_ELT and Alternative 4A (Scenario H4_ELT, in this case).

Table 11-4A-23. Through-Delta Survival (%) of Emigrating Juvenile Winter-Run Chinook Salmon under Alternative 4A (Scenarios H3_ELT and H4_ELT)

	Average Percentage Survival					Difference in Percentage Survival (Relative Difference)					
	SCENARIO					EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	NAA_ ELT	NAA_ ELT (mod.)	H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT (vs. NAA_ELT mod.)	H4_ELT (vs. NAA_ELT mod.)
Wetter Years	46.3	46.3	46.3	45.0	46.0	-1.3 (-2.8%)	-0.4 (-0.8%)	-1.2 (-2.7%)	-0.3 (-0.7%)	-1.2 (-2.7%)	-0.4 (-0.9%)
Drier Years	28.0	27.3	28.0	25.5	25.6	-2.4 (-8.7%)	-2.4 (-8.6%)	-1.7 (-6.3%)	-1.7 (-6.2%)	-2.5 (-8.9%)	-2.5 (-8.9%)
All Years	34.9	34.4	34.9	32.8	33.2	-2.1 (-6.0%)	-1.7 (-4.9%)	-1.6 (-4.7%)	-1.2 (-3.5%)	-2.0 (-5.8%)	-1.7 (-4.9%)

Note: Average Delta Passage Model results for survival to Chipps Island.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
Wetter = Wet and Above Normal Water Years (6 years).
Drier = Below Normal, Dry and Critical Water Years (10 years).
H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.
NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT

Adults

As noted for Alternative 4, adult salmonids migrating through the delta use flow and olfactory cues for navigation to their natal streams (Marston et al. 2012), as discussed for winter-run Chinook under Impact AQUA-42 for Alternative 1A. Attraction flows and olfactory cues in the west Delta would be altered because of shifts in exports from the south Delta to the north Delta. Flows in the Sacramento River downstream of the north Delta intake diversions would be reduced, with concomitant proportional increases in San Joaquin River flow, with differences between water-year types because of differences in the relative proportion of water being exported from the north Delta and south Delta facilities (Appendix B, *Supplemental Modeling for Alternative* 4A, Section B.7).

As described for Alternative 4, these changes may slightly decrease the Sacramento River olfactory cues used by migrating adults, although the changes are within the dilution factor and the behavioral response is uncertain. Fingerprint analyses determined that attraction flow, as estimated by the percentage of Sacramento River water at Collinsville, declined from NAA_ELT to Scenario H3_ELT operations by up to 6% during the peak migration period for winter-run adults (December through February) and by 10–12% in March–April (Table 11-4A-24). As noted for Alternative 4, the Sacramento River would still represent a substantial proportion of Delta outflows. Under Scenario H4_ELT, the difference would be less due to increased spring outflows in March, April, and May. Overall, the reductions in olfactory cues resulting from all scenarios would be less than the magnitude of change in dilution (20% or more) reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to affect adult Chinook salmon migration. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. This topic is discussed further in Impact AQUA-42 for Alternative 1A.

Table 11-4A-24. Percentage (%) of Water at Collinsville that Originated in the Sacramento River during the Adult Winter-Run Chinook Salmon Migration Period for Alternative 4A (Scenario H3_ELT)

Month	EXISTING CONDITIONS	NAA_ELT	H3_ELT	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
December	67	67	65	-1	-1
January	76	75	73	-2	-2
February	75	74	69	-6	-4
March	78	77	69	-9	-8
April	77	76	67	-10	-9
May	69	67	61	-8	-7
June	64	61	57	-7	-5
July	64	65	58	-6	-6
	Shading indicates 10% or greater absolute difference.				

H4_ELT/HOS_ELT

Juveniles

Plan Area flows have considerable importance for downstream migrating juvenile salmonids and would be affected by the north Delta diversions, as discussed for winter-run Chinook above (Impact AQUA-42 for Alternative 1A). Under H4_ELT, average Sacramento River flows below the NDD during the juvenile winter-run migration period (November–May) would range from being reduced by 32% to being increased by 15%, depending on water year type, compared to NAA_ELT (Appendix B, *Supplemental Modeling for Alternative 4A,* Section B.7). As described for the analysis of H3_ELT, the water conveyance facilities include bypass flow criteria that will be managed in real time to minimize adverse effects of diversions at the north Delta intakes on downstream-migrating salmonids, including the use of biological and hydrological triggers developed by NMFS and DFW to adjust NDD operations to protect migrating salmonids. Note also that, as described in the DPM analysis of H3_ELT above, CALSIM modeling of NAA_ELT does not include the slightly reduced Sacramento River flow that would occur because of Yolo Bypass improvements (more flow entering the Bypass through a modified Fremont Weir).

Through-Delta survival of juvenile winter-run Chinook salmon estimated by DPM under Scenario H4_ELT averaged 33.2% across all years, 25.6% in drier years, and 46.0% in wetter years (Table 11-4A-23; for further details, refer to *BDCP Appendix 5.C, Section 5C.5.3.1.3.1 incorporated by reference*). Average through-Delta juvenile survival under Scenario H4_ELT was generally similar to (in wetter years) or slightly lower than (in drier years) NAA_ELT based on operations assuming no adjustments made in real-time in response to actual presence of fish (Table 11-4A-23). However, as noted for the discussion of the H3_ELT scenario above, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements in NAA_ELT. As done for the H3_ELT scenarios analysis, by assuming the same Yolo Bypass survival and entry as H3_ELT for NAA_ELT (mod.), there were slightly greater differences between H4_ELT and NAA_ELT (mod.) than between H4_ELT and NAA_ELT (Table 11-4A-23).

Overall, the relatively small difference in through-Delta survival between H3_ELT and H4_ELT is explained by the relatively low overlap of the winter-run Delta entry distribution with the spring period that has differing outflows for H3_ELT and H4_ELT. In addition, the DPM has less representation of intermediate-outflow years where the differences among the Alternative 4A operations (i.e., H3_ELT vs. H4_ELT) are more pronounced than wetter or drier years.

Adults

Results for H4_ELT regarding attraction flows and olfactory cues are presented as part of the corresponding discussion under H3_ELT (above).

NEPA Effects: Modeling analyses indicate that upstream migratory conditions would generally not change under Alternative 4A. Within the Delta, adult attraction flows under Alternative 4A would not be substantially different from those under NAA_ELT and the identified differences are not expected to result in behavioral changes in upstream migration.

Near-field effects of Alternative 4A on winter-run Chinook salmon related to impingement and predation associated with three new intake structures could result in negative effects on juvenile migrating winter-run Chinook salmon, although there is high uncertainty regarding the overall effects. It is expected that the level of near-field impacts would be directly correlated to the number of new intake structures in the river and thus, as described for Alternative 4, the level of impacts associated with 3 new intakes would be considerably lower than those expected from having 5 new intakes in the river (as examined for Alternative 1A, for example). Estimates within the effects analysis range from very low levels of effects (<1% mortality) to more significant effects (~ 12% mortality above current baseline levels). As noted for Alternative 4, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, as described in the adaptive management and monitoring program in Section 4.1, several pre-construction studies to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for winter-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains highly uncertain.

As noted for Alternative 4, two recent studies (Newman 2003 and Perry 2010) indicate that far-field effects associated with the new intakes could cause a reduction in smolt survival in the Sacramento River downstream of the NDD intakes due to reduced flows in this area. The analyses of other elements of Alternative 4A related to reduced interior Delta entry (Environmental Commitment 16) and reduced south Delta entrainment suggest that these could offset the far-field effects of reduced flow (see, for example, Table 5.C.5.3-36 in the *BDCP Effects Analysis Appendix 5.C hereby incorporated by reference*). The overall magnitude of each of these factors and how they might interact and/or offset each other in affecting salmonid survival through the plan area is uncertain, and will be investigated as part of the adaptive management and monitoring program described in Section 4.1.

As described for Alternative 4, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 4A would be similar or slightly lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 4A on juvenile winter-run Chinook salmon migration suggests a potential adverse effect of small magnitude. Note that the DPM focuses on smolt-sized individuals (70 mm or more) and is not based on survival data for fry-sized individuals, which also may be migrating and could be affected by Alternative 4A operations. There are no fry through-Delta survival data to inform the effects to these individuals in relation to operations and it is uncertain whether the relative difference between scenarios estimated from the DPM for smolt-sized fish would be representative of relative differences for fry. The potential adverse effect to all sizes of juvenile winter-run Chinook salmon would be minimized through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 4A of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of winter-run Chinook salmon juveniles into the low-survival interior Delta.

CEQA Conclusion: In general, Alternative 4A would not reduce migration conditions for winter-run Chinook salmon relative to Existing Conditions.

Upstream of the Delta

H3_ELT /ESO_ELT

Flows in the Sacramento River upstream of Red Bluff were examined during the July through November juvenile emigration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). A reduction in flow may reduce the ability of juvenile winter-run to migrate effectively through the Sacramento River. Mean flows for juvenile migrants under H3_ELT, combined with climate change, would be similar to or up to 16% lower than flows under Existing Conditions during July, August, October, and November, and would be up to 22% lower (dry years) and 32% higher (above normal years) during September.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature at Keswick would be higher (by up to 14%, but generally less than 8%) under H3_ELT than under Existing Conditions in July through October, depending on month and water year type. There would be an increase of 6% in mean water temperature at Bend Bridge for August of critical years, but no other differences in water temperature at this location, and no differences (<5%) between Existing Conditions and H3_ELT in mean water temperature during November for any of the water year type at either location.

Flows in the Sacramento H3_ELT River upstream of Red Bluff were examined during the adult winter-run Chinook salmon upstream migration period (December through August). Flows under H3_ELT would generally be similar to flows under Existing Conditions throughout the adult migration period, except during August, in which flows would be up to 13% lower (critical years) under H3_ELT. These flow reductions would not be frequent or large enough to cause a biologically meaningful effect on adult migrants.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature at Keswick would be higher (by up to 14%, but generally less than 8%) under H3_ELT than under Existing Conditions in July and August, depending on month and water year type. There would be an increase of 6% in mean water temperature at Bend Bridge for August of critical years, but no other differences in water temperature at this location, and no differences (<5%) between Existing Conditions and H3_ELT in mean water temperature during December through June for any of the water year type at either location. These small increases are not expected to cause a biologically meaningful effect to adult migrants, which are less sensitive to temperatures than eggs and fry.

H4_ELT/HOS_ELT

Mean flows in the Sacramento River upstream of Red Bluff during the July through November juvenile emigration period under H4_ELT would generally be similar to or greater than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) except during September (up to 18% lower for dry years and 49% higher for above normal years).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT for all months, water year types, and locations.

Mean flows in the Sacramento River upstream of Red Bluff during the adult winter-run Chinook salmon upstream migration period (December through August) under H4_ELT would generally be similar to flows under Existing Conditions, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT for all months, water year types, and locations.

Through-Delta

Juveniles

During the juvenile winter-run Chinook salmon emigration period (November through May), mean monthly flows in the Sacramento River below the NDD under H3_ELT averaged across years would be lower (13% to 23% lower monthly mean) compared to Existing Conditions. As described above in the discussion of NEPA Effects, potential predation losses at the three north Delta intakes would range from considerably less than 1% (bioenergetics modeling; Table 11-4A-11) to about 12% (conservative upper bound based on 5% loss per intake) of the annual production that reaches the north Delta. In addition, the three intake structures would permanently displace approximately 13.7 acres of in-water habitat.

Through-Delta survival by juvenile winter-run Chinook salmon, as estimated by the Delta Passage Model under Scenario H3_ELT, would be slightly lower than Existing Conditions for H3_ELT (2.1% less, a 6% relative decrease), with the greatest reduction in drier years (2.4% lower, a 8.7% relative decrease) (Table 11-4A-23), although this estimate does not account for the adjustments that can be made during real-time operations to further protect migrating fish as necessary.

Under Scenario H4_ELT, average survival was 1.7% less (a 4.9% relative decrease) than Existing Conditions, with a 2.4% reduction under H4_ELT in drier years (an 8.6% relative decrease).

Adults

Flows in the Sacramento River downstream of the north Delta intake diversions would be reduced, slightly reducing the olfactory cues for migrating adult salmon. Under Scenario H3_ELT, the proportion of Sacramento River water was reduced no more than 8% during peak migration (December through February) and reduced by 12–13% in March-May compared to Existing Conditions (Table 11-4A-24). As described in the NEPA Effects, the reductions in percentage are small in comparison with the magnitude of change in dilution (20% or more) reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to affect adult Chinook salmon migration. The Sacramento River would still represent a substantial proportion of Delta outflows. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. This topic is discussed further in Impact AQUA-42 for Alternative 1A.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce juvenile migration conditions for winter-run Chinook salmon upstream of the Delta. Under Alternative 4A, there would be reductions in flow and increased temperatures in the

Sacramento River that could lead to biologically meaningful reductions in juvenile migration conditions, thereby reducing survival relative to Existing Conditions. Reduced migration conditions would delay or eliminate successful migration necessary to complete the winter-run Chinook salmon life cycle. Winter-run Chinook salmon juvenile survival through the Delta for Alternative 4A would be similar or slightly lower than for Existing Conditions. However, as described in the adaptive management and monitoring program in Section 4.1, several pre-construction studies to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically-based triggers to implement real time operations. As noted in the NEPA Effects discussion, due to the inclusion of bypass flow criteria, real-time operational adjustments, *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers*, the impacts would be minimized in the Delta.

This interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, there would be negligible effects on mean monthly flow and water temperatures for the juvenile and adult migration periods. Therefore, it is concluded that this impact is less than significant and no mitigation is required.

Environmental Commitments 4, 6, 7, and 10

As described for delta smelt and longfin smelt, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small; *Environmental Commitment 6 Channel Margin Enhancement* is reduced from 20 miles to 4.6 miles and *Environmental Commitment 7 Riparian Natural Community Restoration* is reduced from 5,000 acres to 205 acres. The mechanisms of impacts of habitat restoration on winter-run Chinook salmon are anticipated to be similar under Alternative 4A to those described in detail for Alternative 1A, although the magnitude would be considerably reduced in proportion to the difference in restoration area. The effects of restoration measures described for delta smelt under Alternative 1A

(Impacts AQUA-43 through AQUA-45) appropriately disclose the nature of the anticipated effects of habitat restoration Environmental Commitments in Alternative 4A on Chinook salmon.

The following impacts are those presented under Alternative 4 and Alternative 1A that are anticipated to be similar in nature for Alternative 4A, but would occur to a lesser extent because of the reduced extent of the restoration measures as Environmental Commitments under Alternative 4A.

Impact AQUA-43: Effects of Construction of Restoration Measures on Chinook Salmon (Winter-Run ESU)

The effects of construction of restoration measures on winter-run Chinook salmon under Alternative 4A are similar in nature to those discussed in more detail under Alternative 1A: temporary increases in turbidity; increased exposure to mercury and methylmercury; accidental spills; disturbance of contaminated sediments; in-water work activities; and predation. In-water and shoreline restoration construction activities may result in short-term effects on winter-run Chinook salmon through direct disturbance, short-term water quality impacts, and increased exposure to contaminants associated with the incidental disturbance of contaminated sediments. Overall and as noted for Alternative 1A, the effect of restoration construction activities on the bioavailability of contaminants is expected to be minimal, as they would likely be localized, sporadic, and of low magnitude. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on winter-run Chinook salmon. The relevant environmental commitments are: *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material.* Pertinent details of these plans are provided under Impact AQUA-1 for delta smelt under Alternative 1A. Given the greatly reduced extent of restoration under Alternative 4A relative to Alternative 1A, the effects of construction of restoration measures on winter-run Chinook salmon would be expected to be less than for Alternative 1A.

NEPA Effects**:** The effects of short-term construction activities would not be adverse to winter-run Chinook salmon due the environmental commitments described above as well as the limited extent of restoration that would occur.

CEQA Conclusion**:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on winter-run Chinook salmon but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce winter-run Chinook salmon habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-44: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Winter-Run ESU)

Alternative 4A habitat restoration actions could result in the disturbance or mobilization of upland and aquatic contaminants that could affect winter-run Chinook salmon (e.g., by causing bioaccumulation). A detailed analysis of the potential effects based on the larger extent of tidal habitat restoration proposed under Alternative 4 can be found in the *BDCP Effects Analysis – Appendix 5D*, *Contaminants (hereby incorporated by reference)*. Potential impacts on winter-run

Chinook salmon from effects of methylmercury, selenium, copper, ammonia, and pesticides associated with habitat restoration activities would be similar to those discussed for delta smelt (see Impact AQUA-8). The Yolo Bypass, a notable rearing area for juvenile Chinook salmon, is an area expected to be among the highest for potential methylmercury production and would be inundated more under improvements that would be implemented as part of the NAA_ELT (see discussion in section 4.2.7 of Section 4) and that would also exist under Alternative 4A. While juvenile Chinook salmon show high spatial variability in the bioaccumulation of methylmercury (Henery et al. 2010), it has not been demonstrated that these accumulations impair small fishes. Future exposure levels in restored habitats that are similar to current levels may not affect the species' viability, though they may be of concern for passing mercury up the food web to birds and humans. As described in *BDCP Effects Analysis – Appendix D*, *Contaminants, Section 5D.4.1 Mercury (hereby incorporated by reference)*, the amounts of methylmercury mobilized and resultant effects on covered fish species are not currently quantifiable.

Within the relatively small extent of habitat restored under *Environmental Commitment 4 Tidal Natural Communities Restoration*, it is anticipated that any potential effects of methylmercury on winter-run Chinook salmon will be addressed through implementation of Environmental Commitment 12. Environmental Commitment 12 is intended to minimize methylmercury exposure associated with restoration measures for juvenile Chinook salmon. Additional analysis and tools may be developed to further reduce methylmercury exposure as the habitat restoration actions are refined and analyzed in site-specific documents. The site-specific analysis is the appropriate place to assess the potential for risk of methylmercury exposure for Chinook salmon once site-specific sampling and other information can be developed.

NEPA Effects: The effect contaminants related to restoration is not adverse to winter-run Chinook salmon with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of Environmental Commitment 12).

CEQA Conclusion: Alternative 4A restoration actions are likely to result in slightly increased production, mobilization, and bioavailability of methylmercury. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury from restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect winter-run Chinook salmon either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-45: Effects of Restored Habitat Conditions on Chinook Salmon (Winter-Run ESU)

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on winter-run Chinook salmon would not be adverse because restoration is intended to provide habitat benefits to Chinook salmon.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on winter-run Chinook salmon would be less than significant. Consequently, no mitigation would be required.

Environmental Commitments 12, 15, and 16

As noted for delta smelt and longfin smelt, Alternative 4A includes three other Environmental Commitments environmental commitments, which are reduced in their extent relative to the Conservation Measures included in other alternatives in the Draft EIR/EIS (e.g., Alternative 1A and Alternative 4). While the extent of these commitments is reduced compared to these alternatives, the nature of the mechanisms remains the same.

Impact AQUA-46: Effects of Methylmercury Management on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 12)

As noted under Impact AQUA-10 for delta smelt under Alternative 4A, Environmental Commitment 12 will attempt to minimize conditions that promote production of methylmercury in restored areas and its subsequent introduction to the foodweb, and to covered species such as winter-run Chinook salmon. As described for Alternative 1A, Environmental Commitment 12 describes pre-design characterization, design elements, and best management practices to attempt to minimize methylation of mercury, and requires monitoring and reporting of observed methylmercury levels.

NEPA Effects: The effects of methylmercury management on winter-run Chinook salmon would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: Effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant. Consequently, no mitigation is required.

Impact AQUA-49: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish would involve efforts to reduce predation by predatory fish at the proposed north Delta intakes and at the south Delta export facilities, including Clifton Court Forebay.

NEPA Effects: To the extent that localized predator control efforts of *Environmental Commitment 15 Localized Reduction of Predatory Fish* reduce the local abundance of fish predators at the north Delta diversions and near the south Delta export facilities (e.g., in Clifton Court Forebay), it is possible, but not assured, that there would be some reduction in losses to predation of juvenile winter-run Chinook salmon (predation of adults is not a concern). This is of relevance given the potential effects on winter-run Chinook salmon juveniles because of operations of the NDD (see Impact AQUA-42). Environmental Commitment 15 would not have an adverse effect on Chinook salmon and could potentially benefit the species. Due to the uncertainty in the effectiveness of Environmental Commitment 15, however, it is concluded that there would be no demonstrable effect of this commitment on Chinook salmon.

CEQA Conclusion: Environmental Commitment 15 would not have a significant impact on Chinook salmon and could potentially benefit the species. Due to the uncertainties associated with this Environmental Commitment, however, it is concluded that there would be no demonstrable effect on winter-run Chinook salmon. Consequently, no mitigation would be required.

Impact AQUA-50: Effects of Nonphysical Fish Barriers on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 16)

Under Alternative 4A, an NPB at the divergence of Georgiana Slough from the Sacramento River would be intended to guide juvenile salmonid fish such as winter-run Chinook salmon away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to the Sacramento River (Perry et al. 2010). Exploration with the DPM of the potential effects of an NPB at this location suggests that with effectiveness similar to that observed during a pilot study in 2011 (Perry et al. 2012), through-Delta survival of winter-run Chinook salmon juveniles would not differ greatly between Alternative 4A and Existing Conditions or NAA_ELT (see Table 5.C.5.3-36 in the *BDCP Effects Analysis Appendix 5.C hereby incorporated by reference*). As discussed for Alternative 1A, the physical structure of an NPB may provide habitat for piscivorous fish in the area and increase localized predation risk, but the NPB is intended to improve migratory conditions for juvenile Sacramento River salmon, limiting their overall susceptibility to predation in the Delta.

NEPA Effects: The effects of NPBs would not be adverse because it would improve migration conditions for Chinook salmon.

CEQA Conclusion: As discussed above, the NPB at the divergence of Georgiana Slough from the Sacramento River has the potential to reduce the proportion of winter-run Chinook salmon entering the low-survival interior Delta. The impacts of *Environmental Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant. Consequently, no mitigation would be required.

Spring-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to spring-run Chinook salmon. Adult and juvenile spring-run Chinook salmon would have the potential to overlap construction and maintenance to a minor degree (Table 11-8).

Impact AQUA-55: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

The potential effects of construction of the water conveyance facilities on spring-run Chinook salmon would be the same as described for Alternative 4 (Impact AQUA-55). The potential effects of underwater noise as a result of construction of the water conveyance facilities on spring-run Chinook salmon would be the same as described above for winter-run Chinook (Impact AQUA-37), which provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-55 in Alternative 4.

NEPA Effects: Potential effects of construction of the water conveyance facilities on spring-run Chinook salmon would be similar to those discussed for winter-run Chinook salmon (see Impact AQUA-37 for winter run Chinook salmon). Construction of Alternative 4A involves several elements with the potential to cause adverse effects on spring-run Chinook salmon. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment,* *and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*); environmental commitments; and through implementation of the avoidance and minimization measures included in Mitigation Measures AQUA-1a and AQUA-1b. The effects would not be adverse for spring-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-55, the impact of the construction of water conveyance facilities on spring-run Chinook salmon would not be significant except for construction noise associated with pile driving. Potential effects of construction of the water conveyance facilities on spring-run Chinook salmon would be similar to those discussed for winter-run Chinook salmon (see Impact AQUA-37 for winter run Chinook salmon). Construction of Alternative 4A involves several elements with the potential to affect spring-run Chinook salmon. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-56: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

NEPA Effects: The potential effects of water conveyance facilities maintenance under Alternative 4A would be the similar to those described for Alternative 4, Impact AQUA-56. As concluded in Alternative 4, Impact AQUA-38, the impact would not be adverse for spring-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-56, the impact of the maintenance of water conveyance facilities on spring-run Chinook salmon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-57: Effects of Water Operations on Entrainment of Chinook Salmon (Spring-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Average entrainment of juvenile spring-run Chinook salmon at the south Delta export facilities would be reduced nearly 40% under the Scenario H3_ELT compared to NAA_ELT (Table 11-4A-25). The greatest reduction would be in wet years, when entrainment would be reduced 63% (~58,000 fish) compared to NAA_ELT. Entrainment loss under Scenario H4_ELT would further reduce south Delta entrainment relative to the Scenario H3_ELT as spring exports would be lower under H4_ELT compared to H3_ELT.

Table 11-4A-25. Juvenile Spring-Run Chinook Salmon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-53,805 (-61%)	-57,967 (-63%)
Above Normal	-7,403 (-28%)	-8,520 (-31%)
Below Normal	-1,357 (-21%)	-1,669 (-25%)
Dry	1,698 (10%)	74 (0%)
Critical	-2,622 (-22%)	-1,916 (-17%)
All Years	-13,318 (-35%)	-14,788 (-38%)

Note: Estimated annual number of fish lost, based on normalized data.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The proportion of the annual spring-run Chinook salmon index of abundance (assumed to be 750,000 juveniles approaching the Delta) lost at the south Delta facilities averaged 5.2% across all years under the NAA_ELT, and decreased to 3.3% under Alternative 4A Scenario H3_ELT. The greatest improvement was in wet years, when the proportion lost decreased by 7.7% under Alternative 4A Scenario H3_ELT (4.6%) compared to NAA_ELT (12.4%). As noted above, entrainment under Scenario H4_ELT is expected to further reduce entrainment losses relative to NAA_ELT.

Water Exports from SWP/CVP North Delta Intake Facilities

As noted for Alternative 4, the effect of Alternative 4A on entrainment and impingement at the north Delta intakes would be the same as described for Alternative 1A (Impact AQUA-57), but the degree would be less because Alternative 4A would have fewer intakes. State-of-the-art fish screens operated with an adaptive management plan would be expected to eliminate entrainment risk for juvenile spring-run Chinook salmon.

Predation Associated with Entrainment

Entrainment-related predation loss of spring-run Chinook salmon at the south Delta facilities would be no greater and may be lower than baseline due to a reduction in entrainment loss. Entrainment-related predation losses are expected to decrease under Scenario H4_ELT compared to Scenario H3_ELT.

Predation at the north Delta would be increased at the proposed North Delta intake facilities on the Sacramento River. As noted for Alternative 4, bioenergetics modeling with a median predator density predicts a predation loss of about 8,000 juveniles, or 0.2% of the spring-run juvenile population under Alternative 4A (Table 11-4A-26). This minimal predation loss would not be adverse. Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 4A. See additional discussion under Impact AQUA-42 for winter-run Chinook salmon.

Table 11-4A-26. Juvenile Spring-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes for Alternative 4A (Three Intakes)

Striped Bass at NDD (Three Intakes)			Spring-Run Chinook Consumed	
Density Assumption	Bass per 1,000 feet of Intake	Total Number of Bass	Number	Percentage of Annual Production Entering the Delta[1]
Low	18	86	1,204	0.03%
Median	119	571	7,961	0.19%
High	219	1,051	14,650	0.35%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).
[1] Estimated as 4.2 million juveniles. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

NEPA Effects: In conclusion, Alternative 4A would reduce overall entrainment and associated predation losses of juvenile spring-run Chinook salmon relative to NAA _ELT. Conditions under Scenario H4_ELT would further reduce entrainment losses compared to Scenario H3_ELT. The effect of Alternative 4A would not be adverse and may provide some benefit.

CEQA Conclusion: Entrainment losses of juvenile spring-run Chinook salmon at the south Delta facilities will be substantially reduced under the Scenario H3 operations for Alternative 4A for all water year types (35% average reduction in entrainment index) compared to Existing Conditions (Table 11-4A-25). The proportion of the annual spring-run Chinook index of abundance entrained at the south Delta facilities averaged 5.0% across all years under Existing Conditions, and would decrease to 3.3% under Alternative 4A. The greatest improvement would be in wet years, when the proportion lost would decrease by just over 7% under Scenario H3_ELT (4.6%) compared to Existing Conditions (11.8%). Under Scenario H4_ELT, entrainment losses are expected to further decrease relative to Existing Conditions. Predation loss at the north Delta intakes would have minor population level effects on spring-run Chinook salmon (<0.4% of the annual index of abundance). Overall, impacts to spring-run Chinook salmon under Alternative 4A would not be significant and would in fact be beneficial because of the reductions in entrainment losses at the south Delta facilities across all water-years compared to existing biological conditions. No mitigation would be required.

Impact AQUA-58: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Spring-Run ESU)

In general, the effects of Alternative 4A on spawning and egg incubation habitat for spring-run Chinook salmon relative to the NAA are not adverse.

H3_ELT/ESO_ELT

Sacramento River

There has been a small, inconsistent spawning population (<400 individuals) in the mainstem Sacramento River primarily upstream of Red Bluff Diversion Dam over the past decade (Azat 2012).

Flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the spring-run Chinook salmon spawning and incubation period (September through January)

(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during all months except November would generally be similar to those under NAA_ELT, with minor exceptions. Flows under H3_ELT during November would be up to 23% lower than flows during NAA_ELT, depending on water year type and location.

Shasta Reservoir storage volume at the end of September influences flows downstream of the dam during the spring-run spawning and egg incubation period (September through January). Mean storage under H3_ELT would generally be similar to storage under NAA_ELT in all water year types (Table 11-4A-27), so there would be no biologically meaningful effects.

Table 11-4A-27. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Scenario H3_ELT and Two Baseline Scenarios.

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-308 (-9%)	-11 (-0.4%)
Above Normal	-363 (-11%)	0 (0%)
Below Normal	-230 (-8%)	-63 (-2%)
Dry	-171 (-7%)	31 (1%)
Critical	-134 (-11%)	-65 (7%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between H3_ELT and NAA_ELT in any month or water year type throughout the period at either location.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September At Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-15 for Bend Bridge and in Table 11-4A-28 for Red Bluff. At Bend Bridge, there would be 4 (5%) more years with a "red" level of concern under H3_ELT, which would not be biologically meaningful to spring-run Chinook salmon spawners and eggs, as 4 years constitutes a small proportion of the 82 year period examined. At Red Bluff, there would be 1 (5%) more year with a "red" level of concern under H3_ELT, which would not be biologically meaningful to spring-run Chinook salmon spawners and eggs, as 1 year is such a small proportion of the 82 year period.

Table 11-4A-28. Differences between Baseline and H3_ELT Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F are within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Red	10 (83%)	1 (5%)
Orange	5 (83%)	-2 (-15%)
Yellow	14 (108%)	1 (4%)
None	-29 (-57%)	0 (0%)

[a] For definitions of levels of concern, see Table 11-4A-14.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, the monthly total degree-days under H3_ELT would be 8% lower than under NAA_ELT for May and June, 9% higher for September, and would be similar for July and August (Table 11-4A-16). At Red Bluff, total degree-days under H3_ELT would be 19% higher than those under NAA_ELT for March and would be similar for the remaining months of the period (Table 11-4A-29).

Table 11-4A-29. Differences between Baseline and H3_ELT Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
October	Wet	442 (172%)	20 (3%)
	Above Normal	209 (80%)	12 (3%)
	Below Normal	246 (118%)	-12 (-3%)
	Dry	403 (82%)	29 (3%)
	Critical	357 (60%)	-58 (-6%)
	All	1,657 (91%)	-9 (0%)
November	Wet	9 (900%)	1 (11%)
	Above Normal	4 (NA)	1 (33%)
	Below Normal	2 (NA)	0 (0%)
	Dry	37 (463%)	-5 (-10%)
	Critical	20 (500%)	2 (9%)
	All	72 (554%)	-1 (-1%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	1 (NA)	1 (NA)
	Below Normal	10 (111%)	9 (90%)
	Dry	21 (150%)	1 (3%)
	Critical	11 (1100%)	0 (0%)
	All	44 (183%)	11 (19%)
April	Wet	101 (88%)	4 (2%)
	Above Normal	77 (55%)	5 (2%)
	Below Normal	87 (110%)	-7 (-4%)
	Dry	109 (59%)	2 (1%)
	Critical	40 (333%)	-2 (-4%)
	All	414 (78%)	2 (0%)

NA = could not be calculated because the denominator was 0.
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be similar to mortality under NAA_ELT in wet, dry, and critical years, but greater in above normal and below normal water years (26% to 32% greater, respectively) (Table 11-4A-30). Relative increases of 26% and 32% mortality of the spring-run population in above and below normal water years represent 4% and 7% increases, respectively, on an absolute scale and, therefore, would not cause a biologically meaningful effect to spring-run Chinook salmon due to this small magnitude. Combining all water years, there would also be no effect of H3_ELT on egg mortality (2% absolute increase; 7% relative increase).

Table 11-4A-30. Difference and Percent Difference in Percent Mortality of Spring-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	4 (41%)	0.2 (1%)
Above Normal	7 (52%)	4 (26%)
Below Normal	16 (134%)	7 (32%)
Dry	22 (114%)	1 (3%)
Critical	19 (25%)	1 (1%)
All	13 (57%)	2 (7%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

SacEFT predicts that there would be a 4% relative decrease (2% on an absolute scale) in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT relative to NAA_ELT (Table 11-4A-31). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under H3_ELT relative to NAA_ELT. SacEFT predicts that there would be an 11% decrease on a relative scale (7% on absolute scale) in the percentage of years with good (lower) egg incubation conditions under H3_ELT relative to NAA_ELT. SacEFT predicts that there would be a 5% relative decrease (2% on an absolute scale) in the percentage of years with good (lower) redd dewatering risk under H3_ELT relative to NAA_ELT. It is unlikely that spawning habitat availability is currently limiting to spring-run Chinook salmon due to deeply suppressed escapement values over the past decade. Given this, these values may be less important to spring-run Chinook salmon spawning.

Table 11-4A-31. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Spring-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Spawning WUA	-15 (-21%)	-2 (-4%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-28 (-33%)	-7 (-11%)
Redd Dewatering Risk	-10 (-20%)	-2 (-5%)
Juvenile Rearing WUA	6 (27%)	3 (12%)
Juvenile Stranding Risk	1 (5%)	0 (0%)

WUA = Weighted Usable Area.
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The results of the SacEFT model and Reclamation egg mortality model are consistent with regard to predicted conditions for spring-run salmon eggs. SacEFT predicts that egg incubation habitat would decrease (7% absolute scale decrease) and the Reclamation egg mortality model predicts that overall egg mortality would increase 7% under the H3_ELT. This level of agreement in the results of the two models is likely somewhat coincidental because the models employ different sets of data. The SacEFT uses mid-August through early March as the egg incubation period, based on Vogel and Marine (1991), and the reach between ACID Dam and Battle Creek for redd locations. The Reclamation egg mortality model uses the number of days after Julian week 33 (mid-August) that it takes to accumulate 750 temperature units to hatching and another 750 temperature units to emergence. Temperatures units are calculated by subtracting 32°F from daily river temperature and are computed on a daily basis. As a result, egg incubation duration is generally mid-August through January, but is dependent on river temperature. The Reclamation model uses the reach between ACID Dam and Jelly's Ferry (approximately 5 river miles downstream of Battle Creek), which includes 95% of Sacramento River spawning locations based on 2001–2004 redd survey data (Reclamation 2008). The SacEFT model has been peer-reviewed, and the Reclamation egg mortality model has been extensively reviewed and used in prior biological assessments and BiOps. Therefore, both results are considered valid and were considered in drawing conclusions about spring-run egg mortality in the Sacramento River.

Clear Creek

Mean flows in Clear Creek during the spring-run Chinook salmon spawning and egg incubation period (September through January) under H3_ELT would generally be similar to flows under NAA_ELT throughout the spring-run spawning and egg incubation period for all water year types (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under H3_ELT would be the same as that under NAA_ELT in all water year types (Table 11-4A-32).

Water temperatures were not modeled in Clear Creek.

Table 11-4A-32. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-67 (NA)	0 (0%)
Critical	-33 (-50%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Flows were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) where spring-run Chinook salmon primarily spawn during September through January. Flows under H3_ELT would not differ from NAA_ELT because minimum Feather River flows are included in the FERC settlement agreement (California Department of Water Resources 2006) and would be met for all model scenarios (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Oroville Reservoir storage volume at the end of September influences flows downstream of the dam during the spring-run spawning and egg incubation period. Mean storage volume at the end of September under H3_ELT would be similar to storage under NAA_ELT in wet, above normal, and below normal water years and 15% and 12% greater in dry and critical water years (Table 11-4A-33).

Table 11-4A-33. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Alternative 4 (Scenario H3)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-676 (-23%)	46 (2%)
Above Normal	-681 (-29%)	-125 (-7%)
Below Normal	-392 (-19%)	-67 (-4%)
Dry	-65 (-5%)	173 (15%)
Critical	26 (3%)	108 (12%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the egg incubation period to the flow in September when spawning is assumed to occur. Minimum flows in the low-flow channel during October through January were identical between H3_ELT and NAA_ELT (Appendix 11C, *CALSIM II*

Model Results utilized in the Fish Analysis). Therefore, there would be no effect of H3_ELT on redd dewatering in the Feather River low-flow channel.

Mean water temperatures in the low-flow channel would not differ between NAA_ELT and H3_ELT (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for spring-run Chinook salmon in the Feather River were analyzed by comparing the percent of months between September through January over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-34). There would be no differences between NAA_ELT and H3_ELT in the percent of months exceeding the threshold in December and January, and negligible differences (<5% on an absolute scale) in November. However, for September there would be an 11% increase (absolute difference) in the percent of months exceeding the threshold by >5°F and a 6% increase in percent of months exceeding the threshold by >4°F.

Table 11-4A-34. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through January

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
September	0 (0%)	0 (0%)	6 (7%)	11 (15%)	16 (39%)
October	22 (100%)	16 (217%)	7 (120%)	6 (250%)	4 (150%)
November	9 (350%)	7 (600%)	2 (200%)	2 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
NAA_ELT vs. H3_ELT					
September	0 (0%)	0 (0%)	0 (0%)	6 (8%)	11 (24%)
October	-5 (-10%)	0 (0%)	-4 (-21%)	-2 (-22%)	-2 (-29%)
November	1 (13%)	0 (0%)	-1 (-25%)	0 (0%)	-1 (-100%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for spring-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the September through January spring-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-4A-35). Combining all water year types, there would be a reduction of 17 degree-months in the number of degree-months exceeding the NMFS threshold under H3_ELT relative to NAA_ELT for October, an increase of 17 degree-months for September. There would be negligible differences in degree months between NAA_ELT and H3_ELT in the other months. Results are highly variable when separating out by water year type, ranging from 9% more degree-months (absolute difference) under H3_ELT in below normal water years during September to 9% fewer degree-months under H3_ELT in dry water years during October. The absolute scale is used to compare results for these analyses because the large relative differences (percent differences) between NAA_ELT and H3_ELT in most cases are mathematical artifacts due to the small values of degree-months for NAA_ELT (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon.

Table 11-4A-35. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through January

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
September	Wet	-5 (-5%)	4 (4%)
	Above Normal	0 (0%)	3 (8%)
	Below Normal	14 (23%)	9 (14%)
	Dry	31 (45%)	2 (2%)
	Critical	10 (15%)	-1 (-1%)
	All	50 (14%)	17 (4%)
October	Wet	10 (200%)	0 (0%)
	Above Normal	8 (80%)	0 (0%)
	Below Normal	11 (157%)	-3 (-14%)
	Dry	12 (171%)	-9 (-32%)
	Critical	8 (100%)	-5 (-24%)
	All	49 (132%)	-17 (-17%)
November	Wet	0 (NA)	-1 (-100%)
	Above Normal	3 (100%)	0 (0%)
	Below Normal	2 (200%)	-2 (-40%)
	Dry	10 (NA)	3 (43%)
	Critical	2 (NA)	-1 (-33%)
	All	17 (425%)	-1 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

H4_ELT /HOS_ELT

Sacramento River

Mean flows in the Sacramento River between Keswick and upstream of RBDD under H4_ELT during the September through January spring-run Chinook salmon spawning and egg incubation period would generally be similar to flows under NAA_ELT, except during November (up to 20% lower, depending on water year type and location).

Shasta Reservoir storage at the end of September under H4_ELT would be similar to storage under NAA_ELT, except in critical water years (24% higher) (Table 11-4A-36).

Table 11-4A-36. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Baseline and H4_ELT Scenarios

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-302 (-9.1%)	-5 (-0.2%)
Above Normal	-371 (-11.6%)	-7 (-0.3%)
Below Normal	-143 (-5%)	24 (0.9%)
Dry	-144 (-5.8%)	58 (2.6%)
Critical	36 (3%)	235 (23.7%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-20 for Bend Bridge and in Table 11-4A-37 for Red Bluff. At Bend Bridge, there would be 1 (17%) more years with an "orange" level of concern under H4_ELT. This difference would not be biologically meaningful to spring-run Chinook salmon spawners and eggs. At Red Bluff, there would be 6 (27%) fewer years with any of the three "levels of concern", indicating that water temperatures would be within an acceptable range more often under H4_ELT than under NAA_ELT.

Table 11-4A-37. Differences between Baseline and H3_ELT Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Red	9 (75%)	0 (0%)
Orange	2 (33%)	-5 (-38%)
Yellow	12 (92%)	-1 (-4%)
None	-23 (-45%)	6 (27%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] For definitions of levels of concern, see Table 11-4A-14.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, there would be reductions under H4_ELT relative to NAA_ELT in the monthly total degree-days exceeding the 56°F threshold for all of the months (Table 11-4A-21). At Red Bluff, exceedances above the threshold under H4_ELT would be 9 degree-days (16%) higher than those under NAA_ELT for March, and lower or similar for the remaining months (Table 11-4A-38). On an absolute scale, the 9 degree-day increase during March, because it is the sum of differences in degree-days for March summed over the 82-year period, would not translate into a biologically meaningful effect on spring-run Chinook salmon.

Table 11-4A-38. Differences between Baseline and H3 Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
October	Wet	406 (158%)	-16 (-2%)
	Above Normal	191 (73%)	-6 (-1%)
	Below Normal	229 (110%)	-29 (-6%)
	Dry	286 (58%)	-88 (-10%)
	Critical	201 (34%)	-214 (-21%)
	All	1,313 (72%)	-353 (-10%)
November	Wet	7 (700%)	-1 (-11%)
	Above Normal	4 (NA)	1 (33%)
	Below Normal	1 (NA)	-1 (-50%)
	Dry	31 (388%)	-11 (-22%)
	Critical	13 (325%)	-5 (-23%)
	All	56 (431%)	-17 (-20%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	10 (111%)	9 (90%)
	Dry	20 (143%)	0 (0%)
	Critical	11 (1,100%)	0 (0%)
	All	42 (175%)	9 (16%)
April	Wet	97 (84%)	0 (0%)
	Above Normal	68 (49%)	-4 (-2%)
	Below Normal	99 (125%)	5 (3%)
	Dry	118 (63%)	11 (4%)
	Critical	49 (408%)	7 (13%)
	All	431 (81%)	19 (2%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Clear Creek

Flows in Clear Creek during the spring-run Chinook salmon spawning and egg incubation period (September through January) under H4_ELT would generally be similar to those under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Also, flows would generally be similar between H4_ELT and H3_ELT such that results of the redd dewatering analysis would be similar between H4_ELT and H3_ELT. Therefore, no analysis of redd dewatering risk was conducted for H4_ELT in Clear Creek. Due to similar flows between H4_ELT and H3_ELT, effects of H4_ELT on spring-run Chinook salmon spawning and egg incubation habitat in Clear Creek would not be different from effects of H3_ELT. Therefore, there would be no effects of H4_ELT on spring-run Chinook salmon spawning and egg incubation in Clear Creek relative to the NAA_ELT.

Feather River

Flows in the Feather River low-flow channel during the spring-run Chinook salmon spawning and egg incubation period (September through January) would be the same between NAA_ELT and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Oroville Reservoir storage volume at the end of September under H4_ELT would generally be similar to storage under NAA_ELT in wet and above normal water years, slightly (9%) lower in below normal water years, and moderately to substantially higher in dry and critical years (28% to 44% higher), respectively) (Table 11-4A-39). Higher storage in drier water year types would generally benefit spring-run Chinook salmon spawning and egg incubation habitat.

Table 11-4A-39. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Oroville Reservoir for H4 Scenarios

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA vs. H4_ELT
Wet	-664 (-22.9%)	58 (2.6%)
Above Normal	-576 (-24.3%)	-20 (-1.1%)
Below Normal	-481 (-23.8%)	-156 (-9.2%)
Dry	74 (5.4%)	311 (27.7%)
Critical	310 (31.5%)	393 (43.5%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean water temperatures in the low-flow channel would not differ between NAA_ELT and H4_ELT (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Increases in the percent of months exceeding the 56°F threshold between NAA_ELT and H4_ELT would occur during October and November, with up to 10% (absolute difference) more months exceeding the threshold under H4_ELT (Table 11-4A-40).

Table 11-4A-40. Differences between Baselines and H4_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through January

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
September	0 (0%)	-1 (-1%)	4 (4%)	5 (7%)	-1 (-3%)
October	19 (83%)	20 (267%)	16 (260%)	15 (600%)	14 (550%)
November	17 (700%)	15 (1200%)	7 (600%)	4 (NA)	1 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
NAA_ELT vs. H4_ELT					
September	0 (0%)	-1 (-1%)	-2 (-3%)	0 (0%)	-6 (-14%)
October	-9 (-18%)	4 (16%)	5 (29%)	6 (56%)	7 (86%)
November	10 (100%)	7 (86%)	4 (75%)	1 (50%)	0 (0%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Total degree-months of exceedance above the 56°F threshold under H4_ELT would be up to 48 degree-months greater than those under NAA_ELT for September through November (all water years combined) (Table 11-4A-41). An increase of 48 degree-months would not be biologically meaningful, given the 82-year period of analysis. The total degree-months of exceedance for the other months of the period would be similar between H4_ELT and NAA_ELT. Overall, effects of H4_ELT on spring-run Chinook salmon spawning and egg incubation habitat in the Feather River would generally be negligible or beneficial compared to the NAA_ELT.

Table 11-4A-41. Differences between Baseline Scenarios and H4_ELT Scenario in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
September	Wet	7 (6%)	16 (16%)
	Above Normal	10 (23%)	13 (33%)
	Below Normal	36 (60%)	31 (48%)
	Dry	27 (39%)	-2 (-2%)
	Critical	-6 (-9%)	-17 (-22%)
	All	74 (21%)	41 (11%)
October	Wet	35 (700%)	25 (167%)
	Above Normal	14 (140%)	6 (33%)
	Below Normal	24 (343%)	10 (48%)
	Dry	38 (543%)	17 (61%)
	Critical	3 (38%)	-10 (-48%)
	All	114 (308%)	48 (47%)
November	Wet	12 (NA)	11 (1,100%)
	Above Normal	6 (200%)	3 (50%)
	Below Normal	12 (1,200%)	8 (160%)
	Dry	15 (NA)	8 (114%)
	Critical	0 (NA)	-3 (-100%)
	All	45 (1,125%)	27 (123%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 4A on spring-run Chinook salmon spawning and egg incubation conditions would not be adverse because the alternative does not substantially reduce the amount of suitable spawning and egg incubation habitat or substantially interfere with winter-run Chinook salmon spawning and egg incubation. There are no substantial changes to flows, cold water pool storage, or water temperatures that would cause a biologically meaningful negative effect to spring-run Chinook salmon spawners or eggs. Biological models including the Reclamation Egg Mortality Model and SacEFT also indicate that there would be no biologically meaningful effects.

CEQA Conclusion: Collectively, the results of the Impact AQUA-58 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to the CEQA conclusion.

H3_ELT /ESO_ELT

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the spring-run Chinook salmon spawning and incubation period (September through January). Mean flows under H3_ELT during October and November would be similar to or up to 20% lower than flows under Existing Conditions, depending on water year type and location. Mean flows under H3_ELT during September would be up to 24% lower and up to 34% higher than flows under Existing Conditions depending on water year type and location. And mean flows under H3_ELT during January and December would generally be similar to flows under Existing Conditions.

Shasta Reservoir mean storage volume at the end of September would be 7% to 11% lower under H3_ELT relative to Existing Conditions depending on water year type (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At Keswick, the mean monthly (all water years combined) temperatures under H3_ELT would be 6% greater for both September and October than those under Existing Conditions, but they would not be different for other months during the period. Differences by water year type were <10% except for September of critical water years (10.3% higher). At Bend Bridge, there would be no differences (<5%) in water temperatures between H3_ELT and Existing Conditions for all months and water year types during the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern," as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-15 for Bend Bridge and in Table 11-4A-28 for Red Bluff. At Bend Bridge, there would be a 55% increase in the number of years with a "red" level of concern under H3_ELT relative to Existing Conditions. At Red Bluff, there would be 83%, increases in the number of years for both "red" and "orange" levels of concern under H3_ELT relative to Existing Conditions, and a 108% increase for the "yellow" level of concern.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, total degree-days (all water years combined) under H3_ELT would be 60% to 114% higher than that under Existing Conditions depending on month throughout the period (Table 11-4A-16). At Red Bluff, total degree-days under H3_ELT would be 78% to 554% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-4A-29).

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be 25% to 134% greater than mortality under Existing Conditions depending on water year type (Table 11-4A-30).

SacEFT predicts that there would be a 21% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT compared to Existing Conditions (Table 11-4A-31). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under H3_ELT relative to Existing Conditions. SacEFT predicts that there would be a 33% relative decrease in the percentage of years with good (lower) egg incubation conditions under H3_ELT compared to Existing Conditions. SacEFT predicts that there would be a 20% relative decrease in the percentage of years with good (lower) redd dewatering risk under H3_ELT compared to Existing Conditions. These results indicate that spawning and egg incubation conditions for spring-run Chinook salmon under H3_ELT would be substantially lower relative to Existing Conditions. Spawning habitat consists of the appropriate depth, substrate, and water temperatures, among other variables. SacEFT indicates that depth, as a result of flow, and temperature conditions would be degraded under H3_ELT relative to Existing Conditions. However, it is not known whether spawning habitat is limiting to the spring-run Chinook salmon population in the Sacramento River, especially given the recent sharp decline in annual escapement estimates.

Clear Creek

Flows in Clear Creek were examined during the spring-run Chinook salmon spawning and egg incubation period (September through January). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, except for a 40% increase for January of wet years, a 19% decrease for September of critical years, and 10% increases for January and December of critical years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under H3_ELT would be 41 cfs, 67 cfs, and 33 cfs lower (worse) than under Existing Conditions in above normal, dry, and critical years, respectively, and would be 53 cfs higher (better) than under Existing Conditions in below normal years (Table 11-4A-32).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River low-flow channel under H3_ELT are not different from Existing Conditions during the September through January spring-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in October through

January (800 cfs) would be equal to or greater than the spawning flows in September (773 cfs) for all model scenarios.

Oroville Reservoir mean storage volume at the end of September would be similar or up to 29% lower under H3_ELT relative to Existing Conditions, depending on water year type (Table 11-4A-33).

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. Minimum flows in the low-flow channel during October through January were identical between H3_ELT and Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be no effect of H3_ELT on redd dewatering in the Feather River low-flow channel.

Mean monthly water temperatures in the low-flow channel under H3_ELT would be no different (<5%) under H3_ELT relative to Existing Conditions during the September through January spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Effects of H3_ELT on water temperature in the Feather River were analyzed by determining the percent of months between September and January over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-34). In general, the percent of months exceeding the threshold under H3_ELT would be similar to or greater by up to 22% (absolute difference) than the percent under Existing Conditions. This comparison includes the effects of climate change.

The effects of H3_ELT on water temperature in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the September through January spring-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-4A-35). Total degree-months (all water years combined) would be 14% to 425% higher under H3_ELT relative to Existing Conditions for September through November and would be the identical for December and January. These comparisons include the effects of climate change.

H4_ELT /HOS_ELT

Sacramento River

Mean flows in the Sacramento River between Keswick and upstream of RBDD under H4_ELT during the September through January spring-run Chinook salmon spawning and egg incubation period would be up to 20% lower and 53% higher than flows under Existing conditions during September and would be generally similar or up to 19% lower than flows under Existing conditions during October through January.

Shasta Reservoir mean storage at the end of September under H4_ELT would be similar to or up to 12% lower than storage under Existing Conditions, depending on water year type (Table 11-4A-36).

Mean water temperatures in the Sacramento River under H4_ELT would not differ (<5%) from those under Existing Conditions for any month or water year type at both Keswick and Bend Bridge (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Clear Creek

Mean flows in Clear Creek during the spring-run Chinook salmon spawning and egg incubation period (September through January) under H4_ELT would generally be similar to those under Existing Conditions, except for a 40% increase for January of wet years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be no effects of H4_ELT on spring-run Chinook salmon spawning and egg incubation in Clear Creek relative to Existing Conditions.

Feather River

Flows in the Feather River low-flow channel during the spring-run Chinook salmon spawning and egg incubation period (September through October) would be similar between Existing Conditions and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Oroville Reservoir mean storage volume at the end of September under H4_ELT would be similar to or greater than storage under Existing Conditions in dry and critical water years (32% higher for critical year types) and about 24% lower in below normal, above normal and wet water years (Table 11-4A-39). Higher storage in drier water year types would generally benefit spring-run Chinook salmon spawning and rearing habitat.

Mean water temperatures in the low-flow channel would be up to no different (<5%) under H4_ELT relative to Existing Conditions during the September through January spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be an increased percent of months (up to 20% on an absolute scale) above the 56°F threshold under H4_ELT compared to Existing Conditions during September through November and no change in December and January (Table 11-4A-40).

The total number of degree-months (all water year types combined) exceeding the threshold under H4_ELT would be up to 1,125% higher than the number under Existing Conditions during September through November, but no there would be no differences during December and January (Table 11-4A-41).

Summary of CEQA Conclusion

Under Alternative 4A (including climate change effects), there are flow and storage reductions, as well as temperature increases in the Sacramento River that would lead to biologically meaningful increases in egg mortality and overall reduced habitat conditions for spawning spring-run and egg incubation, as compared to Existing Conditions. Flows in the Feather River low-flow channel do not differ between Alternative 4A and Existing Conditions. However, water temperature analyses in the Feather River low-flow channel using thresholds developed in coordination with NMFS indicate that there would be moderate to large negative effects on temperature conditions during spring-run Chinook salmon spawning and egg incubation.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of spring-run as a result of egg mortality.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would be similar between NAA_ELT and Alternative 4A. There would be no effects of Alternative 4A on spawning and egg incubation conditions in Clear Creek, and small beneficial or no effects on flows, reservoir storage, and water temperatures in the Feather River. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-59: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Spring-Run ESU)

In general, Alternative 4A would not affect the quantity and quality of rearing habitat for fry and juvenile spring-run Chinook salmon relative to the NAA_ELT.

H3_ELT /ESO_ELT

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). At Keswick, mean flows under H3_ELT would be up to 23% lower during November than under NAA_ELT and would generally be similar in the remaining months. Upstream of Red Bluff, mean flows under H3_ELT would be up to 18% lower during November than under NAA_ELT and similar in the remaining months. These results indicate that there would be very few reductions in flows due to H3_ELT in the Sacramento River.

As reported in Impact AQUA-40, May Shasta mean storage volume under H3_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-4A-12), so there would be no biologically meaningful effects on downstream flows.

As reported in Impact AQUA-58, September Shasta mean storage volume under H3_ELT would generally be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the November through March spring-run Chinook salmon juvenile rearing period (Appendix

11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location except for a 7% increase for August in critical years at Keswick.

SacEFT predicts that the percentage of years with good juvenile rearing WUA conditions under H3_ELT would be 12% greater than that under NAA_ELT (Table 11-4A-31) and predicts no difference in the percentage of years with good (lower) juvenile stranding risk conditions under H3_ELT. On an absolute scale, juvenile rearing WUA increase in only 3% of years, which would not have a biologically meaningful effect on spring-run Chinook salmon.

SALMOD predicts that spring-run smolt equivalent habitat-related mortality would be similar to (<5% different from) NAA_ELT.

Clear Creek

Mean flows in Clear Creek during the November through March rearing period under H3_ELT would be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during November through June were reviewed to determine flow-related effects on larval and juvenile spring-run rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Relatively constant flows in the low-flow channel throughout this period under H3_ELT would not differ from those under NAA_ELT. In the high-flow channel, mean flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT for February through June (by up to 106% greater for June, above normal years). For November through January, flows would generally be similar to those under NAA_ELT, with minor exceptions.

May Oroville mean storage volume under H3_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-4A-42).

As reported in Impact AQUA-58, September Oroville mean storage volume under H3_ELT would be similar to volume under NAA_ELT in wet, above normal, and below normal water years and 12% to 15% greater than volume under NAA_ELT during dry and critical water years (Table 11-4A-33). Consequently, there would be minimal effects on downstream flows.

Table 11-4A-42. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Alternative 4A (Model Scenario H3_ELT)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-21 (-1%)	-2 (-0.05%)
Above Normal	-111 (-3%)	-52 (-2%)
Below Normal	-162 (-5%)	3 (0.1%)
Dry	-332 (-12%)	18 (1%)
Critical	-157 (-9%)	-17 (-1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during May and June (Table 11-4A-43). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-4A-13, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months. In general, differences in the percent of months exceeding the threshold between NAA_ELT and H3_ELT would be negligible (<5% on an absolute scale), although there are some small (up to 9% on an absolute scale) decreases in percent of months exceeding the threshold during June and August, depending on the degrees above the threshold.

Table 11-4A-43. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
May	4 (NA)	2 (NA)	0 (NA)	0 (NA)	0 (NA)
June	20 (36%)	20 (73%)	15 (300%)	4 (NA)	0 (NA)
July	0 (0%)	0 (0%)	1 (1%)	26 (36%)	36 (91%)
August	0 (0%)	11 (13%)	27 (47%)	26 (91%)	26 (263%)
NAA_ELT vs. H3_ELT					
May	0 (0%)	1 (100%)	0 (NA)	0 (NA)	0 (NA)
June	-4 (-5%)	-7 (-14%)	-9 (-30%)	0 (0%)	0 (NA)
July	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)
August	0 (0%)	0 (0%)	5 (6%)	0 (0%)	6 (21%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

The effects of H3_ELT on water temperature-related juvenile rearing conditions for spring-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 63°F NMFS threshold during May and June for all 82 years (Table 11-4A-44). As discussed above, although this table includes results through August, only May and June results apply to spring-run Chinook salmon. The steelhead analysis below includes the remaining months. Combining all water year types, there would be little difference in total degree-months (<5 degree-months) exceeded between NAA_ELT and H3_ELT during May and a (16 degree-month reduction (12% lower) during June). There would be small decreases (up to 6 degree-months) for the different water year types in June.

Table 11-4A-44. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
May	Wet	0 (NA)	0 (NA)
	Above Normal	1 (NA)	0 (0%)
	Below Normal	0 (NA)	0 (NA)
	Dry	2 (NA)	1 (100%)
	Critical	2 (NA)	0 (0%)
	All	5 (NA)	1 (25%)
June	Wet	11 (73%)	-6 (-19%)
	Above Normal	6 (43%)	-2 (-9%)
	Below Normal	7 (54%)	-6 (-23%)
	Dry	13 (57%)	-2 (-5%)
	Critical	10 (167%)	0 (0%)
	All	47 (66%)	-16 (-12%)
July	Wet	24 (20%)	1 (1%)
	Above Normal	9 (20%)	-1 (-2%)
	Below Normal	15 (25%)	0 (0%)
	Dry	19 (27%)	0 (0%)
	Critical	22 (42%)	4 (6%)
	All	89 (26%)	4 (1%)
August	Wet	17 (19%)	7 (7%)
	Above Normal	9 (36%)	2 (6%)
	Below Normal	15 (39%)	1 (2%)
	Dry	28 (70%)	4 (6%)
	Critical	14 (33%)	-6 (-10%)
	All	83 (35%)	8 (3%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

H4_ELT/HOS_ELT

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 20% lower than flows under NAA_ELT during November and would generally be similar to flows under NAA_ELT in remaining months and water year types of the period.

September Shasta mean storage volume under H4_ELT would be similar to September storage volume under NAA_ELT in all years except critical, in which storage would be 24% greater under H4_ELT (Table 11-4A-36).

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

Clear Creek

Mean flows in Clear Creek during the November through March rearing period under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, effects of H4_ELT regarding larval and juvenile spring-run Chinook salmon rearing habitat in Clear Creek would be similar to those under NAA_ELT.

Feather River

Flows in the Feather River low-flow channel during November through June would not differ between NAA_ELT and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-flow channel during the November through June juvenile rearing period under H4_ELT would generally be similar to or greater than flows under NAA_ELT for February through June (by up to 548% greater for April, below normal years). For November through January, flows would generally be similar to those under NAA_ELT, with a few exceptions.

May Oroville mean storage under H4_ELT would be 11% to 16% lower than storage under NAA_ELT in wet, above normal, and below normal water years, similar in dry water years, and 24% greater in critical water years (Table 11-4A-45). September Oroville storage under H4_ELT would be similar to storage under NAA_ELT in wet, above normal, and below normal years, but 28% and 44% higher in dry and critical years, respectively (Table 11-4A-39).

Table 11-4A-45. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Baseline and H4_ELT Scenarios

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-399 (-11%)	379 (-11%)
Above Normal	-613 (-18%)	-553 (-16%)
Below Normal	-613 (-19%)	-448 (-15%)
Dry	-331 (-12%)	19 (1%)
Critical	267 (15%)	407 (24%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean monthly water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

Differences in the percent of months exceeding the 63°F threshold between NAA_ELT and H4_ELT would be negligible (<5% on an absolute scale) for May and 1% to 14% lower (absolute difference) for June (Table 11-4A-46). This represents a small benefit of H4_ELT on spring-run spawning habitat conditions in the Feather River.

Table 11-4A-46. Differences between Baseline and H4 Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
May	2 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
June	10 (18%)	17 (64%)	11 (225%)	2 (NA)	0 (NA)
July	0 (0%)	0 (0%)	0 (0%)	21 (29%)	28 (72%)
August	0 (0%)	11 (13%)	22 (38%)	22 (78%)	12 (125%)
NAA_ELT vs. H4_ELT					
May	-1 (-33%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
June	-14 (-17%)	-10 (-18%)	-12 (-43%)	-1 (-33%)	0 (NA)
July	0 (0%)	0 (0%)	-1 (-1%)	-5 (-5%)	-6 (-8%)
August	0 (0%)	0 (0%)	0 (0%)	-4 (-7%)	-7 (-25%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Combining all water year types, total degree-months above the 63°F threshold under H4_ELT would be similar (<5 degree-months difference) to those under NAA_ELT for May, but 131 degree-months lower for June, (Table 11-4A-47). This represents a small benefit of H4_ELT on spring-run spawning habitat conditions in the Feather River.

Table 11-4A-Table 11-4A-47. Differences between Baseline and H4 Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
May	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	-1 (-100%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	-1 (-100%)
	Critical	0 (NA)	-2 (-100%)
	All	0 (NA)	-4 (-100%)
June	Wet	-15 (-100%)	-32 (-100%)
	Above Normal	-14 (-100%)	-22 (-100%)
	Below Normal	-13 (-100%)	-26 (-100%)
	Dry	-22 (-96%)	-37 (-97%)
	Critical	-4 (-67%)	-14 (-88%)
	All	-68 (-96%)	-131 (-98%)
July	Wet	-85 (-71%)	-108 (-76%)
	Above Normal	-22 (-50%)	-32 (-59%)
	Below Normal	-35 (-59%)	-50 (-68%)
	Dry	-34 (-48%)	-53 (-59%)
	Critical	-36 (-69%)	-54 (-77%)
	All	-213 (-62%)	-298 (-69%)
August	Wet	56 (63%)	46 (46%)
	Above Normal	32 (128%)	25 (78%)
	Below Normal	38 (100%)	24 (46%)
	Dry	54 (135%)	30 (47%)
	Critical	31 (74%)	11 (18%)
	All	210 (90%)	135 (44%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because rearing habitat conditions would not be substantially reduced. Both SacEFT and SALMOD predicts no substantial effects on spring-run rearing habitat in the Sacramento River. In the Feather River, habitat conditions would improve under Alternative 4A relative to the NAA_ELT, particularly in the H4 scenario. There would be no effects on spring-run Chinook salmon rearing in Clear Creek.

CEQA Conclusion: In general, Alternative 4A could reduce the quantity and quality of rearing habitat for spring-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for spring-run Chinook salmon relative to the CEQA baseline.

H3_ELT /ESO_ELT

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). At Keswick, mean flows under H3_ELT would be up to 14% greater during February, up to 18% lower during November, and similar in the remaining three months. Upstream of Red Bluff, mean flows under H3_ELT would generally be similar to those under Existing Conditions throughout the period. These results indicate that there would be very little reduction in flows due to H3_ELT in the Sacramento River.

As reported in Impact AQUA-40, Shasta Reservoir mean storage volume at the end of May under H3_ELT would be similar to volume under Existing Conditions for all water years types (Table 11-4A-19). As reported in AQUA-58, Shasta Reservoir storage volume at the end of September under H3_ELT would be up to 11% lower relative to Existing Conditions (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both sites, mean water temperature under H3_ELT would be similar to (<5%) those under Existing Conditions in all months except for July through October at Keswick, in which temperatures in critical years would be 14% higher for August, 10% higher for September, and 9% higher for July under H3_ELT. Temperatures in the other year types in July through October would be up to 8% higher under H3_ELT.

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under H3_ELT would be 27% higher than under Existing Conditions (Table 11-4A-31). In addition, the percentage of years with good (low) juvenile stranding risk under H3_ELT is predicted to be 5% higher than under Existing Conditions. This indicates that the quantity and quality of juvenile rearing habitat in the Sacramento River would be higher under H3_ELT relative to Existing Conditions.

SALMOD predicts that spring-run smolt equivalent habitat-related mortality under H3_ELT would be 9% lower than under Existing Conditions.

Clear Creek

Flows in Clear Creek during the November through March rearing period under H3_ELT would generally be similar to flows under Existing Conditions, except during January and February of wet year types, in which flows would be 40% and 13% greater, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperatures were not modeled in Clear Creek.

Feather River

Relatively constant flows in the low-flow channel throughout the November through June rearing period under H3_ELT would not differ from those under Existing Conditions. In the high-flow channel, flows under H3_ELT during January through March, November, and December would be up to 48% lower than flows under Existing Conditions, and during April through June would be up to 140% greater than flows under Existing Conditions.

May Oroville mean storage volume under H3_ELT would be 12% lower than volume under Existing Conditions in dry year types and generally similar to volume under Existing Conditions in other water year types (Table 11-4A-42).

As reported in Impact AQUA-58, September Oroville mean storage volume under H3_ELT would be similar to or up to 29% lower than storage volume under Existing Conditions depending on water year type (Table 11-4A-33).

Mean monthly water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). In the low-flow channel, mean water temperatures under H3_ELT would be similar (<5%) for all months and water year types. In the high-flow channel, mean water temperatures under H3_ELT would be similar for all months and water years types except July of critical years (6.5% higher) and August of dry years (5.3% higher).

Effects of H3_ELT on water temperature-related effects on spring-run Chinook salmon juvenile rearing conditions in the Feather River were analyzed by comparing the percent of months during May and June over the 82-year CALSIM modeling period that exceed a 63°F temperature threshold in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-43). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-4A-13, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months. In general, the percent of months exceeding the threshold under H3_ELT would be similar or up to 20% greater (absolute difference) than those under Existing Conditions. This comparison includes the effects of climate change.

The effects of H3_ELT on water temperature-related juvenile rearing conditions for spring-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 63°F NMFS threshold during May through August for all 82 years (Table 11-4A-44). As discussed above, although this table includes results through August, only May and June results apply to spring-run Chinook salmon. The steelhead analysis below includes the remaining months. Combining all water year types, there would be a very small difference (5 degree-months) between Existing Conditions and H3_ELT during May, but 47 degree-month increases for June. These comparisons include the effects of climate change.

H4_ELT/HOS_ELT

Sacramento River

Mean flows in the Sacramento River between Keswick and upstream of RBDD under H4_ELT during the September through January spring-run Chinook salmon spawning and egg incubation period would generally be similar to or slightly lower than flows under Existing Conditions during January and October through December, and would be up to 20% lower and 53% higher in September. September mean Shasta storage volume under H4_ELT would be similar to or up to 12% lower than storage volume under Existing Conditions (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, there would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type.

Clear Creek

Flows in Clear Creek during the November through March rearing period under H4_ELT would generally be similar to or up to 40% higher than flows under Existing Conditions. Therefore, effect of H4_ELT regarding larval and juvenile spring-run Chinook salmon rearing habitat in Clear Creek would be similar to or beneficial relative to Existing Conditions.

Feather River

Flows in the Feather River low-flow channel during November through June would not differ between Existing Conditions and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In the high-flow channel, mean flows under H4_ELT would be up to 36% lower than flows under Existing Conditions during November through March and up to 509% greater than flows under Existing Conditions during April through June.

May Oroville mean storage volume under H4_ELT would be 11% to 19% lower relative to Existing Conditions except in critical water years, in which storage would be 15% greater (Table 11-4A-45). September Oroville mean storage under H4_ELT would be similar to storage under Existing Conditions in dry water years, 32% greater in critical water years, and about 24% lower in wet, above normal, and below normal water years (Table 11-4A-39).

Mean monthly water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, mean water temperatures under H4_ELT would be no different (<5%) as temperatures under Existing Conditions for all months and water year types.

Differences in the percent of months exceeding the 63°F threshold between Existing Conditions and H4_ELT would be negligible (<5% on an absolute scale) during May and between 0% and 17% (absolute difference) higher under H4_ELT during June (Table 11-4A-46). These comparisons include the effects of climate change.

Combining all water year types, total degree-months above the 63°F threshold under H4_ELT would be the same as those under Existing Conditions during May, but 68 and 213 degree-months lower than those under Existing Conditions for June and July, and 210 degree-months higher for August (Table 11-4A-47). Changes by water year type are the same direction (positive or negative) as the differences of the months that combined the water year types. These comparisons include the effects of climate change.

Summary of CEQA Conclusion

Under Alternative 4A, there would be small to moderate flow reductions and temperature increases in the Feather River. SacEFT predicts improvements to spawning habitat availability for spring-run Chinook salmon in the Sacramento River under Alternative 4A and SALMOD predict slightly reduced habitat conditions. Exceedances above NMFS temperature thresholds would be higher under

Alternative 4A relative to Existing Conditions. Results would be similar among model scenarios. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of spring-run Chinook salmon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact would be less than significant and no mitigation is required.

Impact AQUA-60: Effects of Water Operations on Migration Conditions for Chinook Salmon (Spring-Run ESU)

In general, the effects of Alternative 4A on spring-run Chinook salmon migration conditions relative to the NAA_ELT are not adverse.

Upstream of the Delta

H3_ELT/ESO_ELT

Sacramento River

Flows in the Sacramento River upstream of Red Bluff were evaluated during the December through May juvenile Chinook salmon spring-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT during this period.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type.

Flows in the Sacramento River upstream of Red Bluff were evaluated during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT during this Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Mean Shasta Reservoir storage at the end of September under H3_ELT would be similar to storage under NAA_ELT (Table 11-4A-36).

Clear Creek

Mean flows in Clear Creek during the November through May juvenile Chinook salmon spring-run migration period under H3_ELT would be similar to flows under NAA_ELT throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean flows in Clear Creek during the April through August adult spring-run Chinook salmon upstream migration period under H3_ELT would generally be similar to flows under NAA_ELT, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT in all months and water year types of the period, with minor exceptions.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Flows in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 50% lower than flows under NAA_ELT during July and August, up to 77% greater than flows under NAA_ELT during June, and generally similar to flows under NAA_ELT during April and May. Although these flow reductions would be of moderate to large magnitude, flows under H3_ELT during these months would generally exceed flows suggested by NMFS during the Alternative 4a planning process at similar or greater frequencies as those under NAA_ELT (Table 11-4A-48).

Therefore, these reduced flows would not affect spring-run Chinook salmon in a biologically meaningful way.

Table 11-4A-48. Differences (Percentage Differences) in the Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel (at Thermalito)

	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Above Normal Water Year Type		
October	0 (0%)	0 (0%)
November	0 (0%)	0 (0%)
December	9 (50%)	-9 (-25%)
January	-18 (-40%)	9 (50%)
February	9 (14%)	9 (14%)
March	9 (25%)	0 (0%)
April	0 (NA)	0 (NA)
May	9 (100%)	9 (100%)
June	9 (13%)	0 (0%)
July	0 (0%)	0 (0%)
August	9 (10%)	0 (0%)
September	36 (57%)	0 (0%)
Below Normal Water Year Type		
October	-15 (-18%)	0 (0%)
November	-8 (-10%)	0 (0%)
December	-7 (-25%)	0 (0%)
January	-36 (-83%)	0 (0%)
February	-14 (-33%)	7 (34%)
March	-14 (-67%)	0 (0%)
April	0 (NA)	0 (NA)
May	0 (NA)	0 (NA)
June	21 (33%)	14 (20%)
July	0 (0%)	0 (0%)
August	0 (0%)	0 (0%)
September	-29 (-36%)	-50 (-50%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Mean monthly water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

H4_ELT /HOS_ELT

Sacramento River

Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the December through May juvenile spring-run Chinook salmon migration period would be similar to flows under NAA_ELT for all months and water year types of the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT during the April through August adult upstream migration period would also be similar to flows under NAA_ELT.

September Shasta storage volume under H4_ELT would be similar to storage volume under NAA_ELT except in critical water years, in which it would be 24% greater under H4_ELT (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Clear Creek

Mean flows under H4_ELT in Clear Creek during the November through May juvenile spring-run Chinook salmon migration period and the April through August adult upstream migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be no effects of H4_ELT on juvenile or adult spring-run Chinook salmon migration in Clear Creek relative to NAA_ELT.

Feather River

Flows under H4_ELT were evaluated in the Feather River at the confluence with the Sacramento River during the November through May juvenile spring-run Chinook salmon migration period and the April through August adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT during November through March would generally be similar to flows under NAA_ELT, but would be up to 119% greater during April and May. Flows during July and August would be consistently lower than flows under NAA_ELT (up to 42% lower in August of wet years), although 42% greater in critical years during August. Flows during April through June would be similar to or up to 119% greater than flows under NAA_ELT. Flows under H4_ELT during these months would generally exceed flows suggested by NMFS during the Alternative 4a planning process at similar frequencies as those under NAA_ELT (Table 11-4A-49). Therefore, these reduced flows would not affect spring-run Chinook salmon in a biologically meaningful way.

Table 11-4A-49. Differences (Percentage Differences) in the Percentage of Years Exceeding NMFS Suggested Minimum Flows in the Feather River High-Flow Channel (at Thermalito) between Baseline and H4 Model Scenarios

	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Above Normal Water Year Type		
October	9.1 (12.5%)	9.1 (12.5%)
November	0 (0%)	0 (0%)
December	9.1 (50%)	-9.1 (-25%)
January	-18.2 (-40%)	9.1 (50%)
February	0 (0%)	0 (0%)
March	0 (0%)	-9.1 (-20%)
April	27.3 (NA)	27.3 (NA)
May	36.4 (400%)	36.4 (400%)
June	0 (0%)	-9.1 (-11.1%)
July	-9.1 (-9.1%)	-9.1 (-9.1%)
August	-18.2 (-20%)	-27.3 (-27.3%)
September	18.2 (28.6%)	-18.2 (-18.2%)
Below Normal Water Year Type		
October	-7.7 (-9.1%)	7.7 (11.1%)
November	0 (0%)	7.7 (11.1%)
December	0 (0%)	7.2 (33.6%)
January	-35.8 (-83.4%)	0 (0%)
February	0 (0%)	21.5 (100.5%)
March	0 (0%)	14.3 (201.4%)
April	42.9 (NA)	42.9 (NA)
May	35.7 (NA)	35.7 (NA)
June	14.3 (22.2%)	7.2 (10.1%)
July	-7.1 (-7.1%)	-7.1 (-7.1%)
August	-21.4 (-21.4%)	-21.4 (-21.4%)
September	-50 (-63.6%)	-71.4 (-71.4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Through-Delta

Juveniles

Scenario H3_ELT operations would reduce OMR reverse flows (Appendix B, *Supplemental Modeling for Alternative 4A,* Section B.7), with a corresponding increase in net positive downstream flows, during the outmigration period of spring-run Chinook salmon through the interior Delta channels. Conditions under Scenario H3_ELT would result in slightly decreased overall average OMR flows in April and May relative to NAA_ELT, however overall average flows during these months would still be net positive (flowing towards the sea) because of relatively high average positive flows in wet water years, with negative mean negative flows in drier years of no less than around -1,500 cfs. OMR flows under Scenario H4_ELT would generally be improved compared to NAA_ELT conditions during all water year types throughout the migration period, or similar in April and May. These improved net positive downstream flows would be substantial benefits of the proposed operations.

Flows downstream of the north Delta intakes would be reduced, which may increase predation potential. During the juvenile spring-run Chinook salmon emigration period (December through May), mean monthly flows under Scenario H3_ELT in the Sacramento River below the NDD would be lower (13% to 22% reduced in monthly mean across years) compared to NAA_ELT. Mean flows by water-year type range from 2% lower in December of critical years up to 30% lower in April of above normal years. Under the high spring outflow Scenario, H4_ELT, mean flows during April and May would not decrease as much compared to NAA_ELT (4% to 9% lower under H4_ELT, compared to 18-22% lower under H3_ELT). As noted for winter-run Chinook salmon under the discussion of Impact AQUA-42, the modeling of NAA_ELT does not account for any flow entering the Yolo Bypass because of Fremont Weir modifications that would occur separately from Alternative 4A (but which are included in the modeling of H3_ELT and H4_ELT; see also section 4.1.1.3 of Section 4); this would slightly decrease the amount of water in the Sacramento River under NAA_ELT, so the above comparison of H3_ELT vs. NAA_ELT is conservative. Alternative 4A includes real-time biological and hydrological triggers developed by NMFS and DFW to adjust NDD operations to protect migrating salmonids above and beyond the operational criteria for NDD. Additional detail is provided in Chapter 3 Section 3.6.4.2.

As described above under *Predation Associated with Entrainment*, the three North Delta intake facilities proposed on the Sacramento River under Alternative 4A would attract predatory fish to the structure. Potential predation at the three North Delta intakes was estimated in two ways. As noted in Alternative 4, bioenergetics modeling with a median predator density predicts a predation loss of about 8,000 juveniles, or 0.2% of the spring-run juvenile population under Alternative 4A (Table 11-4A-26). In addition, the three intake structures and associated permanent bankline modifications would result in a permanent loss of up to 13.7 acres of aquatic habitat and the permanent modification of 2.6 miles of shoreline. A conservative assumption of 5% loss per intake would yield a cumulative loss of about 12% of juvenile spring-run Chinook salmon that reach the north Delta. This assumption is uncertain and represents an upper bound estimate. For a discussion of this topic see Impact AQUA-42 for Alternative 1A and additional discussion under Impact AQUA-42 of Alternative 4A for winter-run Chinook salmon.

As estimated by the Delta Passage Model, through-Delta survival under Scenario H3_ELT by juvenile spring-run Chinook salmon averaged 29% across all years, ranging from about 23% in drier years to 38% in wetter years (Table 11-4A-51). Scenario H3_ELT survival was slightly lower than NAA_ELT in both drier years (1.1% less survival, or 4.5% less in relative difference) and wetter years (3.1%

reduced survival, or 7.4% less in relative difference) (Table 11-4A-51). These results are based on operations that do not assume any adjustments made in real time to response to actual presence of fish.

Average survival under Scenario H4_ELT (high outflow) was 30.6%, compared to 30.7% for NAA_ELT. In wetter years, Scenario H4 had 1.7% greater survival, a 4% relative difference compared to NAA_ELT. This difference was driven by appreciably higher survival in wetter years (the above-normal year of 1980 and the wet year of 1984) as a result of greater outflow under Scenario H4_ELT. However, as noted for winter-run Chinook salmon in the discussion of Impact AQUA-42, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the discussion of Impact AQUA-42 resulted in the relative difference between NAA_ELT and H3_ELT/H4_ELT increasing: for H3_ELT, the relative difference across all years increased from 6% less compared to NAA_ELT to nearly 8% less compared to NAA_ELT (mod.); whereas for H4_ELT, the relative difference across all years increased from 0.3% less compared to NAA_ELT to 2.4% less compared to NAA_ELT (mod.) (Table 11-4A-51).

Table 11-4A-51. Through-Delta Survival (%) of Emigrating Juvenile Spring-Run Chinook Salmon under Alternative 4A (Scenarios H3_ELT and H4_ELT)

	Average Percentage Survival					Difference in Percentage Survival (Relative Difference)					
	Scenario					EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	NAA_ ELT	NAA_ ELT (mod.)	H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT (vs. NAA_ELT mod.)	H4_ELT (vs. NAA_EL T mod.)
Wetter Years	42.1	41.4	41.6	38.3	43.1	-3.8 (-9.1%)	0.9 (2.2%)	-3.1 (-7.4%)	1.7 (4.1%)	-3.3 (-7.9%)	1.4 (3.5%)
Drier Years	24.8	24.3	25.2	23.2	23.1	-1.6 (-6.4%)	-1.7 (-6.7%)	-1.1 (-4.5%)	-1.2 (-4.9%)	-2.0 (-7.9%)	-2.1 (-8.2%)
All Years	31.3	30.7	31.3	28.8	30.6	-2.5 (-8.0%)	-0.7 (-2.2%)	-1.8 (-6.0%)	-0.1 (-0.3%)	-2.5 (-7.9%)	-0.7 (-2.4%)

Note: Average Delta Passage Model results for survival to Chipps Island.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
Wetter = Wet and Above Normal Water Years (6 years).
Drier = Below Normal, Dry and Critical Water Years (10 years).
H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.
NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT.

Adults

As described for winter-run Chinook, attraction flows and olfactory cues in the west Delta would be altered because of shifts in exports from the south Delta to the north Delta. Flows in the Sacramento River downstream of the north Delta intake diversions would be reduced, with concomitant proportional increases in San Joaquin River flows. The flow changes under Scenario H3_ELT would slightly decrease the olfactory cues for migrating adult salmon in the Sacramento River (by 9% or less compared to NAA_ELT) and slightly increase the olfactory cues for the San Joaquin River (Table

11-4A-52). As noted for Alternative 4, the Sacramento River would still represent a substantial proportion of Delta outflows; the changes are within the typical range and behavioral response is uncertain. Conditions under Scenario H4_ELT are expected to reduce the magnitude of this effect because it would involve fewer exports from the north Delta compared to Scenario H3_ELT.

Table 11-4A-52. Percentage (%) of Water at Collinsville that Originated in the Sacramento during the Adult Spring-Run Chinook Salmon Migration Period for Alternative 4A (Scenario H3_ELT)

Month	EXISTING CONDITIONS	NAA_ELT	H3_ELT	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
March	78	77	69	-9	-8
April	77	76	67	-10	-9
May	69	67	61	-8	-7
June	64	61	57	-7	-5
	Shading indicates 10% or greater absolute difference.				
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).					

NEPA Effects: Upstream of the Delta, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially interfere with the movement of fish. Flows in the Sacramento River and Clear Creek, and water temperatures in the Sacramento and Feather Rivers would generally not be affected by Alternative 4A. Flows in the Feather River under Alternative 4A scenarios would be lower during summer months, although flows would otherwise be similar to or greater than the NEPA baseline and would generally exceed NMFS thresholds at similar or greater frequencies than those under the baseline.

Near-field effects of Alternative 4A NDD on spring-run Chinook salmon related to impingement and predation associated with three new intake structures could result in negative effects on juvenile migrating spring-run Chinook salmon, although there is high uncertainty regarding the overall effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to more significant effects (~ 12% mortality above current baseline levels). As noted for Alternative 4, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, as described in the adaptive management and monitoring program in Section 4.1, several pre-construction studies to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for spring-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of predation-related mortality expected from near-field effects at the NDD remains highly uncertain.

As noted for Alternative 4 and as discussed for winter-run Chinook salmon above, two recent studies (Newman 2003 and Perry 2010) indicate that far-field effects associated with the new intakes could cause a reduction in smolt survival in the Sacramento River downstream of the NDD intakes due to reduced flows in this area. The analyses of other elements of Alternative 4A related to reduced interior Delta entry (Environmental Commitment 16) and reduced south Delta entrainment suggest that these could offset the far-field effects of reduced flow (see, for example, Table 5.C.5.3-36 in the *BDCP Effects Analysis Appendix 5.C hereby incorporated by reference*). As noted for winter-run Chinook salmon, the overall magnitude of each of these factors and how they might interact and/or offset each other in affecting salmonid survival through the plan area is uncertain, and will be investigated as part of the adaptive management and monitoring program described in Section 4.1.

As described for Alternative 4 and as discussed for winter-run Chinook salmon above, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of Alternative 4a operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 4A would be somewhat lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 4A on juvenile spring-run Chinook salmon migration suggests a potential adverse effect of small magnitude. As noted for winter-run Chinook salmon, the DPM focuses on smolt-sized individuals (70 mm or more) and is not based on survival data for fry-sized individuals, which also may be migrating and could be affected by Alternative 4A operations. There are no fry through-Delta survival data to inform the effects to these individuals in relation to operations and it is uncertain whether the relative difference between scenarios estimated from the DPM for smolt-sized fish would be representative of relative differences for fry. The potential adverse effect of Alternative 4A would be minimized through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 4A of specific important Environmental Commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of spring-run Chinook salmon juveniles into the low-survival interior Delta.

CEQA Conclusion: In general, Alternative 4A would not substantially affect migration conditions for spring-run Chinook salmon relative to the CEQA baseline.

Upstream of the Delta

H3_ELT /ESO_ELT

Sacramento River

Flows in the Sacramento River upstream of Red Bluff were examined during December through May juvenile spring-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions during all months and water year types of the period.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type.

Flows in the Sacramento River upstream of Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, with minor exceptions.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type.

Mean September Shasta Reservoir storage volumes under H3_ELT would be up to 11% lower than those under Existing Conditions (Table 11-4A-27).

Clear Creek

Flows in Clear Creek were examined during the November through May juvenile Chinook salmon spring-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or up to 40% greater than flows under Existing Conditions, depending on water year type.

Flows in Clear Creek were examined during the April through August adult spring-run Chinook salmon upstream migration period. Mean flows under H3_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile Chinook salmon spring-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to or up to 17% lower than flows under Existing Conditions during January through March, would be 19% lower in critical years and 18% higher in above normal years in December, and would be similar during November, April and May.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type.

Flows were examined for the Feather River at the confluence with the Sacramento River during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 55% lower than flows under Existing Conditions during July and August, would be up to 71% greater in June, and similar during April and May. However, the frequencies of exceedance above flow thresholds suggested by NMFS during the Alternative 4a planning process under H3_ELT would be similar to those under Existing Conditions during the two periods in above normal water years (Table 11-4A-48). The frequencies of exceedance during the two periods in below normal water years would be lower during January through March.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month and water year type except July of critical years, in which temperatures under H3_ELT would be 6% greater.

H4_ELT/HOS_ELT

Sacramento River

Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the December through May juvenile spring-run Chinook salmon migration period would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT during the April through August adult upstream migration period would generally be similar to flows under Existing Conditions.

Mean Shasta Reservoir storage at the end of September under H4_ELT would be similar to or up to 12% lower than storage under Existing Conditions (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT.

Clear Creek

Flows under H4_ELT in Clear Creek during the November through May juvenile spring-run Chinook salmon migration period would generally be similar to or up to 40% greater than flows under Existing Conditions, and flows during the April through August adult upstream migration period would generally be similar (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be occasional beneficial effects of H4_ELT on spring-run Chinook salmon migration conditions in Clear Creek relative to Existing Conditions.

Feather River

Flows under H4_ELT were evaluated in the Feather River at the confluence with the Sacramento River during the November through May juvenile spring-run Chinook salmon migration period and the April through August adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT during November through March would generally be similar to flows under Existing Conditions. Flows during April and May would be similar to or up to 112% greater than flows under Existing Conditions. Flows under H4_ELT during April through August would, as described above, be up to 112% greater in April and May than flows under Existing Conditions, but flows would be up to 51% lower in June through August

The exceedance of monthly minimum flows in the Feather River suggested by NMFS during the Alternative 4a planning process was evaluated for H4_ELT relative to Existing Conditions (Table 11-4A-49). The percent of years exceeding minimum flows would be lower under H4_ELT relative to Existing Conditions during January, July and August of both above normal and below normal water years.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month.

Mean monthly water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT except in July and of critical years, for which temperatures under H4_ELT would be 5% higher.

Through-Delta

Juveniles

Scenario H3_ELT has lower through-Delta survival averaged across all years compared to Existing Conditions (2.5% reduced survival, or 8% less in relative difference) (Table 11-4A-51). Survival under the high outflow Scenario H4_ELT would be similar to Existing Conditions (0.7% less averaged for all years, a 2.2% relative difference), particularly in wetter years; this estimate does not account for the adjustments that can be made during real-time operations to further protect migrating spring-run Chinook. Overall reductions in OMR reverse flows under all flow scenarios for Alternative 4A would be beneficial (Appendix B, *Supplemental Modeling for Alternative 4A*, Section B.7). Conditions under Scenario H4_ELT would further improve OMR flow conditions (i.e., less reverse) relative to Scenario H3_ELT. Flows below the north Delta intakes would be reduced, which may increase predation potential. The impact is considered less than significant due to somewhat lower survival under Alternative 4A relative to Existing Conditions being minimized by bypass flow criteria, real-time operational adjustments based on biological and hydrological triggers developed by NMFS and DFW to adjust NDD operations to protect migrating salmonids, and the inclusion in Alternative 4A of Environmental Commitment 6, Environmental Commitment 15, and Environmental Commitment 16 (see additional discussion below).

Adults

As described above, attraction flows will be altered because of shifts in exports from the south Delta to the north Delta These changes would slightly decrease the olfactory cues for migrating adult salmon in the Sacramento River (reduced by 8–10% in March–May under the Scenario H3_ELT compared to Existing Conditions) and slightly increase olfactory cues for the San Joaquin River (Table 11-4A-52). Conditions between all flow scenarios under Alternative 4A would be similar; there would only be small changes in olfactory cues for migrating adult spring-run Chinook salmon. Overall, impacts related to migration conditions for spring-run Chinook salmon are considered less than significant.

Summary of CEQA Conclusion

Collectively, the results indicate that the effects would be less than significant because it would not substantially reduce the suitability of migration habitat or interfere with the movement of fish. Flows in the Sacramento River and Clear Creek and water temperatures in the Sacramento and Feather Rivers would generally not be affected by Alternative 4A. Flows would be lower in 2 months of the 5-month adult migration period in the Feather River, although flows generally exceed NMFS thresholds as often as flows under the CEQA baseline throughout the period. Reductions in spring-run Chinook salmon juvenile survival under Alternative 4A relative to Existing Conditions suggested by the DPM would be limited during all water year types by bypass flow criteria, real-time operational adjustments, and the inclusion in Alternative 4A of Environmental Commitment 6, Environmental Commitment 15, and Environmental Commitment 16 (see additional discussion below). Additionally, as described in the adaptive management and monitoring program in Section 4.1, several pre-construction studies to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically based triggers for real time operations. With incorporation of these measures and the lack of difference in adult migration cues between Alternative 4A scenarios and Existing Conditions, the impact would be less than significant. No mitigation is necessary.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for winter-run Chinook salmon, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. The general discussion of impacts to winter-run Chinook salmon (Impacts AQUA-43, AQUA-44, and AQUA-45) also applies to spring-run Chinook salmon.

Impact AQUA-61: Effects of Construction of Restoration Measures on Chinook Salmon (Spring-Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-43) is also applicable to spring-run Chinook salmon.

NEPA Effects: For the same reasons described under Impact AQUA-43, the effects of short-term construction activities would not be adverse to spring-run Chinook salmon because effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*.

CEQA Conclusion: As discussed for winter-run Chinook salmon, habitat restoration activities could result in short-term effects on spring-run Chinook salmon, primarily as a result of increased potential for contaminated sediments to enter the water column. However, these effects are likely to be localized, sporadic, and of low magnitude. Adverse effects during restoration would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*. The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce spring-run Chinook salmon habitat, restrict its range or interfere with its movement. Additionally, there would be substantial long-term net benefits of habitat restoration. Consequently, no additional mitigation would be required.

Impact AQUA-62: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Spring-Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-44) is also applicable to spring-run Chinook salmon.

NEPA Effects: As noted for winter-run Chinook salmon, the effect of restoration measures on chemical contaminants is not adverse to spring-run Chinook salmon with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of Environmental Commitment 12).

CEQA Conclusion: As noted for winter-run Chinook salmon, the impact of contaminants is considered less than significant. Alternative 4A restoration actions are likely to result in slightly increased production, mobilization, and bioavailability of methylmercury. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury from restoration areas and it would not substantially affect spring-run Chinook salmon either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-63: Effects of Restored Habitat Conditions on Chinook Salmon (Spring-Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-45) is also applicable to spring-run Chinook salmon.

NEPA Effects: The effects of restored habitat conditions on spring-run Chinook salmon would not be adverse because restoration is intended to provide habitat benefits to Chinook salmon.

CEQA Conclusion: As described for winter-run Chinook salmon, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on spring-run Chinook salmon would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for winter-run Chinook salmon, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms remains the same. The general discussion of impacts to winter-run Chinook salmon (Impacts AQUA-46, AQUA-49, and AQUA-50) also applies to spring-run Chinook salmon.

Impact AQUA-64: Effects of Methylmercury Management on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 12)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to spring-run Chinook salmon.

NEPA Effects: The effects of methylmercury management on spring-run Chinook salmon would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant. Consequently, no mitigation is required.

Impact AQUA-67: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 15)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-49) is also applicable to spring-run Chinook salmon.

NEPA Effects: As noted for winter-run Chinook salmon, Environmental Commitment 15 would not have adverse impacts and could benefit spring-run Chinook salmon. Due to the uncertainty in the effectiveness of Environmental Commitment 15, however, it is concluded that there would be no demonstrable effect of this conservation measure on spring-run Chinook salmon.

CEQA Conclusion: As noted for winter-run Chinook salmon, Environmental Commitment 15 would not have a significant impact and could benefit spring-run Chinook salmon. Due to the uncertainties associated with this Environmental Commitment, however, it is concluded that there would be no demonstrable effect on spring-run Chinook salmon. Consequently, no mitigation would be required.

Impact AQUA-68: Effects of Nonphysical Fish Barriers on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 16)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-50) is also applicable to spring-run Chinook salmon.

NEPA Effects: The effects of the NPB would not be adverse because it is intended to improve migratory conditions for juvenile Sacramento River salmon.

CEQA Conclusion: As concluded for winter-run Chinook salmon, the impacts of *Environmental Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant because it is intended to improve migratory conditions for juvenile Sacramento River salmon. Consequently, no mitigation would be required.

Fall-/Late Fall–Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of Water Conveyance Facilities under Alternative 4A is also relevant to fall-run/late fall-run Chinook salmon. Adult and juvenile fall-run/late fall-run Chinook salmon would have the potential to overlap construction and maintenance to a minor degree (Table 11-8).

Impact AQUA-73: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

The potential effects of construction of the water conveyance facilities on fall-run/late fall-run Chinook salmon would be the same as those described for Alternative 4, Impact AQUA-73.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-73, the effect would not be adverse for fall-run/late fall-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-73, the impact of construction of the water conveyance facilities on fall-run/late fall-run Chinook salmon would not be significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-74: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect Chinook salmon. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on Chinook salmon from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.The potential effects of the maintenance of the water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-74. The impact would not be adverse for fall-run/late fall-run Chinook salmon.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect Chinook salmon. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on Chinook salmon from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.As described in Alternative 4, Impact AQUA-74, the impact of maintenance of the water conveyance facilities on fall-run/late fall-run Chinook salmon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-75: Effects of Water Operations on Entrainment of Chinook Salmon (Fall-/Late Fall–Run ESU)

Overall entrainment under Alternative 4A at the south Delta export facilities would be reduced for all water year types (Table 11-4A-53). Under Scenario H3_ELT, average entrainment across all years would be reduced 42% (~24,000 fish) for fall-run Chinook salmon and reduced 33% (643 fish) for late fall-run Chinook salmon compared to NAA_ELT.

Table 11-4A-53. Juvenile Fall-Run and Late Fall-Run Chinook Salmon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Fall-run Chinook Salmon		
Wet	-79,680 (-62%)	-85,155 (-64%)
Above Normal	-13,483 (-41%)	-14,279 (-42%)
Below Normal	-4,120 (-30%)	-3,951 (-29%)
Dry	933 (5%)	-760 (-4%)
Critical	-13,262 (-32%)	-11,208 (-29%)
All Years	-22,380 (-41%)	-23,707 (-42%)
Late fall-run Chinook Salmon		
Wet	-2,724 (-46%)	-2,895 (-47%)
Above Normal	-225 (-39%)	-223 (-39%)
Below Normal	-24 (-43%)	-26 (-45%)
Dry	-39 (-28%)	-30 (-23%)
Critical	-35 (-22%)	-25 (-16%)
All Years	-622 (-32%)	-643 (-33%)
	Shading indicates10% or greater increased entrainment.	

Note: Estimated annual number of fish lost, based on normalized data.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

The annual juvenile population that approaches the Delta is assumed to be 23 million fall-run Chinook salmon and 1 million late fall-run Chinook salmon (juvenile index of abundance). The proportion of juvenile index of abundance lost at the south Delta facilities is very low for both runs under NAA_ELT (fall-run 0.24%, late fall-run 0.20% averaged for all years), and under Scenario H3_ELT decreases to negligible levels (fall-run 0.14%; late fall-run 0.13%).

Lower south Delta export pumping during the spring under Scenario H4_ELT would result in lower entrainment during this period than under Scenario H3_ELT.

Water Exports from SWP/CVP North Delta Intake Facilities

The impact would be similar in type to Alternative 1A, but the degree would be less because Alternative 4A would have fewer intakes. Thus under Alternative 4A there would be about a 40% reduction in impingement and predation risk relative to Alternative 1A (Impact AQUA-75).

Predation Associated with Entrainment

Entrainment-related predation loss at the south Delta facilities would be no greater and may be lower than NAA_ELT, due to a reduction in entrainment loss. Scenario H3_ELT entrainment-related predation losses are expected to decrease under Scenario H4_ELT.

Predation at the north Delta would be increased due to the installation of the proposed SWP/CVP North Delta intake facilities on the Sacramento River, although the magnitude of this increase is uncertain. Bioenergetics modeling with a median predator density predicts a predation loss under Alternative 4A of less than 0.6% of the annual juvenile production (155,000 fall-run juveniles, 0.24% annual production; 25,000 late fall-run juveniles, 0.57% annual production) (Table 11-4A-54). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 4A. See additional discussion under Impact AQUA-78.

Table 11-4A-54. Fall-Run and Late Fall-Run Chinook Salmon Juvenile Predation Loss at the Proposed North Delta Diversion (NDD) Intakes for Alternative 4A (Three Intakes)

Striped Bass at NDD (Three Intakes)			Fall-Run Chinook		Late Fall-Run Chinook	
Density	Bass per 1,000 Feet of Intake	Total Number of Bass	Number Consumed	Percentage of Annual Production Entering the Delta[1]	Number Consumed	Percentage of Annual Production Entering the Delta[1]
Low	18	86	22,025	0.04%	3,703	0.09%
Median	119	571	145,610	0.24%	24,483	0.57%
High	219	1,051	267,971	0.44%	45,056	1.05%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (Appendix 5F Biological Stressors).

[1] Estimated as 61.6 million for fall-run and 4.3 million for late fall-run. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

NEPA Effects: In conclusion, Alternative 4A would reduce overall entrainment and associated predation losses of juvenile fall-run Chinook salmon and late fall-run Chinook salmon relative to NAA_ELT. The population benefit would be minor because entrainment losses affect a small proportion of the total juvenile population. Conditions under Scenario H4_ELT would further reduce entrainment losses compared to Scenario H3_ELT. The effect of Alternative 4A would not be adverse.

CEQA Conclusion: Scenario H3_ELT would substantially reduce entrainment at the south Delta facilities for fall-run (41% less) and late fall-run Chinook salmon (32% less) compared to Existing Conditions. Proportional losses of the juvenile population (juvenile index of abundance) would be slightly reduced from already-low levels (less than 0.25% on average). Under Scenario H4_ELT, entrainment losses are expected to further decrease relative to Existing Conditions. Overall, impacts to fall-run and late fall-run Chinook salmon under Alternative 4A would be less than significant. No mitigation would be required.

Impact AQUA-76: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for fall-/late fall-run Chinook salmon relative to the NAA_ELT.

H3_ELT/ESO_ELT

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to NAA_ELT during October through January, except for November, in which flow would be up to 18% lower.

Shasta Reservoir storage at the end of September would affect flows during the fall-run spawning and egg incubation period. As reported in Impact AQUA-58, mean end of September Shasta Reservoir storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month, during October through April, and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-28. There would be 1 (5%) more years with a "red" level of concern under H3_ELT relative to NAA_ELT. This difference would not be biologically meaningful to fall-run Chinook salmon spawners and eggs.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H3_ELT would be 11 degree-days (19% higher) than those under NAA_ELT during March, but were similar during the remaining months (Table 11-4A-29). This total degree-day difference during March across 82 years would correspond to a negligible difference per day. Therefore, this would not result in a negative effect on fall-run Chinook salmon spawning and egg incubation.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be similar to mortality under NAA_ELT in all water year types except below normal years, for which mortality under H3_ELT would be 11% higher (Table 11-4A-55). However, the corresponding absolute increase would be 2% of the fall-run population, which is not substantial. (Therefore, these results indicate that H3_ELT would have negligible effects on fall-run Chinook salmon egg mortality.

Table 11-4A-55. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	4 (40%)	0.2 (1%)
Above Normal	5 (46%)	1 (7%)
Below Normal	7 (62%)	2 (11%)
Dry	7 (47%)	-0.4 (-2%)
Critical	5 (18%)	-0.3 (-1%)
All	5 (39%)	0.4 (2%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

SacEFT predicts that there would be a 33% increase in the percentage of years with good spawning habitat availability for fall-run Chinook salmon, measured as weighted usable area, under H3_ELT relative to NAA_ELT (Table 11-4A-56). SacEFT predicts that there would be a 12% reduction in the percentage of years with good (lower) redd scour risk under H3_ELT relative to NAA_ELT. SacEFT predicts that there would be no difference in the number of years with good egg incubation conditions between H3_ELT and NAA_ELT. SacEFT predicts that there would be a 7% decrease in the number of years with good redd dewatering risk conditions under H3_ELT relative to NAA_ELT.

Table 11-4A-56. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Spawning WUA	9 (19%)	14 (33%)
Redd Scour Risk	-3 (-5%)	-8 (-12%)
Egg Incubation	-5 (-5%)	0 (0%)
Redd Dewatering Risk	0 (0%)	-2 (-7%)
Juvenile Rearing WUA	1 (3%)	-4 (-11%)
Juvenile Stranding Risk	-8 (-26%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
WUA = Weighted Usable Area.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT during February through May.

Shasta Reservoir storage at the end of September would affect flows during the fall-run spawning and egg incubation period. As reported in Impact AQUA-58, end of September Shasta Reservoir storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be similar to or lower than mortality under NAA_ELT in all water years (Table 11-4A-57).

Table 11-4A-57. Difference and Percent Difference in Percent Mortality of Late Fall-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Wet	2 (80%)	-0.1 (-3%)
Above Normal	1 (48%)	-1 (-14%)
Below Normal	2 (120%)	0.1 (3%)
Dry	2 (69%)	-0.1 (-2%)
Critical	1 (60%)	0 (0%)
All	2 (76%)	-0.1 (-3%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month, during October through April, and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-28. There would be 1 (5%) more year with a "red" level of concern under H3_ELT. This difference would not be biologically meaningful to late fall-run Chinook salmon spawners and eggs.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H3_ELT would be 19% higher than those under NAA _ELT during March and similar during the remaining months (Table 11-4A-29).

SacEFT predicts that there would be difference 6% reduction in in the percentage of years with good spawning availability for late fall-run Chinook salmon, measured as weighted usable area, between NAA_ELT and H3_ELT (Table 11-4A-58). SacEFT predicts that there would be a 1% reduction in redd scour risk between NAA_ELT and H3_ELT. SacEFT predicts that there would be no difference in the percentage of years with good (lower) egg incubation conditions and redd dewatering risk between H3_ELT and NAA_ELT.

Table 11-4A-58. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Late Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Spawning WUA	-7 (-13%)	-3 (-6%)
Redd Scour Risk	-3 (-4%)	-1 (-1%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-6 (-10%)	0 (0%)
Juvenile Rearing WUA	-2 (-4%)	-14 (-25%)
Juvenile Stranding Risk	-21 (-29%)	-9 (-15%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
WUA = Weighted Usable Area.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Clear Creek flows below Whiskeytown Reservoir were examined for the September through February fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT.

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest monthly reduction in Clear Creek flows during September through February under H3_ELT would be the same as those under NAA_ELT for all water year types (Table 11-4A-59).

Table 11-4A-59. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September through February Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-67 (NA)	0 (0%)
Critical	-33 (-50%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.
[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Fall-Run

Flows in the Feather River in the low-flow and high-flow channels were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the low-flow channel under H3_ELT would be identical to those under NAA_ELT. Flows in the high-flow channel under H3_ELT would generally be similar to than those under NAA_ELT, with a few exceptions.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Minimum flows in the low-flow channel during November through January were identical between H3_ELT and NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be no effect of H3_ELT on redd dewatering in the Feather River low-flow channel.

Mean monthly water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were analyzed by comparing the percent of months between October through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold at Gridley (Table 11-4A-60). In general, differences in the percent of months exceeding the threshold between NAA_ELT and H3_ELT would be negligible (<5% on an absolute scale), although there would be a 5% reduction (absolute difference) in months exceeding the threshold by >5°F during October.

Table 11-4A-60. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
October	0 (0%)	7 (9%)	11 (15%)	25 (61%)	26 (140%)
November	14 (367%)	5 (400%)	2 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	15 (200%)	5 (133%)	4 (300%)	1 (NA)	1 (NA)
April	9 (12%)	12 (22%)	20 (64%)	12 (71%)	7 (67%)
NAA_ELT vs. H3_ELT					
October	-1 (-1%)	-1 (-1%)	0 (0%)	-1 (-2%)	-5 (-10%)
November	1 (8%)	0 (0%)	0 (0%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	4 (20%)	0 (0%)	0 (0%)	-1 (-50%)	0 (0%)
April	0 (0%)	1 (2%)	0 (0%)	0 (0%)	2 (15%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months in the Feather River at Gridley for months that exceed the 56°F NMFS threshold during the October through April fall-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-4A-61). Combining all water year types, there would be little difference in total degree-months exceeded between NAA_ELT and H3_ELT. Overall, these methods, combined with other temperature analyses, indicate that there would be no effect of H3_ELT on temperature-related fall-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Table 11-4A-61. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
October	Wet	32 (44%)	-2 (-2%)
	Above Normal	12 (27%)	-2 (-3%)
	Below Normal	13 (24%)	-4 (-6%)
	Dry	21 (40%)	-1 (-1%)
	Critical	18 (44%)	0 (0%)
	All	96 (36%)	-9 (-2%)
November	Wet	1 (NA)	0 (0%)
	Above Normal	3 (150%)	0 (0%)
	Below Normal	3 (300%)	0 (0%)
	Dry	6 (NA)	0 (0%)
	Critical	4 (400%)	0 (0%)
	All	17 (425%)	0 (0%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (0%)	1 (NA)
	Below Normal	7 (700%)	1 (14%)
	Dry	7 (175%)	0 (0%)
	Critical	6 (150%)	0 (0%)
	All	21 (210%)	2 (7%)
April	Wet	16 (114%)	1 (3%)
	Above Normal	9 (39%)	1 (3%)
	Below Normal	6 (15%)	0 (0%)
	Dry	18 (37%)	2 (3%)
	Critical	14 (48%)	3 (8%)
	All	63 (41%)	7 (3%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under H3_ELT would be similar to or lower than mortality under NAA_ELT in all water years, including above normal and below water years, in which, although there would be a 17% and 19% relative increase, the absolute increase would be 0.4% and 0.6% of the fall-run population, respectively (Table 11-4A-62). Therefore, this increase would not cause an overall effect to fall-run Chinook salmon.

Table 11-4A-62. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Feather River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	2 (107%)	0.2 (7%)
Above Normal	2 (145%)	0.4 (17%)
Below Normal	2 (106%)	0.6 (19%)
Dry	3 (127%)	-1 (-22%)
Critical	5 (110%)	-1 (-5%)
All	3 (119%)	-0.1 (-2%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would be similar to or up to 25% greater than flows under NAA_ELT during October, similar to or up to 15% lower than flows under NAA_ELT during November, and generally similar in December and January.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October, when spawning is assumed to occur. The greatest reductions in American River flows during November through January under H3_ELT would range from 30% to 52% (absolute difference) greater in magnitude than under NAA_ELT in wet, below normal, and critical water years and 9% to 13% lower in magnitude than NAA_ELT in above normal and dry water years (Table 11-4A-63).

Table 11-4A-63. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in the American River at Nimbus Dam during the October through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Wet	-18 (-83%)	-39 (NA)
Above Normal	15 (50%)	9 (37%)
Below Normal	-25 (-131%)	-30 (-197%)
Dry	32 (68%)	13 (45%)
Critical	-16 (-30%)	-52 (-329%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in October, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Mean water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-64). The percent of months exceeding the threshold under H3_ELT would generally be similar to the percent under NAA_ELT, except for the >5.0°F exceedance category during November, which would be 4% lower (absolute difference) under H3_ELT.

Table 11-4A-64. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
November	32 (70%)	35 (127%)	28 (209%)	26 (1050%)	14 (1100%)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	6 (50%)	5 (67%)	5 (200%)	1 (100%)	2 (NA)
April	17 (25%)	12 (20%)	17 (38%)	17 (54%)	5 (18%)
NAA_ELT vs. H3_ELT					
November	-5 (-6%)	1 (2%)	-1 (-3%)	-2 (-8%)	-4 (-20%)
December	0 (0%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	-1 (-9%)	-2 (-25%)	0 (0%)	0 (0%)
April	0 (0%)	0 (0%)	-1 (-2%)	0 (0%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-65). Total degree-months would be similar between NAA_ELT and H3_ELT for all months.

Table 11-4A-65. Differences between Baseline and H3 Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
November	Wet	34 (136%)	-5 (-8%)
	Above Normal	16 (145%)	-1 (-4%)
	Below Normal	22 (275%)	-4 (-12%)
	Dry	25 (192%)	-1 (-3%)
	Critical	19 (119%)	1 (3%)
	All	116 (159%)	-10 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	3 (75%)	-2 (-22%)
	Critical	6 (60%)	-1 (-6%)
	All	16 (84%)	-3 (-8%)
April	Wet	22 (79%)	0 (0%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	15 (42%)	-1 (-2%)
	Dry	15 (20%)	0 (0%)
	Critical	14 (24%)	-2 (-3%)
	All	80 (36%)	-3 (-1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under H3_ELT would be similar to mortality under NAA_ELT (Table 11-4A-66).

Table 11-4A-66. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the American River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	15 (99%)	-0.2 (-1%)
Above Normal	14 (130%)	-1 (-3%)
Below Normal	13 (105%)	0.3 (1%)
Dry	10 (59%)	0 (0%)
Critical	4 (19%)	0 (0%)
All	12 (77%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H3_ELT throughout the October through January period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences in mean flows between H3_ELT and NAA_ELT throughout the period for all water year types

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff during October through January under H4_ELT would be similar to flows under NAA_ELT, except during November in which flows would be up to 15% lower, depending on water year type) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

September Shasta mean storage volume under H4_ELT would be similar to storage volume under NAA_ELT, except in critical water years, in which storage volume would be 24% greater under H4_ELT (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-67. There would be 6 (27%) more years without any of the three levels of concern, under H4_ELT relative to NAA_ELT. These results suggest that water temperatures would improve for fall-run Chinook salmon spawning and egg incubation in the Sacramento River under H4_ELT.

Table 11-4A-67. Differences between Baseline Scenarios and H4_ELT Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Red	9 (75%)	0 (0%)
Orange	2 (33%)	-5 (-38%)
Yellow	12 (92%)	-1 (-4%)
None	-23 (-45%)	6 (27%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
[a] For definitions of levels of concern, see Table 11-4A-14.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H4_ELT would be 10% lower than those under NAA_ELT for October, 20% lower for November, 16% higher for March, and would be similar for the remaining four months (Table 11-4A-68). The largest difference in degree-days would be the 353 degree-day reduction for October.

Table 11-4A-68. Differences between Baseline and H4_ELT Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA vs. H4_ELT
October	Wet	406 (158%)	-16 (-2%)
	Above Normal	191 (73%)	-6 (-1%)
	Below Normal	229 (110%)	-29 (-6%)
	Dry	286 (58%)	-88 (-10%)
	Critical	201 (34%)	-214 (-21%)
	All	1,313 (72%)	-353 (-10%)
November	Wet	7 (700%)	-1 (-11%)
	Above Normal	4 (NA)	1 (33%)
	Below Normal	1 (NA)	-1 (-50%)
	Dry	31 (388%)	-11 (-22%)
	Critical	13 (325%)	-5 (-23%)
	All	56 (431%)	-17 (-20%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	10 (111%)	9 (90%)
	Dry	20 (143%)	0 (0%)
	Critical	11 (1100%)	0 (0%)
	All	42 (175%)	9 (16%)
April	Wet	97 (84%)	0 (0%)
	Above Normal	68 (49%)	-4 (-2%)
	Below Normal	99 (125%)	5 (3%)
	Dry	118 (63%)	11 (4%)
	Critical	49 (408%)	7 (13%)
	All	431 (81%)	19 (2%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Due to similar Sacramento River flows, reservoir storage, and water temperatures between H4_ELT and H3_ELT, results for additional analyses (e.g., Reclamation egg mortality model, SacEFT) under H4_ELT would be similar to results for analyses under H3_ELT. As a result, these additional analyses were not conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

Late Fall-Run

There would be no difference (<5%) in mean flows in the Sacramento River upstream of Red Bluff during February through May between NAA_ELT and H4_ELT in any month or water year type throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

September Shasta mean storage volume under H4_ELT would be similar to storage volume under NAA_ELT except in critical water years, in which storage volume would be 24% greater under H4_ELT (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-67. There would be 6 (27%) more years without any of the three levels of concern, under H4_ELT relative to NAA_ELT. These results indicate that water temperature conditions would improve for late fall-run Chinook salmon spawning and egg incubation in the Sacramento River under H4_ELT.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H4_ELT would be 10% lower than those under NAA_ELT for October, 20% lower for November, 16% higher for March, and would be similar for the remaining four months (Table 11-4A-68). The largest difference in degree-days would be the 353 degree-day reduction for October, which would correspond to a <0.2°F change per day, which is not expected to affect spawning and egg incubation.

Due to similar Sacramento River flows, reservoir storage, and water temperatures between H4_ELT and H3_ELT, results for additional analyses (e.g., Reclamation egg mortality model, SacEFT) under H4_ELT would be similar to results for analyses under H3_ELT. As a result, these additional analyses were not conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

There would be no differences (<5%) between H4_ELT and NAA_ELT in mean flows in Clear Creek below Whiskeytown Reservoir during October through January for any month or water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Feather River

Fall-Run

Mean flows in the Feather River low-flow channel during October through January would be the same (<5%) between H4_ELT and NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT in the high-flow channel would generally be similar to those under NAA_ELT, with minor exceptions.

Differences in the percent of months exceeding the 56°F NMFS threshold between NAA_ELT and H4_ELT would be negligible (<5% on an absolute scale) during all months except October, March, and April, in which the percent of months under H4_ELT would be similar to or up to 20% lower than (absolute difference) those under NAA_ELT (Table 11-4A-69). This method indicates that there would be benefits of H4_ELT on temperature-related fall-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Table 11-4A-69. Differences between Baselines and H4_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
October	1 (1%)	7 (9%)	5 (7%)	22 (55%)	26 (140%)
November	12 (333%)	9 (700%)	4 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (33%)	2 (67%)	2 (200%)	1 (NA)	0 (NA)
April	-11 (-16%)	-6 (-11%)	2 (8%)	2 (14%)	-1 (-11%)
NAA_ELT vs. H4_ELT					
October	0 (0%)	-1 (-1%)	-6 (-7%)	-4 (-6%)	-5 (-10%)
November	0 (0%)	4 (60%)	1 (50%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-9 (-47%)	-2 (-29%)	-1 (-25%)	-1 (-50%)	-1 (-100%)
April	-20 (-25%)	-17 (-25%)	-17 (-34%)	-10 (-33%)	-6 (-38%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Combining all water year types, there would be no difference between NAA_ELT and H4_ELT in total degree-months exceeded in all months except October, November, March, and April. For October and November, degree-months would be higher by 8% and 62%, respectively, while for March and April they would be lower by 14% and 19%, respectively (Table 11-4A-70). Splitting monthly results into water year types yields highly variable outcomes. There would be small increases and decreases in degree-months under H4_ELT relative to NAA_ELT depending on month and water year type. Large relative differences between NAA _ELT and H4_ELT during some months and water year types are mathematical artifacts due to small values of degree-months for NAA_ELT and would not translate into biologically meaningful effects on fall-run Chinook salmon. Overall, this method indicates that there would be no effects of H4_ELT on temperature-related fall-run Chinook salmon spawning and egg incubation conditions in the Feather River.

Table 11-4A-70. Differences between Baselines and H4_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
October	Wet	47 (64%)	13 (12%)
	Above Normal	15 (34%)	1 (2%)
	Below Normal	24 (44%)	7 (10%)
	Dry	31 (58%)	9 (12%)
	Critical	18 (44%)	0 (0%)
	All	135 (51%)	30 (8%)
November	Wet	8 (NA)	7 (700%)
	Above Normal	3 (150%)	0 (0%)
	Below Normal	7 (700%)	4 (100%)
	Dry	10 (NA)	4 (67%)
	Critical	2 (200%)	-2 (-40%)
	All	30 (750%)	13 (62%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	-1 (-100%)	0 (NA)
	Below Normal	3 (300%)	-3 (-43%)
	Dry	7 (175%)	0 (0%)
	Critical	6 (150%)	0 (0%)
	All	15 (150%)	-4 (-14%)
April	Wet	5 (36%)	-10 (-34%)
	Above Normal	-4 (-17%)	-12 (-39%)
	Below Normal	-16 (-40%)	-22 (-48%)
	Dry	16 (33%)	0 (0%)
	Critical	14 (48%)	3 (8%)
	All	15 (10%)	-41 (-19%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River during October through January would generally be similar between H4_ELT and NAA_ELT, except during October, in which flows would be up to 24% higher under H4 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-71). The percent of months exceeding the threshold under H4_ELT would be similar to or up to 11% lower (absolute difference) than the percent under NAA_ELT.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-72). Total degree-months would generally be similar between NAA_ELT and H4_ELT for all months.

Table 11-4A-71. Differences between Baseline and H4_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
November	27 (59%)	26 (95%)	23 (173%)	17 (700%)	10 (800%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (20%)	5 (67%)	4 (150%)	1 (100%)	1 (NA)
April	11 (16%)	6 (10%)	10 (22%)	10 (31%)	4 (14%)
NAA_ELT vs. H4_ELT					
November	-10 (-12%)	-7 (-12%)	-6 (-14%)	-11 (-36%)	-7 (-40%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-20%)	-1 (-9%)	-4 (-38%)	0 (0%)	-1 (-50%)
April	-6 (-7%)	-6 (-8%)	-9 (-13%)	-7 (-15%)	-1 (-4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Table 11-4A-72. Differences between Baseline H4_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
November	Wet	36 (144%)	-3 (-5%)
	Above Normal	16 (145%)	-1 (-4%)
	Below Normal	24 (300%)	-2 (-6%)
	Dry	23 (177%)	-3 (-8%)
	Critical	20 (125%)	2 (6%)
	All	118 (162%)	-8 (-4%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	5 (125%)	0 (0%)
	Critical	7 (70%)	0 (0%)
	All	19 (100%)	0 (0%)
April	Wet	19 (68%)	-3 (-6%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	16 (44%)	0 (0%)
	Dry	14 (18%)	-1 (-1%)
	Critical	17 (29%)	1 (1%)
	All	80 (36%)	-3 (-1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H4_ELT throughout the October through January period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences in mean flows between H4_ELT and NAA throughout the period for all water year types.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, it is concluded that the effect is not adverse because spawning and egg incubation habitat conditions are not substantially reduced. There are no reductions in flows under Alternative 4A or increases in temperatures that would translate into biologically meaningful effects on fall-/late fall-run Chinook salmon. In all rivers, there are no large or consistent differences relative to NAA_ELT. Biological modeling results also indicate that Alternative 4A would not substantially affect fall-/late fall–run Chinook salmon spawning and egg incubation habitat relative to the NAA_ELT. There would generally be no differences among scenarios.

CEQA Conclusion: In general, Alternative 4A would degrade the quantity and quality of spawning and egg incubation habitat for fall-/late fall-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for fall-/late fall-run Chinook salmon relative to the CEQA baseline.

H3_ELT /ESO_ELT

Sacramento River

Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would be up to 16% lower than flows under Existing Conditions during October and November, and similar during December and January.

Shasta storage volume at the end of September would be 7% to 11% lower under H3_ELT relative to Existing Conditions depending on water year type (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT during the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between H3_ELT and baselines in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-28. There would be 10 (83%) and 5 (83%) more years with "red" and "orange" levels of concern under H3_ELT than under Existing Conditions. Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H3_ELT would be 78% to 554% higher than those under Existing Conditions during October, November, March, and April, and there were no differences during December through February (Table 11-4A-29).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be 18% to 62% greater than mortality under Existing Conditions, depending on water year type (Table 11-4A-55).

SacEFT predicts that there would be a 19% increase in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT relative to Existing Conditions (Table 11-4A-56). SacEFT predicts that there would be a 5% reduction in the percentage of years with good (lower) redd scour risk under H3_ELT relative to Existing Conditions. SacEFT predicts that there would be a 5% relative decrease in the percentage of years with good (lower) egg incubation conditions under H3_ELT compared to Existing Conditions. SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd dewatering risk between H3_ELT and Existing Conditions.

Late Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II*

Model Results utilized in the Fish Analysis). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions for all months and water year types during the period.

Shasta storage volume at the end of September would be 7% to 11% lower under H3_ELT relative to Existing Conditions, depending on water year type (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between H3_ELT and baselines in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-28. There would be 10 (83%) and 5 (83%) more years with "red" and "orange" levels of concern under H3_ELT than under Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H3_ELT would be 78% to 554% higher than those under Existing Conditions during October, November, March, and April, and there would be no differences during December through February (Table 11-4A-29).

The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the Sacramento River under H3_ELT would be 60% to 120% greater than mortality under Existing Conditions (Table 11-4A-57). However, absolute differences in the percent of the late-fall population subject to mortality would be minimal in all water years.

SacEFT predicts that there would be a 13% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under H3_ELT compared to Existing Conditions (Table 11-4A-58). SacEFT predicts that there would be a 4% relative decrease in the percentage of years with good (lower) redd scour risk under H3_ELT compared to Existing Conditions. SacEFT predicts that there would be no difference in the percentage of years with good (lower) egg incubation conditions under H3_ELT relative to Existing Conditions. SacEFT predicts that there would be a 10% relative decrease in the percentage of years with good (lower) redd dewatering risk under H3 compared to Existing Conditions.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined during the September through February fall-run spawning and egg incubation period. Flows under H3_ELT would be up to 40% greater during January and February, and generally similar during September through December to flows under Existing Conditions, with minor exceptions.

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning occurred. Clear Creek flows would be reduced during October through February under H3_ELT up to 67% (absolute difference) in above normal, dry, and critical water years and increased in below normal water years (Table 11-4A-59).

Feather River

Fall-Run

Flows in the Feather River low-flow channel during October through January under H3_ELT would be identical to those under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-flow channel under H3_ELT would be up to 47% lower than flows under Existing Conditions during January, up to 24% greater during October, 18% higher and up to 26% lower in December, and generally similar during November.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Minimum flows in the low-flow channel were identical between H3_ELT and Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, there would be no effect of Alternative 4 on redd dewatering in the Feather River low-flow channel.

Mean water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT and Existing Conditions would be no different (<5%) at either location.

Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were analyzed by comparing the percent of months between October through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold at Gridley (Table 11-4A-60). In general, the percent of months exceeding the threshold under H3_ELT would be up to 25% greater than the percent under Existing Conditions in all months except December, January, and February, during which the percent would not differ from Existing Conditions. This comparison includes the effects of climate change.

The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the October through April fall-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-4A-61). In general, total degree-months under H3_ELT would be up to 96 degree-months (36%) greater than under Existing Conditions in all months except December, January, and February, during which degree-months would not differ from Existing Conditions. This comparison includes the effects of climate change.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under H3_ELT would be 106% to 145% greater than mortality under Existing Conditions (Table 11-4A-62).

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River under H3_ELT would generally be up to 24% lower than flows under Existing Conditions during November and January, but generally similar to flows under Existing Conditions during October and December, with some exceptions.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. The greatest monthly reduction in American River flows during November through January under H3_ELT would be 30% to 131% greater magnitude than those under Existing Conditions for all year types except above normal (50% lower magnitude)(Table 11-4A-63).

Mean water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under H3_ELT would be 6% to 7% higher than those under Existing Conditions during October of all water year types except critical (5% higher).

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-64). The percent of months exceeding the threshold under H3_ELT would be up to 35% greater (absolute difference) than the percent under Existing Conditions during November, March, and April and similar to the percent under Existing Conditions during December through February.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-65). Total degree-months under H3_ELT would be 36% to 159% greater than total degree-months under Existing Conditions during November, March and April and similar to total degree months under Existing Conditions during December through February.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under H3_ELT would be 19% to 130% greater than mortality under Existing Conditions (Table 11-4A-66).

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would not be different (<5%) from those under Existing Conditions for all months and water year types of the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar in all months of the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would be up to 28% greater than flows under Existing Conditions during December, and would generally be similar to flows under Existing Conditions during the other three months of the period.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined during the October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT 4 would generally be similar to flows under Existing Conditions. September Shasta storage volume under H4_ELT would be similar to or up to 12% lower than to storage volume under Existing Conditions, depending on water year type (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT during the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-67. There would be 75% and 33% increases in the number of years with "red" and "orange" levels of concern, respectively, under H4_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H4_ELT would be 72% to 431% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-4A-68).

Late Fall-Run

Flows in the Sacramento River upstream of Red Bluff were evaluated during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions. End of September Shasta storage volume under H4_ELT would be up to 12% lower than storage volume under Existing Conditions (Table 11-4A-36).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT during the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H1in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-67. There would be 75% and 33% increases in the number of years with "red" and "orange" levels of concern, respectively, under H4_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under H4_ELT would be 72% to 431% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-4A-68).

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek flows below Whiskeytown Reservoir were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 40% greater during January and February, and generally similar during September through December, than flows under Existing Conditions.

Feather River

Fall-Run

Flows in the Feather River were evaluated in the low- and high-flow channels during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the low-flow channel would be identical between Existing Conditions and H4_ELT. Mean flows in the high-flow channel under

H4_ELT would be up to 36% lower than those under Existing Conditions throughout the period, with a few exceptions.

Mean water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean monthly water temperatures would be no different (<5%) under H4_ELT relative to Existing Conditions at either location.

Differences in the percent of months exceeding the 56°F NMFS threshold between Existing Conditions and H4_ELT would be negligible (<5% on an absolute scale) during all months except October, November, March, and April, in which the percent of months under H4_ELT would be similar to or up to 26% higher (absolute difference) than those under Existing Conditions.

Combining all water year types, there would be no difference between Existing Conditions and H4_ELT in total degree-months exceeded in all months except October, November, March, and April, during which degree-months under H4_ELT would be greater by up to 135 degree-months (51% higher).

American River

Fall-Run

Flows were evaluated in the American River at the confluence with the Sacramento River during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would be up to 25% lower than those under Existing Conditions during November and would generally be similar between Existing Conditions and H4_ELT during the other three months of the period, with a few exceptions.

Mean water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under H4 ELT would be 6% to 7% greater than those under Existing Conditions during October of all water year types except critical (5% greater) and would be no different (<5%) for all other months and water year types of the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-71). The percent of months exceeding the threshold under H4 ELT would be up to 27% greater (absolute difference) than the percent under Existing Conditions during November, March, and April and similar to the percent under Existing Conditions during December through February.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-72). Total degree-months under H4 ELT would be 36% to 159% greater than total degree-months under Existing Conditions during November, March and April and similar to total degree months under Existing Conditions during December through February.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar between Existing Conditions and H4_ELT.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) than Existing Conditions throughout the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be generally similar to those under Existing Conditions throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would generally be similar to flows under Existing Conditions during October, November, and January, and up to 28% greater than flows under Existing Conditions during December.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 4A, there would be moderate to substantial flow reductions and substantial increases in temperatures and temperature exceedances above thresholds in the Sacramento, Feather, and American Rivers, which would interfere with fall-/late fall--run Chinook salmon spawning and egg incubation. Biological models, including the Reclamation egg mortality model and SacEFT, predict substantially degraded spawning and egg incubation habitat conditions in the Sacramento, Feather, and American Rivers. These modeling results are generally consistent for H3_ELT and H4_ELT. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of egg mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be no effect of Alternative 4A on flows, reservoir storage, and water temperatures that would cause a substantial reduction in fall-/late fall-run Chinook salmon. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-77: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 4A would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall-run Chinook salmon relative to the NAA_ELT.

H3_ELT /ESO_ELT

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Sacramento River upstream of Red Bluff under H3_ELT would generally be similar to flows under NAA_ELT.

Shasta Reservoir storage at the end of September would affect flows during the fall-run larval and juvenile rearing period. As reported in AQUA-58, mean end of September Shasta Reservoir storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

SacEFT predicts that there would be an 11% decrease (4% on an absolute scale) in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under H3_ELT relative to NAA_ELT (Table 11-4A-56). SacEFT predicts that there would be no difference in the percentage of years with “good” (lower) juvenile stranding risk between H3_ELT and NAA_ELT.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under H3_ELT would be similar to mortality under NAA_ELT.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the March through July late fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).Upstream of Red Bluff, mean flows under H3_ELT would generally be similar to those under NAA throughout the period.

Shasta Reservoir storage at the end of September and May would affect flows during the late fall-run larval and juvenile rearing period. As reported in AQUA-156, end of September Shasta Reservoir storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

As reported in AQUA-40, May Shasta storage volume under H3_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-4A-19).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

SacEFT predicts that there would be a 25% relative decrease in the percentage of years with good juvenile rearing habitat availability for late fall-run Chinook salmon, measured as weighted usable area, under H3_ELT compared to NAA_ELT (Table 11-4A-58). SacEFT predicts that there would be a 15% reduction in the percentage of years with “good” (lower) juvenile stranding risk under H3_ELT relative to NAA_ELT, which would be negligible on an absolute scale (4% difference).

SALMOD predicts that late fall-run smolt equivalent habitat-related mortality under H3_ELT would be similar (<5% difference) to mortality under NAA_ELT. These results are inconsistent with SacEFT results, which indicate that juvenile rearing habitat availability would decline under H3_ELT (Table 11-4A-58).

Both SacEFT and SALMOD are considered to be reliable models for late fall-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about late fall-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile rearing habitat availability may be reduced under H3_ELT, when combined with all early life stage effects in SALMOD, there would be no effect of H3_ELT on late-fall-run Chinook salmon habitat-related survival of all early life stages, including juveniles. Further, results from SALMOD are consistent with results described above that indicate that there would be no differences in instream flows or reservoir storage between NAA_ELT and H3_ELT.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined for the January through May fall-run Chinook salmon rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to those under NAA_ELT throughout the period.

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Relatively constant flows in the low-flow channel throughout this period under H3_ELT would not differ from those under NAA_ELT. In the high-flow channel, mean flows under H3_ELT would generally be similar to those under NAA_ELT during December through April and up to 106% greater during May and June.

As reported in AQUA-59, May Oroville mean storage volume under H3_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-4A-42).

As reported in AQUA-58, September Oroville mean storage volume under H3_ELT would be similar to volume in wet, above normal, and below normal water years and 12% to 15% greater than volume under NAA_ELT during dry and critical water years (Table 11-4A-39).

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under NAA_ELT throughout the period.

Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT are not different from those under NAA_ELT, for the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures throughout the Stanislaus River would be similar between NAA_ELT and H3_ELT throughout the January through May fall-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis for H3_ELT are not different from those under NAA_ELT, for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta for H3_ELT are not different from those under NAA_ELT, for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT/HOS_ELT

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were evaluated during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows under H4_ELT during this period would generally be similar to those under NAA_ELT.

September Shasta mean storage volume under H4_ELT would generally be similar to September storage volume under NAA_ELT, except in critical years (24% higher under H4_ELT) (Table 11-4A-36).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA and H4 in any month or water year type throughout the period.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were evaluated during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT during this period would be similar to those under NAA_ELT for all year types throughout the period.

September Shasta mean storage volume under H4_ELT would be similar to September storage volume under NAA_ELT except in critical years (24% higher under H4) (Table 11-4A-36). May Shasta storage volume under H4_ELT would be similar to May storage volume under NAA_ELT except in critical years (11% higher under H4_ELT) (Table 11-4A-19).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir during January through May under H4_ELT would generally be similar to those under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Feather River

Fall-Run

Flows in the Feather River were evaluated at both above (low-flow channel) and at (high-flow channel) Thermalito Afterbay during the December through June fall-run juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the low-flow channel would be identical between NAA_ELT and H4_ELT. Mean flows in the high-flow channel would generally be similar to or greater than those under NAA_ELT (up to 548% greater for below normal year types in April) than flows under NAA_ELT.

September Oroville mean storage under H4_ELT would generally be similar to mean storage volume under NAA_ELT in wet, above normal, and below normal water year types and 28% to 44% greater in dry and critical water year types (Table 11-4A-39). May Oroville storage under H4_ELT would be 11% to 16% lower than storage under NAA_ELT in wet, above normal, and below normal water years, similar in dry water years, and 24% greater in critical water years (Table 11-4A-45).

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were evaluated during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under NAA_ELT throughout the period.

Mean water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Stanislaus River

Fall-Run

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT are not different (<5%) from those under NAA_ELT for the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures throughout the Stanislaus River would be similar between NAA_ELT and H4_ELT throughout the January through May fall-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Fall-Run

Mean flows in the San Joaquin River at Vernalis for H4_ELT are not different (<5%) from those under NAA_ELT for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Mean flows in the Mokelumne River at the Delta for H4_ELT are not different (<5%) from those under NAA_ELT for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: All changes in flow rates and water temperatures are generally small and infrequent under Alternative 4A relative to the NAA_ELT. Therefore, there would be no biologically meaningful effects to fall- or late fall-run Chinook salmon. Biological modeling generally supports this conclusion, except for a reduction in late fall-run Chinook salmon juvenile rearing habitat conditions predicted by SacEFT. However, review of this result in combination with SALMOD results, which evaluates habitat-related survival of all early life stages and found no effect of Alternative 4A, it is concluded that the effect to juvenile habitat conditions predicted by SacEFT would not have a substantial effect on all early life stages combined, including juveniles, as predicted by SALMOD As such, the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat of fish.

CEQA Conclusion: In general, Alternative 4A would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall-run Chinook salmon relative to Existing Conditions.

H3_ELT /ESO_ELT

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions throughout the period.

As reported in AQUA-58, end of September Shasta Reservoir mean storage would be 7% to 11% lower under H3_ELT relative to Existing Conditions, depending on water year type (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

SacEFT predicts that there would be a 3% increase in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under H3_ELT relative to Existing Conditions (Table 11-4A-56). SacEFT predicts that there would be a 26% reduction in the percentage of years with "good" (lower) juvenile stranding risk under H3_ELT relative to Existing Conditions.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under H3_ELT would be similar to mortality under Existing Conditions.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the March through July late fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3 would generally be up to 20% greater during May and June, and similar in the remaining months.

As reported in AQUA-58, mean storage volume at the end of September under H3_ELT would be 7% to 11% lower relative to Existing Conditions, depending on water year type (Table 11-4A-27).

As reported in AQUA-40, Shasta Reservoir mean storage volume at the end of May under H3_ELT would be similar to volume under Existing Conditions for all water year types (Table 11-4A-19).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento*

River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3 in any month or water year type throughout the period.

SacEFT predicts that there would be a 4% reduction in the percentage of years with good juvenile rearing availability for late fall-run Chinook salmon, measured as weighted usable area, under H3_ELT relative to Existing Conditions (Table 11-4A-58). SacEFT predicts that there would be a 29% reduction in the percentage of years with "good" (lower) juvenile stranding risk under H3_ELT relative to Existing Conditions.

SALMOD predicts that late fall-run smolt equivalent habitat-related mortality under H3_ELT would be 4% higher than mortality under Existing Conditions.

Clear Creek

No temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined from January through May fall-run Chinook salmon rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions, except for critical year types during January through April (10% greater under H3_ELT in all four months) and wet year types in January and February (up to 40% greater under H3_ELT) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Relatively constant flows in the low-flow channel throughout the period under H3_ELT would not differ from those under Existing Conditions. In the high-flow channel, relative to Existing Conditions, mean flows under H3_ELT would generally be similar during December, March, and April, lower during January and February (by up to 48%), and higher during May and June (up to 140%).

As reported under AQUA-59, May Oroville mean storage volume under H3_ELT would be up to 12% lower (dry year types) than Existing Conditions (Table 11-4A-42).

As reported in AQUA-58, September Oroville mean storage volume would be 5% to 29% lower under H3_ELT relative to Existing Conditions depending on water year type, except for critical years (Table 11-4A-33).

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (5%) in mean water temperature between H3_ELT and Existing Conditions in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during the period would be up to 18% lower and up to 15% higher than flows under Existing Conditions, depending on the month and water year type.

Mean water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different than (<5%) those under Existing Conditions during the period.

Stanislaus River

Fall-Run

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT would generally be lower than those under Existing Conditions during the January through May fall-run larval and juvenile rearing period for most water year types (up to 29% lower for critical year types in February) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different than (<5%) those under Existing Conditions throughout the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or moderately lower than flows under Existing Conditions throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for January through May fall-run Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be generally similar to or moderately greater than those under Existing Conditions during January through March and similar to or slightly lower than flows under Existing Conditions during April and May.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT/HOS_ELT

Sacramento River

Fall-Run

Sacramento River mean flows upstream of Red Bluff during January through May under H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). September Shasta mean storage volume under H4_ELT would generally be similar to or slightly lower than September mean storage volume under Existing Conditions (Table 11-4A-27).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the January through March fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Late Fall-Run

Sacramento River mean flows upstream of Red Bluff during March through July under H4_ELT would generally be similar to flows under Existing Conditions throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

September Shasta mean storage volume under H4_ELT would generally similar to or slightly lower than September mean storage volume under Existing Conditions (Table 11-4A-36). May Shasta mean storage volume under H4_ELT would be similar to mean storage volume under Existing Conditions for all water year types (Table 11-4A-19).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir during January through May under H4_ELT would be similar to or greater than those under Existing Conditions (up to 40% greater for wet years in January) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Feather River

Fall-Run

Flows were evaluated in the Feather River both above (low-flow channel) and at (high-flow channel) Thermalito Afterbay during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the low-flow channel would be identical between Existing Conditions and H4_ELT. Mean flows in the high-flow channel under H4_ELT would generally be lower than flows under Existing Conditions during December through February (up to 36% lower for below normal year types in January), similar during March, and greater than flows under Existing Conditions during April through June (up to 509% greater for below normal year types in April).

September Oroville mean storage under H4_ELT would be 23% to 24% lower than flows under Existing Conditions in wet, above normal, and below normal water years, and 5% to 32% higher in dry and critical water years (Table 11-4A-39). May Oroville mean storage would be 11% to 19% lower under H4_ELT than under Existing Conditions in all water year types except critical, in which storage would be 15% higher (Table 11-4A-45).

Mean monthly water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (5%) in mean water temperature between H4_ELT and Existing Conditions in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows were evaluated in the American River at the confluence with the Sacramento River during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 20% lower than flows under Existing Conditions during May, up to 14% higher during February, and similar, with minor exceptions, in the remaining months of the rearing period.

Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (5%) in mean water temperature between H4_ELT and Existing Conditions in any month or water year type throughout the period.

Stanislaus River

Fall-Run

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT would be lower for most water year types than those under Existing Conditions in the January through May fall-run larval and juvenile rearing period (up to 29% lower for critical years during February) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between H4_ELT and Existing Conditions in any month or water year type throughout the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to or moderately lower than those under Existing Conditions for most water year types in the January through May fall-run larval and juvenile rearing period. Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined for January through May fall-run Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean monthly flows under H4_ELT would be similar to those under Existing Conditions for most water year types than in the January through May fall-run larval and juvenile rearing period.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 4A, including climate change effects, there would be persistent moderate flow reductions in the Feather, American, Stanislaus, Mokelumne, and San Joaquin Rivers, which would interfere with fall-/late fall--run Chinook salmon juvenile rearing habitat conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable rearing habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of degraded juvenile rearing conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under

Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-78: Effects of Water Operations on Migration Conditions for Chinook Salmon (Fall-/Late Fall–Run ESU)

With implementation of Mitigation Measure AQUA-78d, the effect of Alternative 4A on migration conditions for fall-/late fall–run Chinook salmon relative to the No Action Alternative would not be adverse.

Upstream of the Delta

H3_ELT /ESO_ELT

Sacramento River

Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined for juvenile fall-run migrants during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT throughout the juvenile migration period.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA _ELT and H3_ELT in any month or water year type throughout the period.

Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under NAA_ELT during August, October and December, and would be up to 18% lower during September and November (mean reduction combining all water year types of 6% and 12%, respectively). These reductions would not be of sufficient magnitude or frequency to cause a biologically meaningful effect to fall-run Chinook salmon migration.

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under H3_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under H3_ELT would be generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA and H3 in any month or water year type throughout the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined for juvenile fall-run migrants during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to those under NAA_ELT.

Flows in Clear Creek below Whiskeytown Reservoir were examined during the adult fall-run Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to flows under NAA_ELT with few exceptions.

Feather River

Fall-Run

Flows in the Feather River at the confluence with the Sacramento River were reviewed for the fall-run juvenile migration period (February through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the period (up to 12% greater for above normal year types in February).

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Flows in the Feather River at the confluence with the Sacramento River were reviewed for the August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar or up to 17% greater than those under NAA_ELT during October through December. During August and September, flows would be up to 28% lower than flows under NAA_ELT except in critical water years in which the flows would be up to 21% greater. Mean flow reductions across all water year types for August and September would be 11% and 15%, respectively. These reductions would not be of sufficient magnitude or frequency to cause a biologically meaningful effect to fall-run Chinook salmon migration. Flows would be similar between NAA_ELT and H3_ELT during November.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under NAA_ELT throughout the migration period, except during April of critical years (17% greater mean flow under H3_ELT).

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 25% lower than flows under NAA_ELT during August, September and November, and similar or up to 25% higher during October and December. Mean flow reductions across all water year types during August, September and November would be 11%, 16%, and 10%, respectively. Because these reductions occur in the majority of migration months, this is considered an adverse effects to fall-run Chinook salmon migration conditions.

Mean monthly water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be no different than (<5%) those under NAA_ELT in all months and water year types throughout the period.

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the September and October adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be no different than (<5%) those under NAA_ELT in both months and water year types of the period.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in either month or any water year type of the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be no different than (<5%) those under NAA_ELT in all months and water year types throughout the period.

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H3_ELT in either month or any water year type of the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H3_ELT in either month or any water year type of the period.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined for the juvenile fall-run Chinook salmon downstream migration period (February through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to those under NAA_ELT except during November, when flows would be up to 15% lower under H4_ELT.

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

Late Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined for the juvenile fall-run Chinook salmon downstream migration period (January through March) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT throughout the period for all water year types.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook salmon upstream migration period (December through February) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under NAA_ELT throughout the period.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Flows in the Clear Creek below Whiskeytown Reservoir during the February through May fall-run Chinook salmon juvenile migration period under H4_ELT would generally be similar to flows under NAA_ELT, (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the Clear Creek below Whiskeytown Reservoir during the August through December fall-run Chinook salmon adult migration period under H4_ELT would generally be no different than (<5%) those under NAA_ELT.

Feather River

Fall-Run

Flows were evaluated in the Feather River at the confluence with the Sacramento River during the February through May juvenile late fall-run Chinook salmon emigration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to or greater than flows under NAA_ELT throughout the period (up to 119% greater for April of below normal year types).

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows were evaluated in the Feather River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be lower during August and September than those under NAA_ELT for all water year types except critical year types (up to 42% lower in August of wet years and up to 42% higher in August of critical years). Mean reductions for all water year types combined during August and September would be 32% and 22%, respectively. These reductions are substantial and, therefore, would cause an adverse effect to fall-run Chinook salmon. Mean flows during October through December would generally be similar to flows under NAA_ELT.

American River

Fall-Run

Flows were evaluated in the American River at the confluence with the Sacramento River during the February through May fall-run Chinook salmon juvenile migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT throughout the period, except for critical years types in April (12% higher under H4_ELT) and May (17% lower under H4_ELT).

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results* *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows were evaluated in the American River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4 ELT would generally be lower than those under NAA_ELT during September and November (up to 22% lower), but would generally be similar or higher during August, October and December (up to 24% higher). However, flow during August of critical water years would be 33% lower under H4_ELT. These flow reductions would not be frequent or of high enough magnitude to be considered adverse.

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the September and October adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be no different than (<5%) those under NAA_ELT in all months and water year types of the period.

Mean water temperatures in the Stanislaus River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flows between NAA_ELT and H4_ELT in either month or any water year type of the period.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be no different than (<5%) those under NAA_ELT for all months or water year types of the period.

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H4_ELT in either month or any water year type of the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and H4_ELT in either month or any water year type of the period.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Fall-Run

Juveniles

Alternative 4A operations would generally reduce OMR reverse flows under Scenario H3_ELT (Appendix B, Supplemental Modeling for Alternative 4A), with a corresponding increase in net positive downstream flows, during the migration period of Chinook salmon through the interior Delta channels. Conditions under Scenario H4_ELT would further improve overall average OMR flows compared to NAA_ELT. These improved net positive downstream flows would be benefits of the proposed operations.

Predation risk at the north Delta would be increased due to the installation of the proposed SWP/CVP North Delta intake facilities on the Sacramento River. Bioenergetics modeling with a median predator density predicts a predation loss under Alternative 4 of less than 0.6% of the annual juvenile production (0.24% fall run; 0.57% late fall-run) (Table 11-4A-54). A conservative assumption of 5% loss per intake would yield a cumulative loss of about 13% of juvenile fall-run and late fall-run Chinook that reach the north Delta. This assumption is uncertain and represents an upper bound estimate. For a discussion of this topic see Impact AQUA-42 for Alternative 1A and additional discussion under Impact AQUA-42 of Alternative 4A for winter-run Chinook salmon.

H3_ELT

Flows below the north Delta intakes would be reduced during the juvenile emigration period for fall-run Chinook (February through May) and late fall-run Chinook salmon (January through March), which may increase predation potential. Mean monthly flows averaged across all water years would decrease about 17% to 22% under H3_ELT compared to NAA_ELT. As noted for winter-run and spring-run Chinook salmon, the modeling of NAA_ELT does not account for any flow entering the Yolo Bypass because of Fremont Weir modifications that would occur separately from Alternative 4A (but which are included in the modeling of H3_ELT and H4_ELT; see also section 4.1.1.3 of Section 4); this would slightly decrease the amount of water in the Sacramento River under NAA_ELT, so the above comparison of H3_ELT vs. NAA_ELT is conservative.

Under Scenario H3_ELT, through-Delta survival of Sacramento River fall-run Chinook salmon, as estimated by the Delta Passage Model, averaged 24.3% across all years, 20.6% in drier years and 30.5% in wetter years (Table 11-4A-74). Compared to NAA_ELT, average survival under Scenario H3 would be similar (<4% lower) across all years, although this estimate does not account for the adjustments that can be made during real-time operations to further protect migrating fish. These real-time operational adjustments would be based on biological and hydrological triggers developed by NMFS and DFW to protect migrating salmonids. However, as noted for winter-run Chinook salmon in the discussion of Impact AQUA-42, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the discussion of Impact AQUA-42 resulted in the relative difference between NAA_ELT and H3_ELT increasing: the relative difference across all years increased from 4% less compared to NAA_ELT to nearly 6% less compared to NAA_ELT (mod.)(Table 11-4A-74).

H4_ELT

Under the high outflow scenario H4_ELT, mean monthly flows below the NDD would decrease by about 4% to 18% during the emigration period, with the greatest relative reduction of 18% in February of below normal years. Under H4_ELT, flow decreases in April and May would be less than 10% compared to NAA_ELT, with small increases in mean monthly flow in some water year types (e.g., 7–15% greater than NAA_ELT in below normal years). Survival based on the DPM under Scenario H4 would be similar to NAA_ELT (<2% relative difference; Table 11-4A-74) based on operations assuming no adjustments made in real-time in response to actual presence of fish; as described above, real-time operational adjustments would be made, based on biological and hydrological triggers developed by NMFS and DFW to protect migrating salmonids. As noted in the discussion for H3_ELT, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the discussion of Impact AQUA-42 for winter-run Chinook salmon resulted in the relative difference between NAA_ELT and H4_ELT changing slightly: the relative difference across all years changed from 1.6% more compared to NAA_ELT to nearly 0.4% less compared to NAA_ELT (mod.)(Table 11-4A-74).

Overall, Alternative 4A would not have an adverse effect on Sacramento River fall-run Chinook salmon juvenile survival due to relatively low differences in survival for most operations, as well as the inclusion in Alternative 4A of bypass flow criteria, real-time management, and several conservation measures (Environmental Commitment 6, Environmental Commitment 15, Environmental Commitment 16) to offset any adverse effects, as discussed for winter-run Chinook salmon under Impact AQUA-42.

Table 11-4A-74. Through-Delta Survival (%) of Emigrating Juvenile Fall-Run Chinook Salmon under Alternative 4A (Scenarios H3_ELT and H4_ELT)

	Average Percentage Survival					Difference in Percentage Survival (Relative Difference)					
	Scenario					EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	NAA_ ELT	NAA_ ELT (mod.)	H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT (vs. NAA_ELT mod.)	H4_ELT (vs. NAA_EL T mod.)
Sacramento											
Wetter	34.5	33.0	33.3	30.5	34.4	-4.0 (-11.6%)	-0.1 (-0.2%)	-2.5 (-7.5%)	1.4 (4.3%)	-2.8 (-8.3%)	1.1 (3.4%)
Drier	20.6	20.7	21.3	20.6	20.4	0.0 (0.0%)	-0.1 (-0.7%)	-0.1 (-0.4%)	-0.2 (-1.1%)	-0.7 (-3.5%)	-0.9 (-4.0%)
All Years	25.8	25.3	25.8	24.3	25.7	-1.5 (-5.8%)	-0.1 (-0.4%)	-1.0 (-3.9%)	0.4 (1.6%)	-1.5 (-5.8%)	-0.1 (-0.4%)
Mokelumne											
Wetter	17.2	16.3	N/A	18.2	19.2	1.0 (5.6%)	2.1 (11.9%)	1.9 (11.6%)	3.0 (18.2%)	N/A	N/A
Drier	15.6	15.7	N/A	15.6	15.8	-0.1 (-0.4%)	0.2 (1.1%)	-0.2 (-1.1%)	0.1 (0.4%)	N/A	N/A
All Years	16.2	15.9	N/A	16.5	17.1	0.3 (1.9%)	0.9 (5.6%)	0.6 (3.8%)	1.2 (7.5%)		
San Joaquin											
Wetter	19.3	20.7	N/A	16.9	16.6	-2.5 (-12.7%)	-2.7 (-14.0%)	-3.8 (-18.5%)	-4.1 (-19.7%)	N/A	N/A
Drier	9.9	9.8	N/A	10.9	10.7	1.0 (9.9%)	0.8 (7.5%)	1.1 (11.1%)	0.9 (8.7%)	N/A	N/A
All Years	13.5	13.9	N/A	13.2	12.9	-0.3 (-2.2%)	-0.6 (-4.4%)	-0.7 (-5.0%)	-1.0 (-7.2%)	N/A	N/A

Note: Average Delta Passage Model results for survival to Chipps Island.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
Wetter = Wet and Above Normal Water Years (6 years).
Drier = Below Normal, Dry and Critical Water Years (10 years).
H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.
NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT.
N/A = not applicable because the Mokelumne and San Joaquin populations do not encounter the upstream end of the Yolo Bypass.

Adults

Attraction flows and olfactory cues in the west Delta for migrating adults would be altered because of shifts in exports from the south Delta to the North Delta under Alternative 4A. Sacramento River flows downstream of the north Delta diversion would be reduced, with concomitant increase in San Joaquin River flow contribution.

Results of fingerprint simulation modeling (DSM2 modeling of percentage of water at Collinsville that originated in the Sacramento River water) for Scenario H3_ELT predicted a minimal reduction in Sacramento River source water September–November (1–4% less) compared with NAA (Table 11-4A-75). Studies indicate that a 20% or less reduction in source flows that provides olfactory cues would not adversely affect adult attraction (Fretwell 1989). The reduction in olfactory cues under Scenario H3_ELT is small and is expected to be within the broad range of olfactory cues and migration conditions that currently occur within the lower reach of the Sacramento River.

Table 11-4A-75. Percentage (%) of Water at Collinsville that Originated in the Sacramento River and San Joaquin River during the Adult Fall-Run and Late Fall-Run Chinook Salmon Migration Period for Alternative 4A (Scenario H3_ELT)

	Scenario			Percentage Difference	
Month	EXISTING CONDITIONS	NAA_ ELT	H3_ELT	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Fall-Run—Sacramento River					
September	60	65	61	0	-4
October	60	64	65	5	1
November	60	64	63	3	-1
December	67	67	65	-1	-1
Fall-Run—San Joaquin River					
September	0.3	0.2	1.7	1.4	1.5
October	0.2	0.2	3.5	3.4	3.3
November	0.4	0.8	5.2	4.8	4.4
December	0.9	1.0	2.9	2.0	1.9
Late Fall-Run—Sacramento River					
December	67	67	65	-1	-1
January	76	75	73	-2	-2
February	75	74	69	-6	-4
March	78	77	69	-9	-8
	Shading indicates 10% or greater absolute difference.				
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).					

Late Fall-Run

Juveniles

Alternative 4A operations would generally reduce OMR reverse flows under all flow scenarios (Appendix B, Supplemental Modeling for Alternative 4A), with a corresponding increase in net positive downstream flows that would benefit juveniles migrating through the Delta. Reduced flows below the north Delta intakes may increase predation potential. Through-Delta survival by emigrating juvenile late fall-run Chinook salmon under Scenario H3_ELT as estimated with the DPM averaged 22% across all years, 19.4% in drier years, and 26.4% in wetter years (Table 11-4A-76). Juvenile survival under the Scenario H3_ELT was similar or slightly lower than under NAA_ELT for drier, wetter and all years averaged (around 3-4% less in relative difference) based on operations assuming no adjustments made in real-time in response to actual presence of fish (Table 11-4A-76).

The results were similar for H4_ELT, in keeping with the timing of late fall-run emigration through the Delta mostly lying outside the spring period in which H3_ELT operations would differ from H4_ELT operations. However, as noted for winter-run Chinook salmon in the discussion of Impact AQUA-42, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the discussion of Impact AQUA-42 resulted in the relative difference between NAA_ELT and H3_ELT/H4_ELT increasing: for H3_ELT, the relative difference across all years increased from 3.4% less compared to NAA_ELT to just over 5.8% less compared to NAA_ELT (mod.); whereas for H4_ELT, the relative difference across all years increased from 3.5% less compared to NAA_ELT to 6.1% less compared to NAA_ELT (mod.) (Table 11-4A-51). Overall, Alternative 4A would not have an adverse effect on late fall-run Chinook salmon juvenile survival due to similar survival between Alternative 4A and NAA_ELT during all water year types.

Table 11-4A-76. Through-Delta Survival (%) of Emigrating Juvenile Late Fall-Run Chinook Salmon under Alternative 4A (Scenarios H3_ELT and H4_ELT)

	Average Percentage Survival					Difference in Percentage Survival (Relative Difference)					
	Scenario					EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	NAA_ ELT	NAA_ ELT (mod.)	H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT (vs. NAA_ELT mod.)	H4_ELT (vs. NAA_ELT mod.)
Wetter	28.8	27.5	28.1	26.4	26.5	-2.4 (-8.2%)	-2.3 (-7.9%)	-1.1 (-4.0%)	-1.0 (-3.7%)	-1.7 (-6.1%)	-1.6 (-5.9%)
Drier	18.8	20.0	20.5	19.4	19.3	0.7 (3.5%)	0.5 (2.7%)	-0.6 (-3.0%)	-0.8 (-3.7%)	-1.1 (-5.5%)	-1.3 (-6.3%)
All Years	22.5	22.8	23.4	22.0	22.0	-0.5 (-2.2%)	-0.5 (-2.2%)	-0.8 (-3.4%)	-0.8 (-3.5%)	-1.4 (-5.8%)	-1.4 (-6.1%)

Note: Delta Passage Model results for survival to Chipps Island.

Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Wetter = Wet and Above Normal Water Years (6 years).

Drier = Below Normal, Dry and Critical Water Years (10 years).

H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.

NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT.

Adults

Flows in the Sacramento River downstream of the north Delta intake diversions would be reduced under Alternative 4A, with concomitant proportional increases in San Joaquin River flows. Under Scenario H3_ELT, the percentage of Sacramento River water at Collinsville would be similar in December, and slightly reduced (2% to 8%) in January through March compared to NAA (Table 11-4A-75). The effect on olfactory cues for migrating adults late fall-run Chinook salmon would be negligible because the change in flow proportions is less than 10% in absolute terms.

Mokelumne River

Fall-Run

Juveniles

Through-Delta survival of Mokelumne River fall-run Chinook salmon under Scenario H3_ELT averaged 16.5% across all years (Table 11-4A-74). Survival under Scenario H3_ELT was similar to NAA_ELT averaged across all years (0.6% greater, or 4% more in relative difference) and in drier years (a 1% relative difference), and there was a 2% increase in survival (nearly a 12% relative difference) in wetter years. Juvenile survival under H4_ELT (high outflow) was similar to Scenarios H3_ELT and NAA_ELT in drier years, and slightly increased (by 7.5% relative difference) when averaged across all years. In wetter years, survival increased 3% under Scenario H4_ELT (an 18% relative difference). Overall, Alternative 4A would not have an adverse effect on Mokelumne River fall-run Chinook salmon juvenile survival due to minor differences in survival for most operations, and a moderate increase in survival for the high outflow years, particularly under operations Scenario H4_ELT. Note that this analysis is conservative because increased flow into the Yolo Bypass with Fremont Weir modifications under NAA_ELT would result in less flow remaining in the Sacramento River; these Fremont Weir modifications were not accounted for in the modeling of NAA_ELT. As described in *BDCP Appendix 5.C, Section 5C.4.3.2.2 hereby incorporated by reference*, the export-dependent survival function for juvenile Chinook salmon in the interior Delta (including Mokelumne River fall-run) is a ratio of survival in the mainstem Sacramento River below Georgiana Slough, which has a positive relationship with Sacramento River flow. Thus, the estimates of through-Delta survival under NAA_ELT for Mokelumne River fall-run Chinook salmon that do not account for flow entering the Yolo Bypass because of Fremont Weir modifications would tend to slightly overestimate survival for NAA_ELT; therefore, the differences between NAA_ELT and H3_ELT/H4_ELT discussed above would be somewhat greater if the flow entering Yolo Bypass under NAA_ELT was accounted for.

San Joaquin River

Fall-Run

Juveniles

Under Alternative 4A Scenario H3_ELT operations, through-Delta survival by juvenile fall-run Chinook salmon emigrating from the San Joaquin River averaged 13% across all years, 11% in drier years, and 17% in wetter years (Table 11-4A-74). Compared to NAA_ELT, average survival across all years was lower for both operations scenarios (H3_ELT and H4_ELT). Survival is slightly increased in drier years (1% greater, a 9–11% relative difference). Survival is greatest in wetter years, but is moderately reduced relative to NAA_ELT by about 4% (19-20% relative difference for Scenarios H3_ELT and H4_ELT). As described in *BDCP Appendix 5.C, Section 5C.5.3.4.5 hereby incorporated by reference*, these results are driven by appreciably lower through-Delta survival of San Joaquin River fall-run Chinook salmon under Alternative 4A scenarios relative to NAA_ELT in very wet years (1982/1983). During these types of years, the Head of Old River operable gate would not be closed because of exceedance of the 10,000-cfs Vernalis flow criterion permitting its closure, so less fish would use the main stem San Joaquin River pathway. In addition, south Delta exports would be very low (averaging 40-50 cfs for H3_ELT in 1983, for example) because of operation of the north Delta intakes, which would result in estimated survival that is relatively low because of the DPM's positive relationship between survival and exports, based on current relationships. There is considerable uncertainty in effects on San Joaquin River Chinook salmon survival at such low levels of exports because the studies upon which the DPM flow- and export-survival relationships are based did not include these low levels of exports. SalSim, a recently completed San Joaquin River watershed Chinook salmon analysis tool that includes juvenile survival through the Delta derived in a different manner than DPM, includes a positive relationship between probability of juvenile survival and flow in the mainstem San Joaquin River at Stockton Deepwater Ship Channel; this flow term is positively related to flow at Vernalis, inversely related to south Delta exports, and positively related to Head of Old River barrier operation; the results of SalSim modeling therefore would be expected to illustrate a benefit of Alternative 4A across any modeled year, which is more in keeping with the anticipated effect of the alternative. Overall and in light of these uncertainties, Alternative 4A would not have an adverse effect on through-Delta migration because the reduction in south Delta exports generally would be expected to benefit through-Delta survival.

Adults

The percentage of water at Collinsville that originated from the San Joaquin River is very small (no more than 1% under NAA_ELT) during the fall-run migration period (September to December). The fingerprinting analysis showed a small increase in olfactory cues from the San Joaquin River passing downstream through the Delta under Scenario H3_ELT (Table 11-4A-75). Although the relative change is substantial (i.e., a severalfold increase in the percentage of flow from the San Joaquin River under Scenario H3_ELT compared to NAA_ELT), the percentage of flow attributable to San Joaquin River water under all scenarios is quite low (no more than around 5%). Scenario H4_ELT would not have as great a relative change because exports at the north Delta diversion would be lower than under Scenario H3_ELT. Overall, Alternative 4A operations conditions would incrementally increase olfactory cues associated with attraction flows in the lower San Joaquin River, but the increase would be small. However, even this seemingly small increase could provide moderate benefits: as illustrated in *BDCP Appendix 5.C, Section 5C.5.3.13.1.5 hereby incorporated by reference,* based on the study of Marston et al. (2012), greater olfactory cues under Alternative 4A could decrease severalfold the straying rate of adult San Joaquin River Chinook salmon to the Sacramento River. This would not be an adverse effect on adult fall-run Chinook salmon migrating to the San Joaquin River.

NEPA Effects: Upstream of the Delta, these modeling results indicate that the effect of Alternative 4A could be adverse because flows in the Feather and American Rivers (depending on scenario – H3_ELT or H4_ELT) would be reduced substantially and persistently and could cause biologically meaningful effects to fall-run Chinook salmon adult migration. There are no substantial upstream flow changes in other rivers evaluated and no water temperature-related effects in any river for which temperature modeling is available. However, with implementation of Mitigation Measure AQUA-78d, this impact would not be adverse.

As described for winter-run and spring-run Chinook salmon, near-field effects of Alternative 4A NDD on fall- and late fall-run Chinook salmon related to impingement and predation associated with three new intake structures could result in negative effects on juvenile migrating fall- and late fall-run Chinook salmon, although there is high uncertainty regarding the overall effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to more significant effects (~ 13% mortality above current baseline levels). Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction surveys to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically based triggers for real time operations. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of predation-related mortality expected from near-field effects at the NDD remains highly uncertain.

As noted for Alternative 4, two recent studies (Newman 2003 and Perry 2010) indicate that far-field effects associated with the new intakes could cause a reduction in smolt survival in the Sacramento River downstream of the NDD intakes due to reduced flows in this area. The analyses of other elements of Alternative 4A related to reduced interior Delta entry (Environmental Commitment 16) and reduced south Delta entrainment suggest that these could counter the far-field effects of reduced flow (see, for example, Table 5.C.5.3-46 in the *BDCP Effects Analysis Appendix 5.C hereby incorporated by reference*). The overall magnitude of each of these factors and how they might interact and/or offset each other in affecting salmonid survival through the plan area is uncertain, and the adaptive management and monitoring program will investigate these outcomes.

As described for Alternative 4 and as discussed for winter-run and spring-run Chinook salmon above, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of Alternative 4a operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 4A would be similar or slightly lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 4A on juvenile fall-/late fall-run Chinook salmon migration suggests a potential adverse effect of small magnitude. As noted for winter-run Chinook salmon, the DPM focuses on smolt-sized individuals (70 mm or more) and is not based on survival data for fry-sized individuals, which also may be migrating and could be affected by Alternative 4A operations. There are no fry through-Delta survival data to inform the effects to these individuals in relation to operations and it is uncertain whether the relative difference between scenarios estimated from the DPM for smolt-sized fish would be representative of relative differences for fry. The potential adverse effect on fall-run and late-fall run Chinook salmon would be minimized through the inclusion within Alternative 4A of specific important Environmental Commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects; *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD; and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of Chinook salmon juveniles into the low-survival interior Delta.

Overall, with implementation of Mitigation Measure AQUA-78d to address upstream flow reductions, the effects on fall-/late-fall run Chinook migration are not adverse in the ELT.

The effect of Alternative 4A in the LLT on fall-/late-fall run Chinook upstream migration conditions would be not adverse. Instream flows in the Sacramento, Feather, and American Rivers during late summer and fall months would decline from ELT to LLT such that flows would be substantially reduced under Alternative 4A relative to the NEPA baseline in the LLT, compared to the ELT comparison. Similar to ELT, implementation of Mitigation Measure AQUA-78d will reduce the magnitude of this effect.

CEQA Conclusion: With implementation of Mitigation Measure AQUA-78d, the impact of Alternative 4A on migration conditions for fall-/late fall–run Chinook salmon relative to Existing Conditions would be less than significant.

Upstream of the Delta

H3_ELT /ESO_ELT

Sacramento River

Fall-Run

Flows in the Sacramento River upstream of Red Bluff were examined for juvenile fall-run migrants during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month throughout the period.

Flows in the Sacramento River upstream of Red Bluff were examined during the adult fall-run Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during August and September would be up to 22% lower (September of dry years) and up to 32% higher (September of above normal years) than those under Existing Conditions. Mean flows would be up to 17% lower under H3_ELT during October and November, would be similar during December. The flow reductions in three of five migration months would constitute a substantial impact to fall-run Chinook salmon migration conditions.

Mean water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month throughout the period.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under H3_ELT would be similar to flows under Existing Conditions, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month throughout the period. Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under H3_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month throughout the period.

Clear Creek

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined during the juvenile fall-run Chinook salmon upstream migration period (February through May). Mean flows under H3_ELT would generally be similar to or slightly greater than those under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon upstream migration period (August through December) under H3_ELT would generally be similar to those under Existing Conditions, except for September of critical years (19% lower under H3_ELT) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperature modeling was not conducted in Clear Creek

Feather River

Fall-Run

Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run juvenile migration period (February through May) under H3_ELT would generally be similar to or lower than flows under Existing Conditions (up to 15% lower for March of below normal years) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month throughout the period.

Flows in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult migration period. Mean flows under H3_ELT during August and September would be up to 100% greater (September of wet years) and up to 43% lower (August of dry years) than flows under Existing Conditions. Mean flows under H3_ELT during October through December would be similar to or up to 21% greater (dry years) than those under Existing Conditions, except for 19% lower flow in December of critical years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3 in any month throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be up to 15% greater than flows under Existing Conditions during February and March, and similar during April, and up to 18% lower than flows under Existing Conditions during January and May, depending on water year type.

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3 in any month throughout the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during August, September, and November would be consistently lower than flows under Existing Conditions, ranging from 10% lower to 52% lower. Mean flows under H3_ELT during October and December would be up to 11% lower and up to 15% higher than flows under Existing Conditions, depending on water year type, but mean reductions across water year types would be small (-2% and 4%, respectively).

Mean water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be 5% higher than those under Existing Conditions during August of dry years and 5% to 6% higher during October, except in critical water years. There would there would be no differences (<5%) during the other three months of the period.

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would generally be lower than Existing Conditions for all water year types (up to 29% lower for February of critical years), except for wet water years, in which flows would be similar or up to 17% greater (February) than flows under Existing Conditions.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3 in any month throughout the period.

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions for all months and water year types of the period.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3 in either month or any water year type of the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions with few exceptions (up to 12% lower).

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be lower than those under Existing Conditions during August and September (up to 14%), but similar to flows under Existing Conditions during the remaining three months.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions during March through May, and would be up to 15% higher than flows under Existing Conditions during February.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 32% lower than flows under Existing Conditions during August and September, and up to 28% greater than flows under Existing Conditions during December. Flows during October and November would be largely similar between H3_ELT and Existing Conditions.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Fall-Run

Mean monthly flows and water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period. Mean flows under H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT in any month throughout the period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Flows and water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period. Mean flows during September under H4_ELT would be up to 49% greater (above normal years) and up to 18% lower (dry years) than flows under Existing Conditions, but flows during the other four months of the period would generally be similar (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would not be different (<5%) from those under Existing Conditions(Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Late Fall-Run

Mean flows and water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period. Mean flows under H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in water temperature between Existing Conditions and H4_ELT in any month or water year type. (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Mean flows and water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period. Mean flows under H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in either month of the period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Clear Creek

Fall-Run

Mean flows in the Clear Creek below Whiskeytown Reservoir during February through May under H4_ELT would generally be similar to or up to 13% greater than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Clear Creek below Whiskeytown Reservoir during August through December under H4_ELT would generally be similar to flows under Existing Conditions.

Water temperature modeling was not conducted in Clear Creek.

Feather River

Fall-Run

Flows and water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period. Mean flows under H4_ELT would generally be similar to flows under Existing Conditions during February and March, but would be up to 112% greater during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month throughout the period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Flows and water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period. Mean flows under H4_ELT during August and September would be from 51% lower (August of dry years) to 87% higher (September of wet years) than flows under Existing Conditions, and from 26% lower to 19% higher than flows under Existing Conditions during October through December (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The prevalence of reduced flows across months and water year types suggests that this would be an adverse effect to fall-run Chinook salmon migration conditions.

Mean water temperatures under H4_ELT would be no different from (<5%) those under Existing Conditions during both months and all water year types (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

American River

Fall-Run

Flows and water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period. Mean flows under H4_ELT would generally be similar to or higher than flows under Existing Conditions during February (up to 14% higher for above normal years), and similar to or lower than flows under Existing Conditions during March through May (up to 20% lower for May of above normal years) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month throughout the period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Flows and water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period. Mean flows under H4_ELT during August, September, and November would be lower than those under Existing Conditions for almost all water year types, ranging from 7% lower in November of above normal years to 47% lower in September of critical years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows during October and December would generally be similar to or greater than those under Existing Conditions. Mean water temperatures under H4_ELT would be 5% to 6% higher during October than those under Existing Conditions and would be similar during the remainder of the migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Stanislaus River

Fall-Run

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT throughout this period would generally be lower than Existing Conditions (up to 29% lower for February of critical years), except in wet years, in which flows would be similar or up to 17% greater (February) than flows under Existing Conditions.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month throughout the period.

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions throughout the migration period.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in either month of the period.

San Joaquin River

Fall-Run

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions for all months with some exceptions (up to 12% lower).

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would be over than those under Existing Conditions during August and September (up to 14%), but similar to flows under Existing Conditions during the remaining three months. Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Fall-Run

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to or up to 15% higher than those under Existing Conditions during February, generally similar during March and April, and up to 11% lower than flows under Existing Conditions during May.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 32% lower than flows under Existing Conditions during August and September, and up to 28% greater than flows under Existing Conditions during December. Flows during October and November would be largely similar between H4_ELT and Existing Conditions.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Fall-Run

Juveniles

As described above, Scenario H3_ELT operations would reduce overall OMR reverse flows and reduce Sacramento River flows below the north Delta diversions (Appendix B, Supplemental Modeling for Alternative 4A). Based on the DPM, survival of Sacramento River fall-run Chinook salmon juveniles under Scenario H3_ELT averaged for all years was less than Existing Conditions, was similar in drier years, and was moderately reduced by about 4% (a 12% relative difference) in wetter years (Table 11-4A-74). Under Scenario H4_ELT average survival was similar (~1% or less relative decrease) to Existing Conditions for all years, drier years, and wetter years. These results do not account for adjustments that would be made during real-time operations to further protect migrating fish, based on biological and hydrological triggers developed by NMFS and DFW.

Adults

The percentage of Sacramento River origin flow at Collinsville, would be slightly increased (5% or less in September to December) under Scenario H3_ELT compared to Existing Conditions (Table 11-4A-75). This would not significantly affect olfactory cues for adults migrating to the Sacramento River because the change is less than 10%.

Late Fall-Run

Juveniles

As described above, Alternative 4A operations would reduce OMR reverse flows and reduce Sacramento River flows below the north Delta diversions (Appendix B, Supplemental Modeling for Alternative 4A). Conditions under Scenario H4_ELT would further improve OMR flow conditions relative to the Scenario H3_ELT. As estimated by DPM, through-Delta survival by emigrating juvenile late fall-run Chinook salmon under Scenario H3_ELT averaged across all years was similar (around 2% relative difference) to Existing Conditions (Table 11-4A-76). Survival was marginally greater in drier years (0.7% increase, a 3.5% relative difference) but reduced in wetter years (2.4%, an 8% relative difference). The results for H4_ELT were very similar to those for H3_ELT because the late fall-run migration period lies outside the spring period when H4_ELT and H3_ELT operations differ (higher outflow under H4_ELT). As noted for fall-run Chinook salmon from the Sacramento River (described above), the DPM results do not account for adjustments that would be made during real-time operations to further protect migrating fish, based on biological and hydrological triggers developed by NMFS and DFW.

Adults

As described above, the percentage of Sacramento River water would be slightly reduced in December and March (1% to 9% less) compared to NAA_ELT (Table 11-4A-75). This effect would be less in March under Scenario H4_ELT compared to Scenario H3_ELT due to reduced north Delta exports. Olfactory cues would be slightly decreased, but the impact would be minor because flow changes are than 10% for the bulk of the late fall-run migration.

Mokelumne River

Fall-Run

Average through-Delta survival of emigrating juveniles estimated by DPM under Scenario H3_ELT was similar to Existing Conditions for all years and drier years (less than 2% relative difference), whereas average survival in wetter years was slightly greater than Existing Conditions (1% absolute difference in survival, 5.6% relative difference) (Table 11-4A-74). Average through-Delta survival under Scenario H4_ELT was similar to Existing Conditions in drier years, but was slightly greater than Existing Conditions when averaged over all years (5.6% relative difference) and was moderately greater than Existing Conditions in wetter years (nearly 12% relative difference). This reflected the inclusion of higher outflow in wetter years under H4_ELT compared to H3_ELT.

San Joaquin River

Fall-Run

Juveniles

Under Alternative 4A (operation Scenarios H3_ELT and H4_ELT), mean survival of juveniles migrating from the San Joaquin River averaged around 13% (Table 11-4A-74). Alternative 4A survival under both was similar (less than 5% relative difference) to Existing Conditions when averaged over all years. Survival was slightly greater than Existing Conditions in drier years (0.8–1% greater survival, or 7.5–10% more in relative difference) and moderately reduced in wetter years (2.5–2.7% decrease, or 13-14% less in relative difference). As described for the NEPA analysis above and described further in *BDCP Appendix 5.C, Section 5C.5.3.4.5 hereby incorporated by reference*, these results are driven by appreciably lower through-Delta survival of San Joaquin River fall-run Chinook salmon under Alternative 4A scenarios relative to Existing Conditions in very wet years (1982/1983) during which the Head of Old River operable gate would not be closed and south Delta exports would be very low, resulting in estimated survival that is relatively low because of the DPM's positive relationship between survival and exports. There is considerable uncertainty in effects on San Joaquin River Chinook salmon survival at such low levels of exports because the studies upon which the DPM flow- and export-survival relationships are based did not include these low levels of exports. As noted in the NEPA analysis above, SalSim, a recently completed San Joaquin River watershed Chinook salmon analysis tool that includes juvenile survival through the Delta derived in a different manner than DPM, includes a positive relationship between probability of juvenile survival and flow in the mainstem San Joaquin River at Stockton Deepwater Ship Channel; this flow term is positively related to flow at Vernalis, inversely related to south Delta exports, and positively related to Head of Old River barrier operation; the results of SalSim modeling therefore would be expected to illustrate a benefit of Alternative 4A across any modeled year, which is more in keeping with the anticipated effect of the alternative.

Adults

As described above, the percentage of San Joaquin River water at Collinsville is very small (less than 1% under Existing Conditions) during the fall-run migration period (September to December). Under Scenario H3_ELT operations, this would increase by 1.4–4.8% in September-December (Table 11-4A-75). Olfactory cues for adults migrating to the San Joaquin River would be slightly increased under all flow scenarios for Alternative 4A.

Summary of CEQA Conclusion

These modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce migration conditions for fall-/late fall-run Chinook salmon upstream of the Delta. Under Alternative 4A, instream flows would be lower in multiple upstream rivers during the fall-run Chinook salmon migration period relative to Existing Conditions, depending on scenario (H3_ELT or H4_ELT). Degraded migration habitat conditions would delay or eliminate successful migration necessary to complete the fall-run Chinook salmon life cycle. However, the impact of Alternative 4A across the operational range (Scenarios H3_ELT and H4_ELT) on through-Delta migration conditions would be small due to generally similar juvenile survival and a minor effect on olfactory cues for adults.

This interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

This impact would still be considered significant in the ELT due to changes in upstream flows. However, when informed by the NEPA analysis above, and with the implementation of Mitigation Measure AQUA-78d, this impact would be less than significant to fall-/late fall-run Chinook salmon.

As noted for winter-run and spring-run Chinook salmon and described in the adaptive management and monitoring program in Section 4.1, several pre-construction studies to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically based triggers for real time operations. Also, with the inclusion of *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers*, the impacts would be minimized.

Given that Mitigation Measure AQUA-78d reduces this impact to less than significant for fall-run Chinook, the impact on the fall-run Chinook salmon commercial fishery also would be less than significant in the ELT.

Mitigation Measure AQUA-78d: Slightly adjust the timing and magnitude of Shasta, Folsom, and/or Oroville Reservoir releases, within all existing regulations and requirements, to ameliorate changes in instream flows that would cause an adverse effect to fall-run Chinook salmon.

Whenever possible during real-time operations, project proponents will slightly adjust Shasta, Folsom and/or Oroville Reservoir operations to ensure that instream flows are sufficient to minimize or avoid migration-related effects to fall-run Chinook salmon. Based on the timing of the modeled flow fluctuations, it is expected that adjustments to minimize drastic changes in releases during operations among various months in which there are increases and decreases in flow, will minimize or avoid substantial reductions in flow without effects on existing applicable regulations or operations.

Fall-/late fall-run Chinook salmon migration conditions in the Sacramento, Feather, and American rivers, would substantially decline from ELT to LLT. However, when informed by the NEPA analysis above, implementation of Mitigation Measure AQUA-78d will reduce the magnitude of this effect to less than adverse. The commercial fishery effect of Alternative 4 in the LLT would be less than significant in the LLT.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for winter-run Chinook salmon, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. The general discussion of impacts to winter-run Chinook salmon (Impacts AQUA-43, AQUA-44, and AQUA-45) also applies to fall-/late fall-run Chinook salmon, which would have the potential to overlap the effects of restoration measures both temporally and spatially.

Impact AQUA-79: Effects of Construction of Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-43) is also applicable to fall-run/late fall-run Chinook salmon.

NEPA Effects: For the reasons described under Impact AQUA-43, the effects of short-term construction activities would not be adverse to fall-run/late fall-run Chinook salmon.

CEQA Conclusion: As discussed for winter-run Chinook salmon, the potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce fall-run/late fall-run Chinook salmon habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-80: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-44) is also applicable to fall-run/late fall-run Chinook salmon.

NEPA Effects: As noted for winter-run Chinook salmon, the effect of restoration measures on chemical contaminants is not adverse to fall-run/late fall-run with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of Environmental Commitment 12).

CEQA Conclusion: As noted for winter-run Chinook salmon, the impact of contaminants is considered less than significant because it would not substantially affect fall-run/late fall-run Chinook salmon either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-81: Effects of Restored Habitat Conditions on Chinook Salmon (Fall-/Late Fall–Run ESU)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-45) is also applicable to fall-run/late fall-run Chinook salmon.

NEPA Effects: The effects of restored habitat conditions on fall-run/late fall-run Chinook salmon would not be adverse because effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*.

CEQA Conclusion: As described for winter-run Chinook salmon, habitat restoration activities could result in short-term effects on fall-run/late fall-run Chinook salmon, primarily as a result of increased potential for contaminated sediments to enter the water column. However, these effects are likely to be localized, sporadic, and of low magnitude. Adverse effects during restoration would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*. The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce fall-run/late fall-run Chinook salmon habitat, restrict its range or interfere with its movement. Additionally, there would be substantial long-term net benefits of habitat restoration. Consequently, no additional mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for winter-run Chinook salmon, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms remains the same. The general discussion of impacts to winter-run Chinook salmon (Impacts AQUA-46, AQUA-49, and AQUA-50) also applies to fall-run/late fall-run Chinook salmon.

Impact AQUA-82: Effects of Methylmercury Management on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 12)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to fall-run/late fall-run Chinook salmon.

NEPA Effects: The effects of methylmercury management on fall-run/late fall-run Chinook salmon would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of Environmental Commitment 12 Methylmercury Management within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant. Consequently, no mitigation is required.

Impact AQUA-85: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 15)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-49) is also applicable to fall-run/late fall-run Chinook salmon.

NEPA Effects: Environmental Commitment 15 would not have an adverse effect on Chinook salmon and could potentially benefit the species. As noted for winter-run Chinook salmon, due to the uncertainty in the effectiveness of Environmental Commitment 15, there would be no demonstrable effect of this conservation measure on fall-run/late fall-run Chinook salmon.

CEQA Conclusion: Due to the uncertainties associated with this Environmental Commitment, there would be no demonstrable effect on fall-run/late fall-run Chinook salmon. Thus, the impact would be less than significant. Consequently, no mitigation would be required.

Impact AQUA-86: Effects of Nonphysical Fish Barriers on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 16)

As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-50) is also applicable to fall-/late fall–run Chinook salmon. In addition, fall-run Chinook salmon from the San Joaquin River watershed would be unlikely to encounter the nonphysical barrier at the divergence of Georgiana Slough from the Sacramento River.

NEPA Effects: The effects of NPBs would not be adverse, because it is expected to improve Chinook salmon migration conditions.

CEQA Conclusion: As concluded for winter-run Chinook salmon, the impacts of *Environmental Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant because it is expected to improve Chinook salmon migration conditions. Consequently, no mitigation would be required.

Steelhead

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to steelhead. Adult and juvenile steelhead would have the potential to overlap construction and maintenance to a minor degree (Table 11-8).

Impact AQUA-91: Effects of Construction of Water Conveyance Facilities on Steelhead

The potential effects of construction of the water conveyance facilities on steelhead would be the same as described for Alternative 4 (Impact AQUA-91). This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-91 in Alternative 4.

Table 11-8 presents the life stages of CCV steelhead and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction period (June 1–October 31). Steelhead eggs and fry would not be exposed to underwater noise from pile driving activities because the proposed construction activities are located in areas that are downstream from the principal spawning and early rearing areas.

Under Alternative 4A, adult steelhead could be exposed to pile driving sound during their migrations past the construction sites of the proposed intakes, barge unloading facilities, and Head of Old River. Based on historical migration timing, migrating adults may be present in the Delta and lower Sacramento and San Joaquin Rivers during their upstream migration from August through November and during their downstream migration as kelts (post-spawn adults) from February through May (Hallock 1961, Busby et al. 1996). Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows, with peaks in abundance in the spring (March through June) and fall (October through November) (McEwan 2001, Nobriga and Cadrett 2001).

Similar to Chinook salmon, the risk of injury or mortality of adult steelhead from pile driving noise is low because of their large size, high mobility, and rapid migration rates through the Delta and lower rivers. The risk of exposure to harmful levels of underwater noise and/or delays in migration is further reduced by the intermittent nature of pile driving activities, the daily cessation of pile driving at night, and the implementation of vibratory driving or other no-impact pile driving methods whenever feasible. Based on the general timing of steelhead outmigration through the Delta, exposure of juvenile steelhead to pile driving noise will be substantially minimized by the restriction of in-water pile driving period to June 1 through October 31. Most steelhead potentially encountering pile driving noise are large, yearling and older smolts (> 10 grams) that are expected to migrate rapidly through the Delta based on recent telemetry studies using tagged hatchery juveniles (DeLaney et al. 2014). As discussed for Chinook salmon, the restriction of pile driving to daylight hours would also reduce the exposure of juvenile steelhead to pile driving noise because of the general tendency for salmonids to migrate at night. However, pile driving noise could have indirect effects on survival by disrupting feeding, resting, and sheltering behavior of individuals that are within the range of noise levels associated with behavioral effects.

Based on the foregoing analysis, the potential exists for some injury and mortality of juvenile steelhead from pile driving noise but only a small proportion of the population is at risk based on the low degree of overlap of pile driving activities with outmigration timing, and the relatively large size and mobility of juveniles that may encounter pile driving noise (migrating smolts). Implementation of Mitigation Measures AQUA-1a and AQUA-1b will further reduce this risk.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-91, the effect would not be adverse for steelhead. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity, would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by steelhead. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin habitat. The direct effects of underwater construction noise on steelhead that may be present could be adverse if steelhead are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-91, the impact of the construction of water conveyance facilities on steelhead would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect steelhead. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-92: Effects of Maintenance of Water Conveyance Facilities on Steelhead

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect steelhead. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on steelhead from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-92. As concluded in Impact AQUA-92, the impact would not be adverse for steelhead.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-92, the impact of the maintenance of water conveyance facilities on steelhead would be less than significant and no mitigation is required. Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect steelhead. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on steelhead from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.

Operations of Water Conveyance Facilities

Impact AQUA-93: Effects of Water Operations on Entrainment of Steelhead

Water Exports from SWP/CVP South Delta Facilities

Under Alternative 4A, entrainment loss at the south Delta export facilities, as estimated by the salvage density method, would be reduced by about 52% (~4,800 fish; Table 11-4A-77) across all years compared to NAA_ELT. Losses under Scenario H3_ELT would be greatest in below normal (~7,300 fish) and lowest in wet water years (~2,100 fish). Conditions under Scenario H4_ELT would further reduce entrainment loss at the south Delta facilities due to decreased exports.

Table 11-4A-77. Juvenile Steelhead Annual Entrainment Index at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-4,143 (-66%)	-4,443 (-68%)
Above Normal	-7,358 (-57%)	-7,752 (-58%)
Below Normal	-4,529 (-38%)	-4,674 (-39%)
Dry	-1,750 (-23%)	-1,517 (-21%)
Critical	-1,007 (-17%)	-917 (-16%)
All Years	-4,620 (-51%)	-4,810 (-52%)
	Shading indicates 10% or greater increased entrainment.	

Note: Estimated annual number of fish lost, based on non-normalized data.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Water Exports from SWP/CVP North Delta Intake Facilities

The impact would be similar in type to Alternative 1A, Impact AQUA-93, but the degree would be less because Alternative 4A would have fewer intakes, therefore, under Alternative 4A there would be about a 40% reduction in impingement and predation risk relative to Alternative 1A.

Predation Associated with Entrainment

Entrainment-related predation loss at the south Delta facilities would be no greater and may be lower than baseline (NAA_ELT), due to a reduction in entrainment. Conditions under Scenario H4_ELT would further reduce entrainment-related predation loss compared to Scenario H3_ELT.

Predation at the north Delta would be increased due to the construction of the proposed SWP/CVP water export facilities on the Sacramento River. It is assumed that per capita steelhead predation losses would be similar to those predicted for spring-run Chinook salmon, although slightly reduced because of the larger size of steelhead outmigrants. Bioenergetics modeling with a median predator density of 0.12 predators per foot (0.39 predators per meter) of intake predicts a predation loss of about 0.2% of the juvenile spring-run juvenile population (Table 11-4A-30).

NEPA Effects: In conclusion, operations under Alternative 4A under both flow scenarios (H3_ELT and H4_ELT) would reduce entrainment at the south Delta facilities and minimize or avoid entrainment with screens at the north Delta intakes. Predation loss at the south Delta would be reduced and predation at the north Delta intakes would likely have a very minor impact on the overall steelhead population. The overall effect under Alternative 4A would not be adverse.

CEQA Conclusion: As described above, entrainment losses of juvenile steelhead would decrease under Alternative 4A (H3_ELT) compared to Existing Conditions at the south Delta export facilities (Table 11-4A-77). The screened intakes of the north Delta diversion, as designed, would exclude juvenile salmonids. The impact of predation associated with entrainment would be the same as described above as predation loss at the south Delta (no greater and possibly lower compared with Existing Conditions), but increased slightly at the north Delta intakes. There may be a minor increase in predation loss under Alternative 4A associated with the north Delta intakes, but this is uncertain and the population-level effect would likely be small. Entrainment loss under Scenario H4_ELT is expected to be less compared to Scenario H3_ELT. Overall, the impact would be less than significant and no mitigation is required.

Impact AQUA-94: Effects of Water Operations on Spawning and Egg Incubation Habitat for Steelhead

In general, Alternative 4A would have negligible effects on spawning and egg incubation habitat for steelhead relative to the NAA_ELT.

H3_ELT/ESO_ELT

Sacramento River

The primary steelhead spawning and egg incubation period extends from January through April. Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (Keswick Dam to upstream of RBDD) were summarized by month and water-year type based on estimated flows at Keswick and upstream of RBDD (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality. Mean flows under H3_ELT would generally be similar to those under NAA_ELT,. Overall results indicate negligible project-related effects on flow.

SacEFT predicts that there would be no effects between NAA_ELT and H3_ELT in spawning metrics including percentage of years with good spawning availability, measured as weighted usable area, redd scour risk, percentage of years with good (lower) egg incubation conditions, and redd dewatering risk (Table 11-4A-78). Results indicate negligible project-related effects on steelhead habitat metrics related to spawning and egg incubation in the Sacramento River.

Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location. Based on negligible effects on mean flow, SacEFT metrics related to spawning and egg incubation, and water temperature conditions compared to NAA_ELT, project-related effects of H3_ELT on flow would not affect steelhead spawning conditions in the Sacramento River.

Table 11-4A-78. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Steelhead Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Spawning WUA	0 (0%)	0 (0%)
Redd Scour Risk	-3 (-4%)	0 (0%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-1 (-2%)	0 (0%)
Juvenile Rearing WUA	1 (2%)	-3 (-7%)
Juvenile Stranding Risk	-9 (-26%)	-4 (-14%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
WUA = Weighted Usable Area.

Clear Creek

The primary spawning and egg incubation period for Clear Creek is January through April. Results of the CALSIM analyses of instream flows for the Clear Creek were summarized by month and water-year type for January through April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Mean flows in Clear Creek during January through April under H3_ELT would be similar to those under NAA_ELT. Therefore, H3_ELT would have negligible effects on mean flows in Clear Creek for the primary steelhead spawning and egg incubation period of January to April.

Redd dewatering risk was evaluated for Clear Creek based on flow reductions for each month during the incubation period (January through April); results are summarized in Table 11-4A-79. The greatest monthly reduction in flows under H3_ELT would be no different than that under NAA_ELT.

No water temperature modeling was conducted in Clear Creek.

Based on mean monthly flows and flow reductions, there would be no effects of H3_ELT on steelhead spawning and egg incubation habitat conditions.

Table 11-4A-79. Comparisons of Greatest Monthly Reduction (Percent Change) in Instream Flow under Model Scenarios in Clear Creek during the January–April Steelhead Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-25 (-38%)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Steelhead spawning and egg incubation on the Feather River occurs primarily in Hatchery Ditch and the low-flow channel in the general vicinity of the Feather River Hatchery. Effects of H3_ELT on flow during the spawning and egg incubation period (January through April) in the Feather River were evaluated using the results of CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (low-flow channel) based on estimated flows above Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Although recent surveys have found that very few steelhead (0 to 28%) spawn in the high-flow channel, (J. Kindopp pers. comm.), flows were also evaluated in the high-flow channel based on information in the Feather River at Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Mean flows in the Feather River high-flow channel during January through April under H3_ELT would generally be similar to flows under NAA_ELT, except for occasional increases (up to 30% higher) and decreases (up to 17% lower) that, due to their low magnitude and frequency, would not amount to a biologically meaningful effect to steelhead.

Instream flows affect physical habitat quality and availability through changes in wetted channel width, water depth, and water velocities. Results of IFIM studies (WUA versus flow relationships) provide information on the spawning habitat conditions in the low-flow channel. Results of CALSIM modeling show that instream flows in the Feather River low-flow channel were the same for NAA_ELT and H3_ELT regardless of month and water year type and range from 700 to 800 cfs under all conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, H3_ELT is not expected to affect physical habitat conditions for steelhead spawning and egg incubation within the Feather River low-flow channel.

Water temperatures in the low-flow channel of the Feather River are determined largely by cold water pool storage in Oroville Reservoir and instream flow releases. Because instream flows in the low-flow channel would be the same under H3_ELT and NAA_ELT, any simulated changes in water temperatures under H3_ELT would be attributed to changes in reservoir storage. Reservoir storage in May and September provides an indicator of cold water pool availability. Mean May Oroville storage volume under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-45). September Oroville storage volume under H3_ELT would be similar to volume in wet, above normal, and below normal water years and 12% to 15% greater than volume under NAA_ELT during dry and critical water years (Table 11-4A-39).

Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for steelhead in the Feather River were analyzed by comparing the percent of months between January through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-80). Differences in the percent of months exceeding the threshold between NAA_ELT and H3_ELT would be negligible (<5% on an absolute scale).

Table 11-4A-80. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, January through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	1 (NA)	1 (NA)	1 (NA)	0 (NA)
April	12 (143%)	5 (100%)	4 (NA)	1 (NA)	0 (NA)
NAA_ELT vs. H3_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	1 (NA)	1 (NA)	0 (NA)
April	1 (6%)	-1 (-11%)	0 (0%)	0 (0%)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for steelhead in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the January through April steelhead spawning period for all 82 years (Table 11-4A-81). There would be no difference (<5% on an absolute scale) in total degree-months exceeded between NAA_ELT and H3_ELT for any month or water year type.

Table 11-4A-81. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, January through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	3 (300%)	2 (100%)
	All	3 (300%)	2 (100%)
April	Wet	0 (NA)	0 (NA)
	Above Normal	2 (100%)	1 (33%)
	Below Normal	3 (75%)	0 (0%)
	Dry	6 (120%)	-1 (-8%)
	Critical	7 (NA)	0 (0%)
	All	18 (164%)	0 (0%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

Overall for the Feather River, these similarity of flows and water temperature results indicate that H3_ELT would not affect flow and water temperatures conditions for steelhead spawning in the Feather River.

American River

The primary steelhead spawning and egg incubation period for the American River extends from January through April. Results of the CALSIM analyses of instream flows within the lower American River at the confluence with the Sacramento River were summarized by month and water-year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation and rapid reductions in flow can dewater redds leading to mortality. Mean flows under H3_ELT would be similar to flows under NAA_ELT during all months and water year types, with few exceptions.

Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-64). Steelhead spawn and eggs incubate in the American River between January and April. During this period, the percent of months exceeding the threshold under H3_ELT would similar to (absolute difference) the percent under NAA_ELT.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-65). During the January through April steelhead spawning and egg incubation period, total degree-months would be similar between NAA_ELT and H3_ELT.

Based on mean monthly flows and water temperature effects, effects under H3_ELT in the American River would consist primarily of negligible effects (<5%) on mean monthly flows and water temperatures and would not have biologically meaningful effects on steelhead spawning and egg incubation conditions in the American River.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would be nearly identical to flows under NAA_ELT.

Water temperatures throughout the Stanislaus River would be the same under NAA_ELT and H3_ELT throughout the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT throughout this period would be the same as flows under NAA_ELT.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT/HOS_ELT

Sacramento River

Flows in the Sacramento River at Keswick and upstream of Red Bluff during January through April under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location. Based on negligible effects on mean flow and water temperature conditions compared to NAA_ELT, project-related effects of H4_ELT on flow would not affect steelhead spawning conditions in the Sacramento River.

Clear Creek

Mean flows in the Clear Creek during January through April under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted in Clear Creek.

Feather River

Flows in the Feather River above Thermalito Afterbay (low-flow channel) during January through April under H4_ELT would be the same as flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) during January through April under H4_ELT would generally be similar to or up to 548% greater than flows under NAA_ELT, with mean flow in April for all water year types combined 87% greater under H4_ELT.

Mean September Oroville storage under H4_ELT would be similar to storage under NAA_ELT in wet, above normal, and below normal water years, and would be 28% and 44% greater for dry and critical years, respectively (Table 11-4A-39). May Oroville storage would be 11% to 16 lower under H4_ELT than under NAA_ELT in wet, above normal, and below normal water years, would be 24% greater in critical years, and would be similar in dry years (Table 11-4A-45).

Differences in the percent of months exceeding the 56°F threshold in the Feather River at Gridley between NAA_ELT and H4_ELT would generally be negligible (<5% on an absolute scale) during January through March (Table 11-4A-69). The percent of months exceeding the threshold under H4_ELT during April would be up to 20% lower (absolute difference) than the percent under NAA_ELT. This represents a small benefit of H4_ELT to steelhead spawning habitat conditions in the Feather River.

Differences in the percent of months exceeding the 56°F threshold in the Feather River above Thermalito Afterbay between NAA_ELT and H4_ELT would be negligible during January through March (Table 11-4A-82). During April, the percent of months exceeding the threshold under H4_ELT would be similar to or up to 6% lower (absolute difference) than the percent under NAA_ELT. This represents a small benefit of H4_ELT to steelhead spawning habitat conditions in the Feather River.

Table 11-4A-82. Differences between Baselines and H4_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, January through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
April	7 (86%)	0 (0%)	1 (NA)	1 (NA)	0 (NA)
NAA_ELT vs. H4_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	0 (NA)	0 (NA)	0 (NA)
April	-4 (-19%)	-6 (-56%)	-2 (-67%)	0 (0%)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Total degree-months (all water year types combined) above the 56°F threshold in the Feather River at Gridley under H4_ELT would be the same as those under NAA_ELT during January and February (Table 11-4A-70). During March and April, degree-months under H4_ELT would be 4% and 41% lower, respectively. The reductions in degree-months during March under H4_ELT would be too small and infrequent to have a biologically meaningful effect on steelhead spawning habitat conditions in the Feather River, although the reductions during April would represent a moderate benefit to steelhead. Total degree-months above the 56°F threshold in the Feather River above Thermalito Afterbay under H4_ELT would be similar to those under NAA_ELT during January through April (Table 11-4A-83).

Table 11-4A-83. Differences between Baselines and H4_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River at above Thermalito Afterbay, January through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	2 (200%)	1 (50%)
	All	2 (200%)	1 (50%)
April	Wet	0 (NA)	0 (NA)
	Above Normal	1 (50%)	0 (0%)
	Below Normal	0 (0%)	-3 (-43%)
	Dry	7 (140%)	0 (0%)
	Critical	8 (NA)	1 (14%)
	All	15 (136%)	-3 (-10%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

American River

Mean flows in the American River at the confluence with the Sacramento River during January through April under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period. The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-71). Steelhead spawn and eggs incubate in the American River between January and April. During January through April period, the percent of months exceeding the threshold under H4_ELT would be similar to or up to 9% lower (absolute difference) than the percent under NAA_ELT.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-72). During the January through April steelhead spawning and egg incubation period, total degree-months would be similar between NAA_ELT and H4_ELT.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT throughout this period would be about the same as those under NAA_ELT.

Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H4_ELT throughout the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT throughout this period would be identical to flows under NAA_ELT.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effects of Alternative 4A on flow would not be adverse because they would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg development. There would be negligible effects on Alternative 4A on mean monthly flows, water temperatures, and reservoir storage in all rivers analyzed. Further, the SacEFT model predicts that there would be no effects to spawning and egg incubation habitat in the Sacramento River.

CEQA Conclusion: In general, Alternative 4A would degrade the quantity and quality of spawning and egg incubation habitat for steelhead relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for steelhead relative to the CEQA conclusion.

H3_ELT /ESO_ELT

Sacramento River

The primary steelhead spawning and egg incubation period extends from January through April. Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (Keswick Dam to upstream of RBDD) were summarized by month and water-year type based on estimated flows at RBDD (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality. Mean flows under H3_ELT would generally be similar to those under Existing Conditions, except for February, in which flows would be up to 14% higher, depending on the water year type.

SacEFT predicts little or no change in spawning habitat, egg incubation, redd dewatering risk, and redd scour risk for H3_ELT compared to Existing Conditions (Table 11-4A-78).

Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period at either location. Based on negligible effects on mean flow, SacEFT metrics related to spawning and egg incubation, and water temperature conditions compared to Existing Conditions, project-related effects of H3_ELT on flow would not affect steelhead spawning conditions in the Sacramento River.

Clear Creek

The primary spawning and egg incubation period for Clear Creek is January through April. Results of the CALSIM analyses of instream flows for the Clear Creek were summarized by month and water-year type for January through April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Mean flows under H3_ELT would be similar to or greater than flows under Existing Conditions for all months, including 40% greater flow for January of wet years and 10% greater flow for all four months in critical water years. Increases in flow would have a beneficial effect on spawning conditions.

Redd dewatering risk was evaluated for Clear Creek based on flow reductions for each month during the incubation period (January through April); results are summarized in Table 11-4A-79. The greatest monthly reduction in flows under H3_ELT would be similar to that under Existing Conditions, except for a 25% increase (absolute difference) in the greatest monthly flow reduction in wet years under H3_ELT.

No water temperature modeling was conducted in Clear Creek.

Based on mean flows and increased maximum flow reductions only in wet years, there would be no effects of H3_ELT on steelhead spawning and egg incubation habitat conditions.

Feather River

Effects of H3_ELT on flow during the spawning and egg incubation period (January through April) in the Feather River were evaluated using the results of CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (low-flow channel) based on estimated flows above Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the high-flow channel were characterized based on information in the Feather River at Thermalito Afterbay (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Results of CALSIM modeling show that instream flows in the Feather River low-flow channel were the same for Existing Conditions and H3_ELT regardless of month and water year type and range from 700 to 800 cfs under all conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Therefore, H3_ELT is not expected to affect physical habitat conditions for steelhead spawning and egg incubation within the Feather River low-flow channel.

Mean flows in the Feather River high-flow channel during under H3_ELT would generally be similar to or up to 48% lower than flows under Existing Conditions in January through March, with minor exceptions, and would be similar to or up to 29% greater in April. The reductions in flow would adversely affect spawning and egg incubation habitat.

Mean May Oroville storage volume under H3_ELT would generally be similar to storage under Existing Conditions in wet and above normal water year types and 5% to 12% lower in below normal, dry, and critical water year types (Table 11-4A-42). Mean September Oroville storage volume under H3_ELT would be 5% to 29% lower than volume under Existing Conditions in wet, above normal, below normal, and dry water years and would be similar in critical water years (Table 11-4A-33).

Mean water temperatures in the Feather River low-flow channel (above Thermalito Afterbay) and high-flow channel (below Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, there would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions for all months and water year types throughout the period.

Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for steelhead in the Feather River were analyzed by comparing the percent of months between January through April over the 82-year CALSIM modeling period that exceed a 56°F temperature threshold in the low-flow channel (above Thermalito Afterbay) (Table 11-4A-80). Differences in the percent of months exceeding the threshold between Existing Conditions and H3_ELT would be negligible (<5% on an absolute scale), except for a 12% increase (absolute difference) for the >1.0°F above the threshold in April.

The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for steelhead in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold in the low-flow channel (above Thermalito Afterbay) during the January through April steelhead spawning period for all 82 years (Table 11-4A-81). There would be no difference (<5% on an absolute scale) for January through March in total degree-months exceeded between Existing Conditions and H3_ELT for any water year type, and an 18 degree-month increase (164% higher on a relative scale) in April for all water year types combined.

Overall, the effects of H3_ELT on flows in the Feather River below Thermalito Afterbay would include substantial decreases in mean flow during some months and water year types. There would be minor increases in the exceedance of water temperature thresholds in the low-flow channel during April, coupled with reductions in coldwater pool availability in the Oroville Reservoir, especially in September.

American River

The primary steelhead spawning and egg incubation period for the American River extends from January through April. Results of the CALSIM analyses of instream flows within the lower American River at the confluence with the Sacramento River were summarized by month and water-year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation and rapid reductions in flow can dewater redds leading to mortality. Combining water year types, mean flows under H3_ELT would be higher than those under Existing Conditions during January and February and would be similar during March and April.

Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-64). Steelhead spawn and eggs incubate in the American River between January and April. During January and February, the percent of month exceeding the threshold under Existing Conditions and H3 would be similar. During March and April, the percent of months exceeding the threshold under H3 would be up to 17% greater (absolute difference) than the percent under Existing Conditions.

Total degree-months (all water year types combined) exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-65). During January and February, there would be no difference in total degree-months above the threshold between Existing Conditions and H3_ELT. During March and April, total degree-months under H3_ELT would be 16 and 80 degree-months greater, respectively, than under Existing Conditions.

The effect of H3_ELT on mean flow and water temperature in the American River would be negligible although increased exceedances of the 56°F temperature threshold indicate a negative effect to steelhead spawning and egg incubation conditions.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would generally be similar to or up to 29% lower than flows under Existing Conditions.

Water temperatures throughout the Stanislaus River would be the same under Existing Conditions and H3_ELT throughout the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would be similar to flows under Existing Conditions, with minor exceptions.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT/HOS_ELT

Sacramento River

Mean flows in the Sacramento River at Keswick and upstream of Red Bluff during January through April under H4_ELT would generally be similar to flows under Existing Conditions, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period at either location.

Clear Creek

Mean flows in the Clear Creek during January through April under H4_ELT would generally be similar to or up to 40% greater than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted in Clear Creek.

Feather River

Flows in the Feather River above Thermalito Afterbay (low-flow channel) during January through April under H4_ELT would be identical to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) under H4_ELT would be up to 36% lower than flows under Existing Conditions during January and February, similar during March, and up to 509% greater during April.

May Oroville storage under H4_ELT would be up to 19% lower than storage under Existing Conditions in all water year types except critical water years, in which storage would be 15% greater under H4_ELT (Table 11-4A-45). September Oroville storage under H4_ELT would be about 24% lower than storage under Existing Conditions in wet, above normal, and below normal water years, similar in dry years, and 32% higher in critical years (Table 11-4A-39).

Mean water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions for all months and water year types at either location throughout the period.

Differences in the percent of months exceeding the 56°F threshold between Existing Conditions and H4_ELT would generally be negligible (<5% on an absolute scale) during January through April, except for the >1.0 degree category for April, in which the percent of months exceeding the threshold would be 7% higher (absolute difference) (Table 11-4A-82).

Total degree-months (all water years combined) above the 56°F threshold under H4_ELT would be similar to those under Existing Conditions during January and February, and would be 19 and 80 degree-days higher for March and April, respectively(Table 11-4A-83). These increases, although large when expressed as percentages, constitute a small proportion with respect to the 82-year period of analysis.

American River

Mean flows in the American River at the confluence with the Sacramento River during January through April under H4_ELT would generally be similar to flows under Existing Conditions, with a number of minor exceptions especially in February (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions for all months and water year types throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-4A-71). Steelhead spawn and eggs incubate in the American River between January and April. During January and February, there would be no differences in the percent of month exceeding the threshold between Existing Conditions and H4_ELT. During March and April, the percent of months exceeding the threshold under H4_ELT would be up to 11% greater (absolute difference) than the percent under Existing Conditions.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-4A-72). During the January and February, there would be no difference in total degree-months above the threshold between Existing Conditions and H4_ELT. During March and April, total degree-months for all water year types combined under H4_ELT would be 19 and 80 degree-months, respectively, greater than under Existing Conditions.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean Flows under H4_ELT would be lower than those under Existing Conditions for about half of the water year means within the four month period, with up to 29% lower flows under in February of critical water years.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River was evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions for all months and water year types throughout the period.

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions, with minor exceptions.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 4A, there are flow and cold water pool availability reductions in the Feather, American, and Stanislaus Rivers, as well as temperature increases in the Feather and American rivers that would lead to biologically meaningful increases in egg mortality and overall reduced habitat conditions for spawning steelhead and egg incubation, as compared to Existing Conditions. Alternative 4A would not have significant effects on steelhead spawning conditions in the Sacramento River, Clear Creek, San Joaquin River, or the Mokelumne River. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of steelhead as a result of egg mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on mean monthly flows, water temperatures, and reservoir storage. Further, the SacEFT model predicts that there would be no effects to spawning and egg incubation habitat in the Sacramento River. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-95: Effects of Water Operations on Rearing Habitat for Steelhead

In general, the effects of Alternative 4A on steelhead rearing conditions would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Sacramento River

Juvenile steelhead rear within the Sacramento River and its tributaries throughout the year because juveniles inhabit upstream areas for a period of 1 to 2 years before migrating downstream to the ocean. Results of the CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (Keswick Dam to upstream of Red Bluff) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were evaluated for effects of H3_ELT. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles, leading to mortality.

In general, mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except during November when the mean flows under H3_ELT would be up to 23% lower at Keswick and up to 18% lower at Red Bluff. These small and isolated reductions would not have biologically meaningful effects on steelhead fry and juvenile rearing habitat.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

SacEFT predicts that there would be a 7% reduction in years classified as good juvenile rearing habitat conditions under H3_ELT compared to NAA_ELT, and a 14% reduction in the percentage of years classified "good" with respect to juvenile stranding risk (Table 11-4A-78). On an absolute scale, these changes to rearing WUA and stranding risk would be 3% and 4%, respectively, which would be negligible to juvenile steelhead.

Based on mean monthly flows, SacEFT rearing metrics, and water temperature effects, project-related effects under Alternative 4A in the Sacramento River would not have biologically meaningful negative effects on steelhead rearing conditions. Effects of H3_ELT consist primarily of negligible effects that would not have biologically meaningful effects on rearing success.

Clear Creek

Steelhead rear in Clear Creek throughout the year. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality.

Instream flows estimated from the modeling each month and water-year type were used to compare among model scenarios (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In general, flows under H3_ELT would be similar to those under NAA_ELT, with minor exceptions.

Evaluation of the minimum instream flows in Clear Creek indicates that H3_ELT would have no effect (0%) on minimum instream flows in any water year type, except for a decrease (-50 cfs or -100%) for dry water years (Table 11-4A-84).

Table 11-4A-84. Minimum Monthly Instream Flow (cfs) for Model Scenarios in Clear Creek during the Year-Round Juvenile Steelhead Rearing Period

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	0 (0%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-70 (-100%)	0 (NA)
Dry	-50 (-100%)	-50 (-100%)
Critical	-50 (-100%)	0 (NA)

Note: Minimum flows occurred between October and March.
Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-1A-4). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study the flow regime could be adjusted in the future. It is expected that the modeled flows will be suitable for the existing steelhead populations in Clear Creek. No change in effect on steelhead in Clear Creek is anticipated.

No water temperature modeling was conducted in Clear Creek.

These results indicate that effects of H3_ELT on flows would not affect juvenile steelhead rearing habitats in Clear Creek.

Feather River

The low-flow channel is the primary reach of the Feather River utilized by steelhead for spawning and rearing. Although there is relatively little natural steelhead production in the river, most steelhead spawning and rearing appears to occur in the low-flow channel in habitats associated with well-vegetated side channels (Cavallo et al. 2003; California Department of Water Resources unpublished data). Because these habitats are relatively uncommon they could limit natural steelhead production. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality.

There would be no change in flows for H3_ELT relative to NAA_ELT in the low-flow channel. Flow in the low-flow channel is projected to remain between 700 and 800 cfs except during occasional flood control releases. This flow is less than pre-dam levels during all months of the year as a result of water diversions through the Thermalito Afterbay. The significance of these flow conditions for steelhead spawning and rearing is uncertain. Feather River screw trap data indicate that Chinook salmon initiate emigration regardless of flow regime (i.e., they do not wait for a high-flow pulse). This is likely true for steelhead as well.

Mean May storage at Oroville under H3_ELT would be similar to that under NAA_ELT for all water year types (Table 11-4A-45). September Oroville storage under H3_ELT would be similar to or up to 15% greater than storage under NAA_ELT (Table 11-4A-39).

The river channel downstream of Thermalito (high-flow channel) offers few of the habitat types upon which steelhead appear to rely in the low-flow channel. Experiments and fish observations also indicate that predation risk for juvenile steelhead is higher downstream of the Thermalito outlet (California Department of Water Resources 2004). Increased predation risk is likely a function of water temperature, where warm water nonnative species such as striped bass, largemouth bass, and smallmouth bass are more prevalent, and in general, predators have greater metabolic requirements. Thus, summer temperatures that exceed 65°F and the absence of preferred steelhead habitat currently appear to limit steelhead rearing in the river downstream of the Thermalito outlet. Comparisons of CALSIM data by month and water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate that mean flows under H3_ELT would generally be similar to or greater than (up to 106% greater for June of below normal water years) those under NAA_ELT in the high-flow channel in all months except July through September. During July through September, flows under H3_ELT would be up to 48% lower than those under NAA_ELT depending on month and water-year type.

Mean monthly water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

Effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the Feather River were analyzed by comparing the percent of months between May through August over the 82-year CALSIM modeling period that exceed a 63°F temperature threshold in the low-flow channel (above Thermalito Afterbay) and by comparing the percent of months between October and April that exceed a 56°F threshold at Gridley. Results for the low-flow channel (above Thermalito Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley, there would generally be only minor differences between NAA_ELT and H3_ELT in the percent of months exceeding the threshold, except in the low-flow channel in June, for which there would be up to a 9% reduction (absolute difference) in the percent of months under H3_ELT.

The effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 63°F NMFS threshold during May through August in the low-flow channel and the 56°F threshold during October through April at Gridley. Results for the low-flow channel (above Thermalito Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low flow channel and at Gridley, there would be small increases and decreases in exceedances above the thresholds, but overall no biologically meaningful effects.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or up to 25% greater than flows under NAA_ELT in all months except August, September, and November. Flows during these months would be up to 25% lower under H3_ELT than under NAA_ELT. Because these reductions would occur only during these months and would be generally low to moderate, they are not expected to cause biologically meaningful effects on steelhead juvenile rearing habitat.

Mean water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-4A-85). During May through July, and October, the percent of months exceeding the threshold under H3_ELT would be similar to or up to 9% lower (absolute difference) than the percent under NAA_ELT. During August and September, the percent of months exceeding the threshold would increase up to 11% (absolute difference) under H3_ELT.

Table 11-4A-85. Differences between Baseline and H3_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 65°F Threshold, May through October

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
May	26 (131%)	20 (133%)	11 (100%)	6 (100%)	4 (75%)
June	27 (42%)	22 (42%)	17 (42%)	15 (48%)	14 (65%)
July	0 (0%)	1 (1%)	30 (47%)	21 (59%)	25 (143%)
August	0 (0%)	2 (3%)	17 (21%)	49 (103%)	57 (184%)
September	11 (13%)	37 (70%)	32 (100%)	30 (185%)	22 (300%)
October	17 (350%)	10 (400%)	9 (NA)	2 (NA)	1 (NA)
NAA_ELT vs. H3_ELT					
May	-1 (-3%)	-2 (-7%)	-1 (-5%)	0 (0%)	0 (0%)
June	0 (0%)	-2 (-3%)	-5 (-8%)	-7 (-14%)	-9 (-20%)
July	0 (0%)	0 (0%)	-2 (-3%)	-9 (-13%)	-5 (-11%)
August	0 (0%)	0 (0%)	0 (0%)	5 (5%)	11 (15%)
September	2 (3%)	9 (11%)	6 (11%)	7 (19%)	4 (14%)
October	-1 (-5%)	-1 (-9%)	2 (40%)	1 (100%)	1 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-4A-86). Total degree-months (all water year types combined) exceeding the threshold would be similar between NAA_ELT and H3_ELT or up to 38 degree-months lower under H3_ELT in all months except August and September, in which degree-months would be 28 degree-months higher under H3_ELT.

Table 11-4A-86. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 65°F in the American River at the Watt Avenue Bridge, May through October

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
May	Wet	9 (150%)	0 (0%)
	Above Normal	7 (NA)	-2 (-22%)
	Below Normal	7 (233%)	-2 (-17%)
	Dry	22 (100%)	1 (2%)
	Critical	13 (68%)	-1 (-3%)
	All	58 (116%)	-4 (-4%)
June	Wet	31 (182%)	-7 (-13%)
	Above Normal	12 (50%)	-8 (-18%)
	Below Normal	21 (72%)	-7 (-12%)
	Dry	10 (15%)	-17 (-18%)
	Critical	33 (66%)	1 (1%)
	All	107 (57%)	-38 (-13%)
July	Wet	32 (41%)	-16 (-13%)
	Above Normal	9 (33%)	1 (3%)
	Below Normal	12 (35%)	-4 (-8%)
	Dry	35 (56%)	7 (8%)
	Critical	30 (37%)	4 (4%)
	All	118 (42%)	-8 (-2%)
August	Wet	69 (87%)	7 (5%)
	Above Normal	19 (46%)	2 (3%)
	Below Normal	29 (52%)	2 (2%)
	Dry	63 (93%)	15 (13%)
	Critical	40 (51%)	2 (2%)
	All	220 (68%)	28 (5%)
September	Wet	35 (146%)	12 (26%)
	Above Normal	14 (88%)	4 (15%)
	Below Normal	26 (93%)	7 (15%)
	Dry	35 (83%)	5 (7%)
	Critical	25 (51%)	0 (0%)
	All	135 (85%)	28 (11%)
October	Wet	6 (600%)	1 (17%)
	Above Normal	5 (NA)	0 (0%)
	Below Normal	3 (NA)	1 (50%)
	Dry	9 (NA)	0 (0%)
	Critical	9 (180%)	0 (0%)
	All	32 (533%)	2 (6%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

These results indicate that effects of H3_ELT on flow and water temperatures would not reduce juvenile rearing conditions in the American River.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the period.

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H3_ELT throughout the year-round period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be the same as flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Mean flows in the Sacramento River at Keswick and upstream of Red Bluff under H4_ELT would generally be similar to flows under NAA_ELT year-round, except during November (11% to 20% lower) at Keswick (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These small and isolated reductions would not have biologically meaningful effects on steelhead fry and juvenile rearing habitat.

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

Clear Creek

Year-round flows in the Clear Creek under H4_ELT would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted in Clear Creek.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under H4_ELT would be the same as flows under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) under H4_ELT would be similar to or up to 548% higher than (April of below normal water years) flows under NAA_ELT during October through June. During July through September, mean flows would be lower for every water year type (up to 60% lower for September of below normal years), except for critical years during August and September, in which flows under H4_ELT would be 48% and 52% higher.

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period at either location.

The analysis evaluating the percent of months exceeding water temperature thresholds from NMFS presented in Impacts AQUA-59 and AQUA-76 indicates that there would be small to moderate benefits (i.e., reduced percent of months exceeding the threshold) of H4_ELT relative to NAA_ELT in the low-flow channel and at Gridley.

The analysis evaluating the total degree-months exceeding water temperature thresholds from NMFS (63°F for the low flow channel and 56°F at Gridley) presented in Impacts AQUA-59 and AQUA-76 indicates that exceedances under H4_ELT would generally be similar to or lower than those under NAA_ELT in the low flow channel and at Gridley during spring and early summer months, but higher during fall months.

Mean May storage would be 11% to 16% lower under H4_ELT relative to NAA_ELT in wet, above normal, and below normal water years, similar in dry years, and 24% higher in critical years (Table 11-4A-45). September Oroville storage under H4_ELT would be similar to or up to 44% greater than storage under NAA_ELT (Table 11-4A-39).

American River

Year-round flows in the American River at the confluence with the Sacramento River under H4_ELT would generally be similar to flows under NAA_ELT, except during August and September, for which mean flows would be up to 33% lower under H4_ELT depending on water year type, and October, for which flows would be up to 24% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-4A-87). The percent of months exceeding the threshold under H4_ELT would be similar to or up to 20% lower (absolute difference) than the percent under NAA_ELT for all months.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-4A-88). Total degree-months exceeding the threshold would be similar between NAA_ELT and H4_ELT throughout the period, except during July and August, in which total degree-months under H4_ELT would be 11% and 24% lower, and during September, in which total degree-months under H4_ELT would be 11% higher.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would be similar to flows under NAA_ELT throughout the period.

Mean monthly water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H4_ELT throughout the year-round period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be the same as flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 4A is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of fry and juvenile mortality. Effects of Alternative 4A on flows and water temperatures would be small and infrequent in the Sacramento River and Clear Creek, and effects in the Feather River and the American River would be more variable, but in general, the overall effects are expected to be slightly beneficial, despite the increased flow variations. Water temperatures in the Sacramento, Feather, American and Stanislaus Rivers would not be affected by Alternative 4A. Overall, Alternative 4A is not expected to have biologically meaningful negative effects on steelhead rearing conditions.

CEQA Conclusion: In general, Alternative 4A would degrade the quantity and quality of rearing habitat for steelhead relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for steelhead relative to the CEQA conclusion.

H3_ELT/ESO_ELT

Sacramento River

Comparisons of CALSIM outputs of mean flow by month and water year type for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were used to evaluate effects of H3_ELT compared to Existing Conditions. Results for H3_ELT at Keswick were generally similar to those for Existing Conditions, except for September, in which flows were up to 34% higher and up to 24% lower, depending on water year type, and October and November, in which flows were up to 20% lower. The results for mean flows at Red Bluff were similar to those for flows at Keswick, except that the differences between H3_ELT and Existing Conditions were generally smaller. The most substantial effects on juvenile rearing habitats would occur from flow reductions in dry and critical water years, including those in September, as well as moderate reductions in dry and or critical years in August, October and November. Based on the overall infrequency and small size of these decreases, and negligible differences or beneficial increases in flow in most of the year, the flow reductions are not expected to have biologically meaningful negative effects on juvenile steelhead rearing conditions in the Sacramento River.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, mean water temperatures under H3_ELT would generally be similar to those under Existing Conditions, except during July through October at Keswick, when temperatures for critical years would range from 7% to 14% higher under H3_ELT, and for other water year types when temperatures would be up to 8% higher under H3_ELT.

SacEFT predicts that there would be a 2% increase in the percentage of years with good juvenile rearing habitat under H3_ELT compared to Existing Conditions (Table 11-4A-78). SacEFT predicts there would be a decrease of 26% in occurrence of years with "good" conditions for juvenile stranding risk (Table 11-4A-78). The increased stranding risk would contribute to the potential for juvenile mortality due to stranding.

Based on the incremental effects of reductions in mean monthly flows (up to 24% lower) for several months during drier water year types, including the warmer summer/ fall months of August through November, and increased risk of juvenile stranding (26%), effects of H3_ELT on flows would have biologically meaningful negative effects on juvenile rearing conditions in the Sacramento River.

Clear Creek

Comparisons of mean flows for Clear Creek were used to evaluate effects of H3_ELT relative to Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality. Effects of H3_ELT year-round would consist primarily of or small changes with respect to Existing Conditions, except that in critical water years during December through April mean flows would increase by 10%, in wet years during January flows would increase 40%, and in critical years during September they would fall 19%. The decreases in flow would not be of sufficient frequency and magnitude to cause biologically meaningful negative effects.

Evaluation of minimum instream flows for H3_ELT relative to Existing Conditions (Table 11-4A-84) indicates no effect (0%) for wet and above normal, and decreases for the remaining water year types (-50 to -70 cfs or -100%). These reductions corresponds to substantial decreases in total flow during drier water years based on relatively small quantities of flow (e.g., as low as 85 cfs in the summer months in drier water years, and more typically between 150 and 200 in other months). The reductions in minimum instream flows would affect juvenile rearing habitat and could increase stranding risk, particularly in drier water years.

No water temperature modeling was conducted in Clear Creek.

While effects of H3_ELT on mean monthly flow would consist predominantly of negligible effects, there would be moderate to substantial reductions in minimum instream flows, particularly during drier water years, that would affect juvenile rearing habitat and increase stranding risk in Clear Creek.

Feather River

The low-flow channel is the primary reach of the Feather River utilized by steelhead spawning and rearing. There would be no change in flows for H3_ELT relative to Existing Conditions in the low-flow channel (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Comparisons using CALSIM data by month and water year type for the Feather River at Thermalito (high-flow channel) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate variable effects of H3_ELT relative to Existing Conditions. H3_ELT would cause substantial changes in mean flows for a number of months and water year types. With some exceptions for specific water year types, there would be increases in mean flows of up to 140% during April through June, as well as for wetter years during July through September (up to 192% higher under H3_ELT)). However, for dry and/or critical years during July through September, flows would be up to 52% lower under H3_ELT than under Existing Conditions. H3_ELT would also cause reductions in flow during January through March, especially for below normal water years, of up to 48%, and during many other months and water year types. The flow changes would have a fairly broad range of effects on rearing habitat throughout the year, with reductions occurring in drier water years having the most adverse effects on juvenile rearing conditions.

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). In the low-flow channel, mean water temperatures under H3_ELT would be similar (<5%) to those under Existing Conditions for all months and water year types,. In the high-flow channel, mean water temperatures under H3_ELT would be 5% and 6% higher than those under Existing Conditions during July of critical water years and August of dry water years, respectively, and would be similar for the remaining months and water year types.

Effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the Feather River were analyzed by comparing the percent of months between May through August over the 82-year CALSIM modeling period that exceed a 63°F temperature threshold in the low-flow channel (above Thermalito Afterbay) and by comparing the percent of months between October and April that exceed a 56°F threshold at Gridley. Results for the low-flow channel (above Thermalito Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley, there would be no differences, small increases, and moderate to large increases (absolute difference), in the percent of months exceeding the threshold between H3_ELT and Existing Conditions. This comparison includes the effects of climate change.

The effects of H3_ELT on water temperature-related juvenile rearing conditions for steelhead in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 63°F NMFS threshold during May through August in the low-flow channel and the 56°F threshold during October through April at Gridley. Results for the low-flow channel (above Thermalito Afterbay) and Gridley are presented for spring-run rearing and fall-run spawning and egg incubation in Impacts AQUA-59 and AQUA-76, respectively. In the low-flow channel and at Gridley, there would be moderate increases in total degree-months (all water years combined) exceeding the temperature threshold during several months. These comparisons include the effects of climate change.

Mean May storage at Oroville would be similar or up to 12% lower under H3_ELT relative to Existing Conditions (Table 11-4A-45). Mean September Oroville storage under H3_ELT would be 19% to 29% lower than storage under Existing Conditions for wet, above normal and below normal water years, and would be similar for dry and critical water years (Table 11-4A-39).

Overall in the Feather River, effects of H3_ELT on mean flow would consist of substantial increases and decreases for various months and water year types. There would be relatively frequent, substantial flow reductions in drier water years that would affect juvenile rearing habitat conditions and contribute to stranding risk. Further, there would be moderate to large increases in the exceedance of temperature thresholds in the low-flow channel and at Gridley.

American River

CALSIM outputs were used to compare mean flows by month and water year type for H3_ELT for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality. Comparisons of H3_ELT to Existing Conditions indicate highly variable results, with moderately lower or higher flows for many months and water year types. There would be relatively large reductions in flow (up to 52%) for all water year types during August, September, and November, with the largest reductions occurring in the drier water year types. Flows in June would increase 25% in dry water years and would decrease up to 36% in critical and wet water years. The prevalent, substantial reductions inflow, particularly during drier water years, would have biologically meaningful negative effects on juvenile rearing conditions in the American River.

Mean water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be 6% to 7% higher than those under Existing Conditions during October of all but critical water years, but would be similar in the remaining months and water year types.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-4A-85). The percent of months under H3_ELT would be greater by up to 57% (absolute difference) than those under Existing Conditions during all months examined.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-4A-86). Total degree-months exceeding the threshold under H3_ELT would be 32 to 220 degree-months greater than those under Existing Conditions.

These results indicate that effects of H3_ELT on flows and water temperatures would affect juvenile steelhead rearing conditions in the American River throughout most of the year, particularly during drier water years.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows would generally be similar under H3_ELT relative to Existing Conditions except during February and March, when flows would be up to 29% lower (dry water year type).

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions except during June through August, when flows would be up to 23% lower.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions during January through May and October and November, with exceptions depending on water year type, would be up to 28% greater than flows under Existing Conditions during December, and up to 35% lower than flows under Existing Conditions during June through September.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT/HOS_ELT

Sacramento River

Year-round flows in the Sacramento River at Keswick under H4_ELT would generally be similar to flows under Existing Conditions except during September, when flows would be 28% and 53% higher in wet and above normal water years, respectively, and 20% and 14% lower in dry and critical water years, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would also be up to 19% lower in November of dry and critical year types. Differences in mean flows between H4_ELT and Existing conditions at Red Bluff would be similar to but smaller than those at Keswick, except during October, in which mean flow would be up to 16% lower.

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions for any month or water year types at either location.

Clear Creek

Year-round flows in the Clear Creek under H4_ELT would generally be similar to flows under Existing Conditions, except that in critical water years during December through April mean flows would increase 10%, and in wet years during January flows would increase 40%. (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). No water temperature modeling was conducted in Clear Creek.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under H4_ELT would be the same as flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) under H4_ELT would generally be similar to or up to 509% greater than flows under Existing Conditions during April through June, and would generally be lower than flows under Existing Conditions (up to 54% lower) during July and August, as well as September of below normal and dry water years. During September of wet, above normal, and critical water years and August of critical years, flows under H4_ELT would be up to 166% higher than flows under Existing Conditions. During the other six months of the year, flows under H4_ELT and Existing Conditions would generally be similar, with many exceptions for individual water year types.

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations there would be no differences (<5%) in mean water temperatures for any month or water year type.

The analysis evaluating the percent of months exceeding water temperature thresholds from NMFS presented in Impacts AQUA-59 and AQUA-76 indicates that there would be a number of small to moderate increases in the percent of months exceeding the NMFS temperature thresholds underH4_ELT relative to Existing Conditions in the low flow channel and at Gridley. These comparisons include the effects of climate change.

The analysis evaluating the total degree-months exceeding water temperature thresholds from NMFS presented in Impacts AQUA-59 and AQUA-76 indicates that there would be small to moderate negative effects of H4_ELT relative to Existing Conditions in August in the low flow channel and October and November at Gridley, and no, small or positive effects in the other months at both locations. These comparisons include the effects of climate change.

Mean May storage at Oroville would be up to 19% lower under H4_ELT relative to Existing Conditions except in critical years, in which storage would be 15% greater (Table 11-4A-45). Mean September Oroville storage under H4_ELT would be about 24% lower than storage under Existing

Conditions for wet, above normal and below normal water years, 32% greater for critical years, and similar for dry years (Table 11-4A-39).

American River

Year-round flows in the American River at the confluence with the Sacramento River under H4_ELT would generally be similar to flows under Existing Conditions during October and December through April, with minor exceptions, and would be up to 47% lower during May through September and November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be 6% to 7% higher than those under Existing Conditions during October of all but critical water years, and would be similar in the remaining months and water year types.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-4A-87). The percent of months under H4_ELT would be greater by up to 37% (absolute difference) than those under Existing Conditions during all months examined.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-4A-88). Total degree-months (all water years combined) exceeding the threshold under H4_ELT would be 32 to 168 degree-months greater than those under Existing Conditions for all months.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows would generally be similar under H4_ELT relative to Existing Conditions, but with some flow reductions (up to 29%), especially for dry and critical water years during February and March.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures throughout the year.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 23% lower during June through August, depending on water year type, than flows under Existing Conditions and would generally be similar in other months, with minor exceptions.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions during January through May and October and November, with minor exceptions. Flows would generally be lower (up to 34% lower) during June through September, primarily in wet, above normal, and below normal water year types, and would be up to 28% higher in December of the same three water year types.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 4A, there are flow reductions in the Feather, American, Stanislaus, San Joaquin, and Mokelumne Rivers and temperature increases in the Sacramento, Feather, American, and Stanislaus Rivers that would lead to reductions in quantity and quality of fry and juvenile steelhead rearing habitat relative to Existing Conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of steelhead as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, *Effects and Mitigation Approaches*, in the Draft EIR/EIS, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on flows would be small and infrequent in the Sacramento River, Clear Creek, and Mokelumne River. Effects in the Feather and American rivers would be variable, but overall effects are expected to be slightly beneficial. Despite the increased flow variations, water temperatures in the Sacramento, Feather, American, and Stanislaus Rivers would not be affected by Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the impact would be less than significant and no mitigation is required.

Impact AQUA-96: Effects of Water Operations on Migration Conditions for Steelhead

In general, the effects of Alternative 4A on steelhead migration conditions relative to the NAA_ELT would not be adverse.

Upstream of the Delta

H3_ELT/ESO_ELT

Sacramento River

Juveniles

Sacramento River flow upstream of Red Bluff during the juvenile steelhead migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) is used to represent flow conditions in the mainstem of the upper river below Keswick Dam. Mean flows under H3_ELT during this period would generally be similar to flows under NAA_ELT, except during November, during which flows would be 6% to 18% lower than flows under NAA_ELT. These reductions would not have a biologically meaningful effect on steelhead juvenile migration because they would occur during only one of eight months of the period and are small to moderate in magnitude.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Overall, these results indicate that H3_ELT would not have biologically meaningful effects on juvenile migration conditions.

Adults

Instream flows upstream of Red Bluff were compared monthly over the period from September through March under H3_ELT and NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT during this period would generally be similar to flows under NAA_ELT, except during November, during which flows would be up to 18% lower than flows under NAA_ELT. These reductions would not have a biologically meaningful effect on steelhead adult migration because they would occur during only one of seven months of the period and are small to moderate in magnitude.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Kelts

Mean Sacramento River flows upstream of Red Bluff under H3_ELT during the March through April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the*

Fish Analysis) would generally be similar to flows under NAA_ELT. Therefore, H3_ELT would not affect kelt migration in the Sacramento River.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Overall in the Sacramento River, these results indicate that H3_ELT would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration in the Sacramento River.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Juveniles

Flows in Clear Creek at Whiskeytown were evaluated for the juvenile steelhead migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT throughout the period. These results indicate that H3_ELT would not affect flow conditions for juvenile steelhead migration in Clear Creek.

Adults

Flows in Clear Creek at Whiskeytown were evaluated for the September through March adult steelhead migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to or greater than flows under NAA_ELT throughout the period. These results indicate that H3_ELT would not affect flow conditions for adult steelhead migration in Clear Creek.

Kelts

Flows in Clear Creek at Whiskeytown were evaluated for the March and April kelt steelhead migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to or greater than flows under NAA_ELT for both months of the period. These results indicate that H3_ELT would not affect flow conditions for kelt steelhead migration in Clear Creek.

Overall in Clear Creek, these results indicate that effects of H3 on flows would not affect juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Flows in the Feather River at Thermalito Afterbay (high-flow channel) and at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-flow channel under H3_ELT would generally be similar to or up to 30% greater than flows under

NAA_ELT during the period. Increases in flow would have a beneficial effect on migration conditions, particularly in drier water years during some months.

Flows under H3_ELT in the Feather River at the confluence with the Sacramento River during October through May would generally be similar to flows under NAA_ELT, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These isolated reduction would not have biologically meaningful effects on juvenile steelhead migration conditions.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Overall, there would be no biologically meaningful effects H3 on juvenile migration conditions in the Feather River.

Adults

Flows in the Feather River at Thermalito Afterbay (high-flow channel) and at the confluence with the Sacramento River were evaluated during the September through March adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the high-flow channel under H3_ELT would generally be similar to or up to 30% greater than flows under NAA_ELT except during September. During September, flows would be up to 43% lower for all water year types except critical, in which flows would be 52% greater. These flow reductions would be limited to one month of the seven month migration period and would, therefore, not have a biologically meaningful effect on adult steelhead migration conditions. Mean flows in the Feather River at the confluence with the Sacramento River under H3_ELT would generally be similar to or greater than flows under NAA_ELT, except during September, in which flows would be up to 27% lower for all but critical water years and would be 14% higher for critical years. The flow reductions would be isolated and would, therefore, not have a biologically meaningful effect on adult steelhead migration conditions.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Kelts

Flows in the Feather River at the Thermalito Afterbay and at the confluence with the Sacramento River were evaluated during the March and April kelt migration period. Flows at Thermalito under H3_ELT during March and April would generally be similar to or, in dry and critical water years, up to 16% greater than flows under NAA_ELT. Flows at the confluence with the Sacramento River would generally be similar to those under NAA_ELT. These results indicate that H3_ELT would not affect kelt steelhead migration conditions in the Feather River.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in* *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in either month or any water year type of the period.

Overall in the Feather River, H3_ELT would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration.

American River

Juveniles

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were evaluated for the juvenile steelhead migration period (October through May). Mean flows under H3_ELT would generally be similar to flows or up to 25% greater than flows under NAA_ELT, except during November, in which flows would be up to 15% lower depending on water year type. Appreciable differences in flow would be too infrequent to have biologically meaningful effects on juvenile steelhead migration.

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Based on its generally small and infrequent effects on mean flow and negligible effects on water temperature, H3_ELT would not affect juvenile steelhead migration in the American River.

Adults

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were evaluated for the September through March adult migration period. Flows under ELT would generally be similar to or up to 25% greater than flows under NAA_ELT, except during September and November, in which flows would be up to 25% lower, depending on month and water year type. These reductions would be too infrequent to cause biologically meaningful effects on adult steelhead migration.

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Kelts

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were evaluated for the March through April kelt migration period. Mean flows under H3_ELT would be similar to flows under NAA_ELT during this period for all water year types.

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in* *the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type of the period.

Overall in the American River, the effects of H3_ELT on flows would not affect juvenile, adult, or kelt migration conditions.

Stanislaus River

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT are essentially no different from flows under NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

Further, mean monthly water temperatures in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

San Joaquin River

Mean flows in the San Joaquin River at Vernalis for H3_ELT are little different from flows under NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt migration in the San Joaquin River.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River at the Delta for H3_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of H3_ELT on juvenile, adult, or kelt migration in the Mokelumne River.

Water temperature modeling was not conducted in the Mokelumne River.

H4_ELT /HOS_ELT

Sacramento River

Juveniles

Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the October through May juvenile steelhead migration period would generally be similar to flows under NAA_ELT, except during November, in which flows would be lower for all water year types (9% to 15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These reductions would not have a biologically meaningful effect on steelhead juvenile migration because they would occur during only one of eight months of the period and are small to moderate in magnitude.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Adults

Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the September through March adult steelhead migration period would generally be similar to flows under NAA_ELT, except during November, in which flows would be 9% to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These reductions would not have a biologically meaningful effect on steelhead adult migration because they would occur during only one of eight months of the period and are small to moderate in magnitude.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Kelts

Mean flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through April adult steelhead migration period would be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Juveniles

Mean flows under H4_ELT in Clear Creek at Whiskeytown during the October through May juvenile migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Adults

Mean flows under H4_ELT in Clear Creek at Whiskeytown during the September through March adult migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Kelts

Mean flows under H4_ELT in Clear Creek at Whiskeytown during the March through April kelt migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Feather River

Juveniles

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the Sacramento River during the October through May juvenile migration period would generally be similar to flows under NAA_ELT during October through March, with a few exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows during April and May would be greater (up to 548% greater at Thermalito Afterbay location) than flows under NAA_ELT except in critical water years, for which flows would be similar.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Adults

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the Sacramento River during the September through March adult migration period would generally be similar to flows under NAA_ELT, except during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). During September of critical water years, mean flow under H4_ELT at Thermalito Afterbay would be 52% higher and at the confluence with the Sacramento River it would be 34% higher During September of the other water year types, mean flows at the two locations would be up to 60% and 38% lower, respectively.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Kelts

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the Sacramento River during the March through April kelt migration period would generally be similar to or up to 18% greater than flows under NAA_ELT during March and up to 548% higher than flows under NAA_ELT during April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

American River

Juveniles

Mean flows under H4_ELT in the American River at the confluence with the Sacramento River during the October through May juvenile migration period would generally be similar to flows under

NAA_ELT except during October of below normal and critical water years, in which flows under H4_ELT would be 17% and 24% higher, respectively(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Adults

Mean flows under H4_ELT in the American River at the confluence with the Sacramento River during the September through March adult migration period would generally be similar to flows under H3_ELT except during September of below normal years, in which flows would be 22% lower, and October of below normal and critical water years, in which flows would be 17% and 24% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Kelts

Mean flows under H4_ELT in the American River at the confluence with the Sacramento River during the March through April kelt migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Stanislaus River

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT are essentially the same as flows under NAA_ELT in all months. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

Further, mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt migration in the Stanislaus River.

San Joaquin River

Mean flows in the San Joaquin River at Vernalis for H4_ELT are little different from flows under NAA_ELT for all months. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt migration in the San Joaquin River.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River at the Delta for H4_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of H4_ELT on juvenile, adult, or kelt migration in the Mokelumne River.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Juveniles

Alternative 4A operations would generally reduce OMR reverse flows under all flow scenarios, with a corresponding increase in net positive downstream flows, during the outmigration period of steelhead through the interior Delta channels (Appendix B, Supplemental Modeling for Alternative 4A). Conditions under Scenario H4_ELT would further improve overall average OMR flows relative to other flow scenarios under Alternative 4A. These improved net positive downstream flows would be substantial benefits of the proposed operations.

As noted under Predation Associated with Entrainment above, predation at the north Delta would be increased due to the construction of the proposed SWP/CVP water export facilities on the Sacramento River. It is assumed that per capita steelhead predation losses would be similar to those predicted for spring-run Chinook salmon, although slightly reduced because of the larger size of steelhead outmigrants. Bioenergetics modeling predicts a predation loss of about 0.2% of the juvenile spring-run population (Table 11-4A-26).

Based on DPM results for spring-run Chinook salmon (Impact AQUA-60 for Alternative 4A), changes in steelhead survival relative to NAA_ELT would be expected to be limited under Alternative 4A. Also, steelhead juveniles are larger than Chinook salmon juveniles in general, and therefore may be less vulnerable to predation during migration. The DPM analysis of Alternative 4A on juvenile spring-run Chinook salmon migration suggests a potential adverse effect of small magnitude. As noted for spring-run Chinook salmon, this adverse effect would be minimized through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 4A of specific important conservation measures. These conservation measures include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of spring-run Chinook salmon juveniles into the low-survival interior Delta. Therefore the effect on juvenile steelhead outmigration success through the Delta under Alternative 4A would not be adverse.

Adults

The upstream adult steelhead migration occurs from September–March, peaking during December-February. The steelhead kelt downstream migration occurs from January–April. The proportion of Sacramento River water in the Delta under Alternative 4A would be similar (8% or less difference) to NAA_ELT throughout the adult steelhead upstream migration (Table 11-4A-89). Under

Alternative 4A's Scenario H3_ELT, mean monthly Sacramento River flows at Rio Vista averaged over all water years would be reduced compared to NAA_ELT, ranging from 46% less in September to 7.5% less in December. For H4_ELT, the range is from about 1% less in April to 30% less in October and November. These differences are less than those observed under Alternative 1A and so, because the effect under Alternative 1A would not be adverse, Alternative 4A would also not have an adverse effect on adult and kelt steelhead migration through the Delta.

San Joaquin River

Juveniles

The only changes to San Joaquin River flows at Vernalis would result from the modeled effects of climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows. There are no flow changes associated with Alternative 4A Alternative 4A would have no effect on steelhead migration success through the Delta from the perspective of changing inflows into the Delta. However, juvenile steelhead migration success would be aided by the inclusion in the water conveyance facilities of an operable barrier at the head of Old River, which would keep flow and fish in the mainstem San Joaquin River.

Adults

Alternative 4A Scenario H3_ELT would slightly increase the proportion of San Joaquin River water in the Delta in September through March by 1.3 to 4.4 % (compared to NAA_ELT) (Table 11-4A-89). The proportion of San Joaquin River water under Scenario H3_ELT would be similar or slightly more than NAA_ELT. Conditions under Scenario H4_ELT are expected to increase the proportion of San Joaquin River water (relative to the change under Scenario H3_ELT) because it would involve fewer exports from the north Delta during spring.

Table 11-4A-89. Percentage (%) of Water at Collinsville that Originated in the Sacramento River and San Joaquin River during the Adult Steelhead Migration Period for Alternative 4A

Month	EXISTING CONDITIONS	NAA_ELT	H3_ELT	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River					
September	60	65	61	0	-4
October	60	64	65	5	1
November	60	64	63	3	-1
December	67	67	65	-1	-1
January	76	75	73	-2	-2
February	75	74	69	-6	-4
March	78	77	69	-9	-8
San Joaquin River					
September	0.3	0.2	1.7	1.4	1.5
October	0.2	0.2	3.5	3.4	3.3
November	0.4	0.8	5.2	4.8	4.4
December	0.9	1.0	2.9	2.0	1.9
January	1.6	1.7	2.9	1.3	1.3
February	1.4	1.5	3.6	2.2	2.2
March	2.6	2.6	5.7	3.1	3.1
	Shading indicates 10% or greater absolute difference.				

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NEPA Effects: Upstream of the Delta, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. Effects of Alternative 4A in all locations analyzed would consist primarily of negligible effects on mean monthly flow and water temperatures for the juvenile, adult, and kelt migration periods. In the Feather River, higher flows during spring months may provide some benefits to migrating steelhead. Effects of Alternative 4A on upstream water temperatures would be negligible.

Near-field effects of Alternative 4A NDD on Sacramento River steelhead related to impingement and predation associated with three new intake structures could result in negative effects on juvenile migrating steelhead, although there is high uncertainty regarding the overall effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to more significant effects (~ 12% mortality above current baseline levels). Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, as described in the adaptive management and monitoring program in Section 4.1, several pre-construction surveys to better understand how to minimize losses associated with the three new intake structures will be implemented as part of the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better understand factors affecting juvenile through-Delta migration (as described in the adaptive management and monitoring program in Section 4.1) and includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for downstream-migrating juvenile salmonids. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of predation-related mortality expected from near-field effects at the NDD remains highly uncertain.

As noted for other salmonids, two recent studies (Newman 2003 and Perry 2010) indicate that far-field effects associated with the new intakes could cause a reduction in smolt survival in the Sacramento River downstream of the NDD intakes due to reduced flows in this area, although these modeling results focused on juvenile Chinook salmon as opposed to steelhead. As noted for winter-run and spring-run Chinook salmon above, the elements of Alternative 4A related to reduced interior Delta entry (Environmental Commitment 16) and reduced south Delta entrainment may offset the far-field effects of reduced flow. As noted for the various Chinook salmon runs, the overall magnitude of each of these factors and how they might interact and/or offset each other in affecting salmonid survival through the plan area is uncertain, and will be investigated as part of the adaptive management and monitoring program.

Adverse effects of the water conveyance facilities operations at the NDD would be minimized through the bypass flow criteria and real-time operations described for other salmonids (e.g., winter-run Chinook salmon), as well as inclusion within Alternative 4A of specific important conservation measures: *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of juvenile salmonids into the low-survival interior Delta.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of migration habitat for steelhead relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of migration habitat for steelhead relative to Existing Conditions.

Upstream of the Delta

H3_ELT/ESO_ELT

Sacramento River

Juveniles

Flows in the Sacramento River just upstream of Red Bluff Diversion Dam were evaluated for the juvenile migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions, except during October and November, in which flows would be up to 16% lower than those under Existing Conditions. These reductions in flow would be too small and infrequent to have biologically meaningful negative effects on migration conditions.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water*

Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis). There would be no differences (<5%) in mean water temperature between Existing Conditions.

Adults

Mean flows under H3_ELT during the adult migration period (September through March) would generally be similar to those under Existing Conditions, except during September through November October, in which flows would be up to 22% lower than those under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) The changes in flow due to H3_ELT would be frequent enough (3 of 7 months), large enough (up to 22% lower), and occur during all water year types to be considered biologically meaningful negative effects on adult migration conditions.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in all months except September and October, in which temperatures under H3_ELT would be 6% greater than those under Existing Conditions.

Kelts

Mean flows under H3_ELT during the kelt migration period (March and April) would be similar to those under Existing Conditions for all water year types (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

Overall in the Sacramento River, H3_ELT would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Juveniles

Flows under H3_ELT in Clear Creek at Whiskeytown during the October through May juvenile migration period would generally be similar to flows under Existing Conditions, except for 40% higher flow in January of wet years and 10% higher flows in December through April of critical water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Adults

Flows under H3_ELT in Clear Creek at Whiskeytown during the September through March adult migration period would generally be similar to flows under Existing Conditions, except for 40% higher flow in January of wet water years, 10% higher flows in December through March of critical years, and 19% lower flow in September of critical years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Kelts

Flows under H3_ELT in Clear Creek at Whiskeytown during the March through April kelt migration period would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Overall in Clear Creek, H3_ELT would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Mean flows were evaluated in the Feather River at Thermalito Afterbay during the October through May juvenile migration period. Flows under H3_ELT would be similar to flows under Existing Conditions during October through December and March, up to 48% lower than flows under Existing Conditions during January and February, and up to 33% greater than flows under Existing Conditions during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows at the confluence with the Sacramento River under H3_ELT would generally be similar to those under Existing Conditions throughout the period.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in all months and water year types of the migration period.

Adults

Mean flows were examined in the Feather River at Thermalito Afterbay during the September through March adult migration period. Flows under H3_ELT would be up to 192% greater than flows under Existing Conditions during September, similar to flows under Existing Conditions during October through December and March, and up to 48% lower than flows under Existing Conditions during January and February (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows at the confluence with the Sacramento River under H3_ELT would generally be similar or up to 19% lower than those under Existing Conditions during November through March and similar or up to 21% higher during October, while flows in September would range from 28% lower to 100% higher, depending on water year type.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in all months and water year types of the period.

Kelts

Mean flows under H3_ELT in the Feather River at Thermalito Afterbay during the March through April kelt migration period would be similar to flows under Existing Conditions during March and up to 29% higher than flows under Existing Conditions during April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows for March and April at the confluence with the Sacramento River would generally be similar between H3_ELT and Existing Conditions.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

Overall in the Feather River, the effect of H3_ELT on flows would include frequent substantial reductions in flows that would affect juvenile and adult migration conditions, particularly in drier water years, but would generally not affect kelt migration.

American River

Juveniles

Mean flows under H3_ELT in the American River at the confluence with the Sacramento River during the October through May juvenile migration period would generally be similar to or up to 15% higher than flows under Existing Conditions, except during November, January, and May, in which flows would be up to 24% lower under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%) from those under Existing Conditions, except in October, for which the water temperatures would 5% to 6% higher for all but critical water years.

Adults

Flows under H3_ELT in the American River at the confluence with the Sacramento River during the September through March adult migration period would generally be similar to or up to 15% higher than flows under Existing Conditions, except during September, November, and January, in which flows would be up to 47% lower (September of critical water years) than under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%) from those under Existing Conditions, except in October, for which the water temperatures would 5% to 6% higher for all but critical water years.

Kelts

Flows under H3_ELT in the American River at the confluence with the Sacramento River during the March through April kelt migration period would generally be similar to flows under Existing

Conditions, except for March of critical water years, in which the mean flow would be 12% lower under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different (<5%) from those under Existing Conditions.

Overall in the American River, the effect of H3_ELT on flows would include frequent moderate reductions in flows that would affect juvenile and adult migration conditions, particularly in drier water years, but would generally not affect kelt migration

Stanislaus River

Juveniles

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions during October through January and up to 29% lower than flows under Existing Conditions during February through May.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the October through May steelhead juvenile downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions.

Adults

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or up to 29% lower (February of critical water years) than flows under Existing Conditions depending on month and water year type.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions.

Kelt

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows during the period under H3_ELT would be up to 23% over than flows under Existing Conditions.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Juveniles

Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, with minor exceptions.

Adults

Flows in the San Joaquin River at Vernalis were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, with minor exceptions.

Kelt

Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, with minor exceptions.

Mokelumne River

Water temperature modeling was not conducted in the Mokelumne River.

Juveniles

Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be lower than flows under Existing Conditions during April and May (up to 11% lower), similar to flows under Existing Conditions during October, November, and January through March, and higher than flows under Existing Conditions during December (up to 28% higher).

Adults

Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions, except during December, in which mean flow would be up to 28% higher, and during September, when flows would be up to 22% lower.

Kelt

Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions during both months of the period.

H4_ELT /ESO_ELT

Sacramento River

Juveniles

Flows in the Sacramento River just upstream of Red Bluff Diversion Dam were evaluated for the juvenile migration period (October through May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to those under Existing Conditions.

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Adults

Mean flows under H4_ELT during the adult migration period (September through March) would generally be similar to those under Existing Conditions except during September, in which flows would be up to 49% higher for wet and above normal water years and up to 18% lower for dry and critical water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The changes in flow would be too infrequent to have biologically meaningful negative effects on migration conditions.

Mean temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Kelts

Mean flows under H4_ELT during the kelt migration period (March and April) would generally be similar to those under Existing Conditions for all water year types (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type in the period.

Overall in the Sacramento River, H4_ELT would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Juveniles

Flows under H4_ELT in Clear Creek at Whiskeytown during the October through May juvenile migration period would generally be similar to flows under Existing Conditions, except for 40% higher flow in January of wet years, 10% higher flows in December through April of critical water years, and other minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Adults

Flows under H4_ELT in Clear Creek at Whiskeytown during the September through March adult migration period would generally be similar to flows under Existing Conditions, except for 40% higher flow in January of wet water years, 10% higher flows in December through March of critical years, and other minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Kelts

Flows under H4_ELT in Clear Creek at Whiskeytown during the March through April kelt migration period would generally be similar to flows under Existing Conditions, except for 13% higher flows in March of below normal water years and 10% higher flows in March and April of critical water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Overall in Clear Creek, H4_ELT would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the October through May juvenile migration period would generally be lower (up to 36% lower) than flows under Existing Conditions during October through March and would be much higher for all water year types except critical during April and May (up to 509% higher) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flow for April with all water years combined would be 92% greater than that under Existing Conditions. The flows at the confluence with the Sacramento River under H4_ELT would generally be similar or up to 26% lower (December of critical water years) than those under Existing Conditions during October through March and up to 112% higher in April and May.

Mean temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in all months and water year types of the migration period.

Adults

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the September through March adult migration period would generally be lower (up to 36% lower) than flows under Existing Conditions during October through March (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in September under H4_ELT would be up to 166% higher for wet, above normal and critical water years, and up to 49% lower for below normal and dry water years. The flows at the confluence with the Sacramento River under H4_ELT would generally be similar or up to 26% lower than those under Existing Conditions during October through March, while flows in September would range from 29% lower to 87% higher depending on water year type.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in all months and water year types of the period.

Kelts

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the March and April kelt migration period would range from 22% lower to 16% higher in March and from 4% to 509% higher in April (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows at the confluence with the Sacramento River for March would generally be similar between H4_ELT and Existing Conditions, while flows in April would be up to 112% higher under H4_ELT.

Mean water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Overall in the Feather River, the effect of H4_ELT on flows would include persistent and/or substantial reductions in flows that would affect juvenile and adult migration conditions, particularly in drier water years.

American River

Juveniles

Mean flows under H4_ELT in the American River at the confluence with the Sacramento River during the October through May juvenile migration period would generally be similar to or up to 15% higher than flows under Existing Conditions, except during November and May, in which flows would be up to 25% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) from those under Existing Conditions, except in October, for which the water temperatures would 5% to 6% higher for all but critical water years.

Adults

Flows under H4_ELT in the American River at the confluence with the Sacramento River during the September through March adult migration period would generally be similar to or up to 15% higher than flows under Existing Conditions, except during September and November, in which flows would be up to 47% lower (September of critical water years) than under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) from those under Existing Conditions, except in October, for which the water temperatures would 5% to 6% higher for all but critical water years.

Kelts

Flows under H4_ELT in the American River at the confluence with the Sacramento River during the March through April kelt migration period would generally be similar to flows under Existing Conditions, except for March of critical years, during which the mean flow would be 12% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%) from those under Existing Conditions.

Overall in the American River, reductions inflows would be too small and infrequent to affect migration conditions for steelhead.

Stanislaus River

Juveniles

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions during October through January and up to 29% lower than flows under Existing Conditions during February through May.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the October through May steelhead juvenile downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions.

Adults

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions during September through January and up to 29% lower than flows under Existing Conditions during February and March.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions.

Kelt

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be lower (by up to 23%) than flows under Existing Conditions in both months.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H4_ELT and Existing Conditions.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Juveniles

Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions, except during March and April (up to 12% lower).

Adults

Flows in the San Joaquin River at Vernalis were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions, except during March (up to 12% lower)

Kelt

Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be lower than flows under Existing Conditions (up to 12% lower)

Mokelumne River

Water temperature modeling was not conducted in the Mokelumne River.

Juveniles

Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead juvenile downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be lower than flows under Existing Conditions during April and May (up to 11% lower), similar to flows under Existing Conditions during October, November, and January through March, and higher than flows under Existing Conditions during December (up to 28% higher).

Adults

Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead adult upstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be lower than flows under Existing Conditions during September (up to 22% lower), similar to flows under Existing Conditions during October, November, and January through March, and higher than flows under Existing Conditions during December (up to 28% higher).

Kelt

Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt downstream migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under Existing Conditions during March and up to 7% lower than flows under Existing Conditions during April.

Through-Delta

Based on DPM results for spring-run Chinook salmon, which do not assume any adjustments in operations based on fish presence, steelhead survival would not be expected to decrease more than 1%. Assuming similar effects on steelhead, Alternative 4A would have a minimal effect on steelhead migration success through the Delta. Therefore, the impact on juvenile steelhead migration through the Delta would be small, particularly given the inclusion in Alternative 4A of Environmental Commitments 6, 15, and 16 (see additional discussion in the *Summary of CEQA Conclusion* below).

The proportion of Sacramento River water in the Delta under Alternative 4A Scenario H3_ELT would be similar to Existing Conditions (<10% difference) during the entire adult steelhead upstream migration (Table 11-4A-89). As discussed in more detail for Alternative 4, because of the overall similarity in olfactory cues and Rio Vista flows between Alternative 1A and Alternative 4A during the entire adult and kelt migration periods, effects on migration success would be expected to be similar to Alternative 1A. Olfactory cues and flows in the San Joaquin River basin would be improved or similar to Alternative 1A and Existing Conditions. Overall, the impact to steelhead adult and kelt migration under Alternative 4A is considered negligible.

Summary of CEQA Conclusion

Under Alternative 4A, there would be reductions in flow in the Sacramento, Feather, American, Stanislaus, and Mokelumne Rivers that would lead to biologically meaningful reductions in juvenile and adult migration conditions, thereby reducing survival relative to Existing Conditions. Reduced migration conditions would delay or eliminate successful migration necessary to complete the steelhead life cycle. Alternative 4A would not affect migration conditions for steelhead in Clear Creek or the San Joaquin River. Water temperatures under Alternative 4A would generally be similar to those under Existing Conditions in all rivers examined. There would be minimal effects on through-Delta migration conditions because changes in juvenile survival and adult olfactory cues would be small. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce migration conditions for steelhead.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, *Effects and Mitigation Approaches*, in the Draft EIR/EIS, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to differ from one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on mean monthly flow and water temperatures for the juvenile, adult, and kelt migration periods. Effects of. Near-field effects of Alternative 4A NDD on Sacramento River steelhead related to impingement and predation associated with the intake structures could result in negative effects on juvenile migrating steelhead, although there is high uncertainty regarding overall effects.

As noted for other salmonids such as winter-run Chinook salmon, similar or slightly lower survival than for Existing Conditions based on the water conveyance facilities operations would be offset by the inclusion of bypass flow criteria, real-time operational adjustments, *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers*. Overall, it is concluded that the impact to steelhead would be less than significant and no mitigation would be required.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for winter-run Chinook salmon, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4A and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for winter-run Chinook salmon would be similar for steelhead. However, as noted for Alternative 1A, juvenile steelhead migrants are typically older and larger than Chinook salmon migrants, making them less susceptible to effects from restoration construction activities. As larger migrants, steelhead pass through the river more quickly, resulting in lower risks of exposure to increased turbidity, methylmercury, accidental spills, disturbed contaminated sediments, or predation.

The following impacts are those presented under Alternative 4A and Alternative 1A that are anticipated to be similar in nature for Alternative 4A, but would occur to a lesser extent because of the reduced extent of the restoration measures under Alternative 4A.

Impact AQUA-97: Effects of Construction of Restoration Measures on Steelhead

The effects of construction of restoration measures on steelhead under Alternative 4A are similar in nature to those discussed in more detail under Alternative 1A: temporary increases in turbidity; increased exposure to mercury and methylmercury; accidental spills; disturbance of contaminated sediments; in-water work activities; and predation. In-water and shoreline restoration construction activities may result in short-term effects on steelhead through direct disturbance, short-term water quality impacts, and increased exposure to contaminants associated with the incidental disturbance of contaminated sediments. Overall and as noted for Alternative 1A, the effect of restoration construction activities on the bioavailability of contaminants is expected to be minimal, as they would likely be localized, sporadic, and of low magnitude. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on steelhead. The relevant environmental commitments are: *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*. Pertinent details of these plans are provided under Impact AQUA-1 for delta smelt under Alternative 1A. Given the greatly reduced extent of restoration under Alternative 4A relative to Alternative 1A, the effects of construction of restoration measures on steelhead would be expected to be less than for Alternative 1A.

***NEPA Effects*:** The effects of short-term construction activities would not be adverse to winter-run Chinook salmon. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on steelhead. The relevant environmental commitments are: *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*. Pertinent details of these plans are provided under Impact AQUA-1.

***CEQA Conclusion*:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on steelhead but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce steelhead habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-98: Effects of Contaminants Associated with Restoration Measures on Steelhead

As also noted for winter-run Chinook salmon, Alternative 4A habitat restoration actions could result in the disturbance or mobilization of upland and aquatic contaminants that could affect steelhead. As noted above, steelhead tend to pass through the Delta more quickly than other salmonids such as winter-run Chinook salmon, so that any overlap with contaminant effects of restoration measures would be limited. A detailed analysis of the potential effects based on the larger extent of tidal habitat restoration proposed under Alternative 4A can be found in the *BDCP Effects Analysis – Appendix 5D*, *Contaminants (hereby incorporated by reference)*. Potential impacts on steelhead from effects of methylmercury, selenium, copper, ammonia, and pesticides associated with habitat restoration activities would be similar to those discussed for delta smelt (see Impact AQUA-8). Within the relatively small extent of habitat restored under *Environmental Commitment 4 Tidal Natural Communities Restoration*, it is anticipated that any potential effects of methylmercury on steelhead will be addressed through implementation of Environmental Commitment 12. Environmental Commitment 12 is intended to minimize methylmercury exposure associated with restoration measures for juvenile Chinook salmon. Additional analysis and tools may be developed to further reduce methylmercury exposure as the habitat restoration conservation measures are refined and analyzed in site-specific documents.

NEPA Effects: The effect of restoration measures on chemical contaminants is not adverse to steelhead with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of Environmental Commitment 12).

CEQA Conclusion: Alternative 4A restoration actions are likely to result in slightly increased production, mobilization, and bioavailability of methylmercury. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury from restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect steelhead either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-99: Effects of Restored Habitat Conditions on Steelhead

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on steelhead would not be adverse because they would provide potentially suitable habitat for steelhead.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on steelhead would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for winter-run Chinook salmon, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for steelhead remains the same.

Impact AQUA-100: Effects of Methylmercury Management on Steelhead (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to steelhead.

NEPA Effects: The effects of methylmercury management on steelhead would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on steelhead would be less than significant. Consequently, no mitigation is required.

Impact AQUA-103: Effects of Localized Reduction of Predatory Fish on Steelhead (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish would involve efforts to reduce predation by predatory fish at the proposed north Delta intakes and at the south Delta export facilities, including Clifton Court Forebay.

NEPA Effects: To the extent that localized predator control efforts of *Environmental Commitment 15 Localized Reduction of Predatory Fish* reduce the local abundance of fish predators at the north Delta diversions and near the south Delta export facilities (e.g., in Clifton Court Forebay), it is possible, but not assured, that there would be some reduction in losses to predation of juvenile steelhead (predation of adults is not a concern). This is of relevance given the potential effects on steelhead juveniles because of operations of the NDD (see Impact AQUA-93). Due to the uncertainty in the effectiveness of Environmental Commitment 15, there would be no demonstrable effect of this conservation measure on steelhead.

CEQA Conclusion: Due to the uncertainties associated with this Environmental Commitment, there would be no demonstrable effect on steelhead. This impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-104: Effects of Nonphysical Fish Barriers on Steelhead (Environmental Commitment 16)

As noted for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of Georgiana Slough from the Sacramento River would be intended to guide juvenile salmonid fish such as steelhead away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to the Sacramento River (Singer et al. 2013). As noted for spring-run Chinook salmon, exploration with the DPM of the potential effects of an NPB at this location suggests that with effectiveness similar to that observed during a pilot study in 2011 (Perry et al. 2012), through-Delta survival of juvenile Chinook salmon would not differ greatly between Alternative 4A and Existing Conditions or NAA_ELT (see Table 5.C.5.3-41 in the *BDCP Effects Analysis Appendix 5.C hereby incorporated by reference*). These results, which are assumed to also be applicable to steelhead given similar life histories, suggest that Environmental Commitment 16 could offset negative effects of the water conveyance facilities. As discussed for Alternative 1A, the physical structure of an NPB may provide habitat for piscivorous fish in the area and increase localized predation risk.

NEPA Effects: The effects of NPB would not be adverse because it is intended to improve migration survival.

CEQA Conclusion*:* As discussed above, the NPB at the divergence of Georgiana Slough from the Sacramento River has the potential to reduce the proportion of steelhead entering the low-survival interior Delta. The impacts of *Environmental Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant. Consequently, no mitigation would be required.

Sacramento Splittail

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to Sacramento splittail. As discussed for Alternative 1A, various life stages of Sacramento splittail would have the potential to overlap construction and maintenance to varying degrees (Table 11-8).

Impact AQUA-109: Effects of Construction of Water Conveyance Facilities on Sacramento Splittail

The potential effects of construction of the water conveyance facilities on Sacramento splittail would be the same as described for Alternative 4 (Impact AQUA-109). This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-109 in Alternative 4.

Table 11-8 presents the life stages of Sacramento splittail and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Under Alternative 4A, underwater noise generated by impact pile driving in or near open waters of the Delta can reach levels associated with potential injury of fish, including Sacramento splittail. The potential exists for relatively large numbers of young-of-the-year to occur in the vicinity of pile driving activities at the north Delta intakes, barge unloading facilities, Clifton Court Forebay, and Head of Old River operable barrier as larvae and juveniles disperse from upstream spawning and early rearing areas (riparian margins and floodplains) to the estuary in April-August. However, because of the relatively small area of open water affected by noise exceeding the injury thresholds (Table 4.3.7-1 under Delta Smelt), the limited duration of pile driving activities (Table 4.3.7-1 under Delta Smelt), and the lack of suitable rearing habitat in the affected areas, adverse effects would be limited to a small proportion of the population. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would further reduce these impacts. No significant population-level effects are expected.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-109, the effect would not be adverse for Sacramento splittail. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by splittail. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin habitat. Underwater noise produced by impact pile driving could result in adverse effects on splittail that occur in areas subject to noise levels exceeding the interim injury threshold for fish smaller than 2 grams (183 dB $SEL_{cumulative}$). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce these potential effects depending on the degree to which they can be implemented (see below).

CEQA Conclusion: As described in Alternative 4, Impact AQUA-109, the impact of the construction of the water conveyance facilities on splittail would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect splittail. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*).

Implementation of Mitigation Measures AQUA-1a and AQUA-1b would potentially reduce noise impacts to less than significant levels. The extent to which these measures can be implemented is unknown at this time. Significant impacts may be unavoidable if these measures cannot be implemented to a sufficient degree to substantially reduce the amount of impact driving or the noise levels produced by impact driving.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-110: Effects of Maintenance of Water Conveyance Facilities on Sacramento Splittail

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-110. Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect splittail. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on splittail from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As concluded in Alternative 4, Impact AQUA-110, the impact would not be adverse for Sacramento splittail.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-110, the impact of the maintenance of water conveyance facilities on Sacramento splittail would be less than significant and no mitigation is required. Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect splittail. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on splittail from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.

Operations of Water Conveyance Facilities

Impact AQUA-111: Effects of Water Operations on Entrainment of Sacramento Splittail

Water Exports from SWP/CVP South Delta Facilities

The salvage of splittail is considered an indicator of reproductive success more than of relative impact (Sommer et al. 1997); in contrast to other EIR/EIS alternatives for which juvenile splittail salvage was predicted using a historical relationship between Yolo Bypass inundation and salvage density at CVP and SWP, the analysis of splittail salvage for Alternative 4A used the per capita method, which evaluates how changes in exports would affect entrainment potential independent of other factors (This method is fully described in *BDCP Effects Analysis, Appendix 5B – Entrainment; Section 5.B.5.4.5 hereby incorporated by reference*). The per capita method was used because Yolo Bypass inundation is not included in the method, thus allowing an appropriate comparison between NAA_ELT (for which Yolo Bypass improvements would occur, but were not modeled) and H3_ELT (for which Yolo Bypass improvements would also occur as part of a program separate from Alternative 4A, and which was included in the modeling). The per capita rate of juvenile splittail entrainment under H3_ELT, which is an index of entrainment risk of an individual splittail and is directly related to the amount of water exported, averaged across all years would be reduced 37% for juveniles (Table 11-4A-91) and 54% for adults (Table 11-4A-92) compared to NAA_ELT. Adult entrainment and juvenile per capita entrainment are anticipated to be reduced in all water year types due to lower south Delta exports. Because Sacramento River and OMR flows are higher under the H4_ELT flow scenario for Alternative 4A compared to NAA_ELT, this scenario is expected to decrease entrainment loss at the south Delta more so than for the H3_ELT scenario.

Table 11-4A-91. Differences Between Model Scenarios in Juvenile Sacramento Splittail Entrainment Index[a] (Per Capita Method) at the SWP and CVP Salvage Facilities for Alternative 4A (Scenario H3_ELT) (See *BDCP Effects Analysis, Appendix 5B – Entrainment, Section 5B.6.1.7.1)*

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-1,036,669 (-52%)	-928,107 (-49%)
Above Normal	-54,102 (-41%)	-42,647 (-35%)
Below Normal	-1,789 (-18%)	-1,201 (-13%)
Dry	-579 (-29%)	-306 (-18%)
Critical	-611 (-46%)	-456 (-39%)
All Years	-234,987 (-43%)	-180,132 (-37%)

Shading indicates entrainment increased 10% or more.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] Estimated annual number of fish lost. Average (May–July).

Table 11-4A-92. Differences Between Model Scenarios in Adult Sacramento Splittail Entrainment Index[a] (salvage density method) at the SWP and CVP Salvage Facilities for Alternative 4A (Scenario H3_ELT) (See *BDCP Effects Analysis, Appendix 5B – Entrainment, Section 5B.6.1.7.1)*

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-2,790 (-70%)	-2,986 (-72%)
Above Normal	-3,294 (-68%)	-3,258 (-68%)
Below Normal	-1,352 (-40%)	-1,344 (-40%)
Dry	-680 (-28%)	-616 (-26%)
Critical	-594 (-18%)	-494 (-15%)
All Years	-1,875 (-54%)	-1,916 (-54%)

Shading indicates entrainment increased 10% or more.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] Estimated annual number of fish lost. Average (December–March).

Water Exports from SWP/CVP North Delta Intake Facilities

The north Delta intakes would be screened, and all splittail except larvae and juveniles less than 22 mm long would be excluded from entrainment (*BDCP Effects Analysis – Appendix 5B Entrainment, Section 5.B.6.2.4, hereby incorporated by reference*). Potential impacts would be minimized by the adaptive management plan under Alternative 4A, including monitoring of the new screens effectiveness and corrective measures if needed. This monitoring would be focused on listed species such as delta smelt and winter-run and spring-run Chinook salmon, but the temporal overlap of splittail early life stages with these species occurrence as larvae or juveniles near the north Delta intakes would result in de facto management for splittail. Although entrainment of smaller life stages at the north Delta intakes is likely to occur during lower flow years when floodplain inundation is less, the bulk of reproduction occurs when floodplains are inundated, which would occur more often under NAA_ELT and Alternative 4A because of Yolo Bypass improvements; splittail emerging from the Yolo Bypass at its downstream terminus in the Cache Slough subregion would not be susceptible to north Delta intake entrainment. In addition, the north Delta intakes would divert considerably less water in drier years, so that the risk of entrainment by the north Delta intakes would be less at times when there would be more juvenile splittail likely to be susceptible to entrainment, having not been spawned in the Yolo Bypass or other floodplains.

Predation Associated with Entrainment

Per-capita entrainment-related predation loss of splittail at the south Delta facilities is not expected to be greater under Alternative 4A than NAA_ELT because predicted per capita entrainment is lower due to lower south Delta exports. The predation loss would be lower under Scenario H4_ELT than under Scenario H3_ELT. However, because predation of entrained splittail is not currently considered to be an important driver of splittail population dynamics, this variation in the predicted impact in both Alternative 4A subscenarios is not considered to be adverse to splittail in either of these operational scenarios.

Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River, with three intakes for Alternative 4A. These losses would be offset by the reduction in entrainment and predation loss at the SWP/CVP south Delta intakes, habitat restoration under Environmental Commitment 6, and reduction in potential predation under Environmental Commitment 15. Further, as described for Alternative 1A and as noted for Alternative 4, the fishery agencies concluded that the predation was not a factor currently limiting splittail abundance. In addition, as described above for entrainment at the north Delta intakes, the importance of floodplain inundation (particularly the Yolo Bypass) and the resulting emigration of juvenile splittail to the Delta downstream of the intakes, plus the relatively low diversions from the north Delta intakes in drier years when floodplains would be less available, suggests a limited effect of predation.

NEPA Effects: In conclusion, the effect from entrainment and predation loss under Alternative 4A would not be adverse, because while predation loss of splittail would be potentially increased at the north Delta facilities, it would be offset by substantial reductions in per capita entrainment and associated predation at the south Delta facilities compared to the NAA_ELT actions, as well as other conservation measures (Environmental Commitment 6, Environmental Commitment 15, and potentially Environmental Commitment 16).

CEQA Conclusion: Operational activities associated with reduced south Delta water exports would result in an overall decrease in the proportion of splittail population entrained for all water year types. As discussed above, although entrainment of smaller life stages at the north Delta intakes is likely to occur during lower flow years when floodplain inundation is less, the bulk of reproduction occurs when floodplains are inundated, which would occur more often under NAA_ELT and Alternative 4A because of Yolo Bypass improvements; splittail emerging from the Yolo Bypass at its downstream terminus in the Cache Slough subregion would not be susceptible to north Delta intake entrainment. Also, as discussed above, there would be less water diverted from the north Delta intakes in drier years in which splittail reproduction was more focused in non-floodplain areas, which would limit the potential for entrainment by the north Delta intakes. Under Scenario H3_ELT, estimated juvenile entrainment (Per Capita method) and hence pre-screen predation losses would be 43% lower and adult entrainment and pre-screen predation losses would be 54% lower than Existing Conditions. Per capita entrainment and related predation loss at the south Delta would be further reduced under Scenario H4_ELT compared to Existing Conditions. The impact and conclusion for predation associated with entrainment would be the same as described above.

In conclusion, the impact of Alternative 4A from entrainment and predation loss would be less than significant because of improvements in overall proportional entrainment, and no mitigation is required.

Impact AQUA-112: Effects of Water Operations on Spawning and Egg Incubation Habitat for Sacramento Splittail

Sacramento splittail spawn in floodplains and channel margins and in side-channel habitat upstream of the Delta, primarily in the Sacramento River and Feather River. Floodplain spawning overwhelmingly dominates production in wet years. During low-flow years when floodplains are not inundated, spawning in side channels and channel margins would be much more critical.

In general, Alternative 4A would have little to no effect on splittail spawning habitat relative to the NAA_ELT because improvements to the Yolo Bypass would occur under the NAA_ELT and therefore would not differentiate Alternative 4A from NAA_ELT. There would be negligible effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River, with beneficial effects from moderate to substantial increases in mean monthly flow for some months and water year types for each location. There would be negligible negative effects on water temperatures in the Feather River and a beneficial effect from a decrease in exposure to critical high water temperatures.

H3_ELT/ESO_ELT

Floodplain Habitat

Effects of H3_ELT on floodplain spawning habitat were evaluated for Yolo Bypass. Note that, in contrast to other Alternatives, Alternative 4A does not include improvements to Yolo Bypass such as modification of the Fremont Weir; these improvements are assumed to occur as part of NAA_ELT (and therefore also are included in Alternative 4A, but are not as a result of the alternative). As described for Alternative 4, effects in Yolo Bypass were evaluated using a habitat suitability approach based on water depth (2 m threshold) and inundation duration (minimum of 30 days). Effects of flow velocity were ignored because flow velocity was generally very low throughout the modeled area for most conditions, with generally 80 to 90% of the total available area having flow velocities of 0.5 foot per second or less (a reasonable critical velocity for early life stages of splittail; Young and Cech 1996), and because habitat heterogeneity in the flooded Yolo Bypass is high (Sommer et al. 2005).

There would be little to no difference in floodplain habitat availability or acreage between NAA_ELT and Alternative 4A because Yolo Bypass improvements would be present in both (Table 11-4A-93; Table 11-4A-94).

Table 11-4A-93. Differences in Frequencies of Inundation Events (for 82-Year Simulations) of Different Durations on the Yolo Bypass under Different Scenarios and Water Year Types, February through June, from 15 2-D and Daily CALSIM II Modeling Runs

Number of Days of Continuous Inundation	Change in Number of Inundation Events for Each Scenario	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
30–49 Days		
Wet	-4	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	4	Little to no difference[a]
Dry	1	Little to no difference[a]
Critical	1	Little to no difference[a]
50–69 Days		
Wet	-5	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]
≥70 Days		
Wet	8	Little to no difference[a]
Above Normal	2	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the number of inundation events between NAA_ELT and H3_ELT.

Table 11-4A-94. Change in Splittail Weighted Habitat Area (HUs[c] and percent) in Yolo Bypass from Existing Biological Conditions to Alternative 4A by Water Year Type from 15 2-D and Daily CALSIM II Modeling Runs

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1,123 (73%)	Little to no difference[b]
Above Normal	715 (62%)	Little to no difference[b]
Below Normal	337 (257%)	Little to no difference[b]
Dry	8 (NA[a])	Little to no difference[b]
Critical	5 (NA[a])	Little to no difference[b]

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] NA percent differences could not be computed because no splittail weighted habitat occurred in the bypass for NAA_ELT and Existing Conditions in those years (dividing by 0).

[b] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the weighted habitat area between NAA_ELT and H3_ELT.

[c] HUs = Habitat Units. HUs were computed as the product of habitat acreage and a Habitat Suitability Index (based on water depth) that ranges from 0 to 1, where maximum suitability = 1. Therefore, HUs are always less than or equal to habitat acreage.

As noted for Alternative 4, a potential effect of Yolo Bypass improvements is changes in inundation of the Sutter Bypass as a result of increased flow diversion at the modified Fremont Weir. Because modification of the Fremont Weir would occur under Alternative 4A and the NAA_ELT, there would be little to no difference in inundated acreage in the lower Sutter Bypass between H3_ELT and NAA_ELT (Table 11-4A-95). Therefore, H3_ELT would not affect splittail spawning and rearing habitat in the Sutter Bypass relative to NAA_ELT.

Table 11-4A-95. Differences (and Percent Change) in Daily Average (December–June) Lower Sutter Bypass Inundation (acres)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-35 (-1.5)	Little to no difference[a]
Above Normal	55 (4.1)	Little to no difference[a]
Below Normal	-26 (-7.8)	Little to no difference[a]
Dry	-4 (-2.8)	Little to no difference[a]
Critical	1 (2.8)	Little to no difference[a]
All	1 (0.1)	Little to no difference[a]

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the lower Sutter Bypass inundation between NAA_ELT and H3_ELT.

Channel Margin and Side-Channel Habitat

In addition to spawning on floodplains, splittail spawning and larval and juvenile rearing also occur in channel margin and side-channel habitat upstream of the Delta. These habitats are likely to be especially important during dry years, when flows are too low to inundate the floodplains (Sommer et al. 2007). Side-channel habitats are affected by changes in flow because greater flows cause more flooding, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. Effects of the alternative on flows in years with low flows are expected to be most important to the splittail population because in years of high flows, when most production comes from floodplain habitats, the upstream side-channel habitats contribute relatively little production. However, as noted by Sommer (1997), splittail have high fecundity and so can respond rapidly to improvements in environmental conditions (e.g., floodplain inundation), so that very high recruitment occurs in years with floodplain inundation.

Effects on channel margin and side-channel habitat were evaluated by comparing flow conditions for the Sacramento River at Wilkins Slough and the Feather River at the confluence with the Sacramento River for the time-frame February through June. These are the most important months for splittail spawning and larval rearing (Sommer pers. comm.), and juveniles likely emigrate from the side-channel habitats during May and June if conditions become unfavorable.

Differences between model scenarios for monthly average flows during February through June by water-year type were determined for the Sacramento River at Wilkins Slough and for the Feather River at the confluence.

Flows under H3_ELT relative to NAA_ELT in the Sacramento River at Wilkins Slough were compared for the February through June spawning period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Modeling results indicate that H3_ELT would have primarily negligible effects (<5%) during February through April and May. During June, flows would be up to 16% greater under H3_ELT than under NAA_ELT). Due to the low magnitude and frequency of flow changes during June, this increase is not expected to have a biologically meaningful effect on splittail spawning conditions. Modeling results also show that Sacramento splittail spawning temperature tolerances would not be exceeded in the Sacramento River under Alternative 4A.

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) during February through June under H3_ELT would generally be similar to or greater than flows under NAA_ELT. Flows under H3_ELT during April, May, and June would be up to 77% greater than flows under NAA_ELT, which, due to the high magnitude and frequency of change, would be a beneficial effect to splittail. These flow increases would substantially increase the amount of channel margin and side channel habitat available for splittail spawning during the majority of the spawning period.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively, were used to investigate the potential effects of H3_ELT on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected as the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between NAA_ELT and H3_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F regardless of water year type (Table 11-4A-96). In the Feather River, there would be differences between NAA_ELT and H3_ELT in temperatures below 45°F. There would be a 6% reduction in the exceedance above the 75°F threshold for above normal water years but due to the low magnitude and frequency of this reduction, it is not expected to have a biologically meaningful effect on splittail.

Table 11-4A-96. Difference (Percent Difference) in Percent of Days or Months[a] during February to June in Which Temperature Would Be below 45°F or above 75°F in the Sacramento River at Hamilton City and Feather River at the Confluence with the Sacramento River[b]

	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Hamilton City		
Temperatures below 45°F		
Wet	-2.8 (-60%)	0 (0%)
Above Normal	-2.8 (-60%)	0 (0%)
Below Normal	-2.7 (-53%)	-0.2 (-8%)
Dry	-1.4 (-47%)	0 (0%)
Critical	-1.1 (-54%)	0 (0%)
All	-2.2 (-55%)	0 (0%)
Temperatures above 75°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Feather River at Sacramento River Confluence		
Temperatures below 45°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Temperatures above 75°F		
Wet	2.3 (NA)	0 (0%)
Above Normal	1.8 (NA)	-5.5 (-76%)
Below Normal	1.4 (NA)	-4.3 (-75%)
Dry	3.4 (77%)	-2.2 (-22%)
Critical	6.6 (396%)	0 (0%)
All	3.0 (243%)	-2.0 (-32%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.
[a] Days were used in the Sacramento River and months were used in the Feather River.
[b] Based on the modeling period of 1922 to 2003.

These results indicate that H3_ELT would cause no negative effects on splittail spawning conditions in channel margin and side-channel habitats resulting from changes in flow and water temperatures. Effects of H3_ELT on mean monthly flow would consist of negligible effects or increases in flow (increases up to 12% in the Sacramento River and to 77% in the Feather River) for some months and water year types in the spawning period that would have beneficial effects on rearing conditions. There would be negligible or beneficial project-related effects on exceedance of critical water temperatures in the Sacramento River, and a beneficial effect from a decrease (up to-6%) in exposure to critical high water temperatures in the Feather River.

Stranding Potential

As indicated above and as described for Alternative 4, rapid reductions in flow can dewater channel margin and side-channel habitats, potentially stranding splittail eggs and rearing larvae. Yolo Bypass improvements would occur under the NAA_ELT and therefore would exist under Alternative 4A, but there would be little to no difference in stranding potential between Alternative 4A and NAA_ELT.

H4_ELT/HOS_ELT

Floodplain Habitat

Floodplain habitat conditions for splittail under H4_ELT would be similar to conditions under H3_ELT, and would not differ from NAA_ELT because Yolo Bypass improvements are assumed to occur independently of Alternative 4A and therefore would be part of Alternative 4A as well as NAA_ELT.

Channel Margin and Side-Channel Habitat

Flows under H4_ELT in the Sacramento River at Wilkins Slough during February through June would be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the Feather River at the Sacramento River confluence under H4_ELT would be up to 119% higher than under NAA_ELT, a benefit to splittail. Flows at these two locations are representative of the reach of these rivers where splittail spawn on wetted channel margin and side channels.

There would be no biologically meaningful difference (<5% difference on an absolute scale) between NAA_ELT and H4_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F regardless of water year type (Table 11-4A-97). In the Feather River, there would be differences between NAA_ELT and H4_ELT in temperatures below 45°F. There would be a 6% reduction in the exceedance above the 75°F threshold for above normal water years under H4_ELT relative to NAA_ELT, but no other differences.

Table 11-4A-97. Difference (Percent Difference) in Percent of Days or Months[a] during February to June in Which Temperature Would Be below 45°F or above 75°F in the Sacramento River at Hamilton City and Feather River at the Confluence with the Sacramento River[b]

	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Sacramento River at Hamilton City		
Temperatures below 45°F		
Wet	-2.8 (-60%)	0 (0%)
Above Normal	-2.8 (-60%)	0 (0%)
Below Normal	-2.6 (-51%)	-0.1 (-4%)
Dry	-1.4 (-47%)	0 (0%)
Critical	-1.1 (-54%)	0 (0%)
All	-2.2 (-55%)	0 (0%)
Temperatures above 75°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Feather River at Sacramento River Confluence		
Temperatures below 45°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Temperatures above 75°F		
Wet	3.8 (NA)	1.5 (702%)
Above Normal	5.5 (NA)	-1.8 (-25%)
Below Normal	1.4 (NA)	-4.3 (-75%)
Dry	5.6 (126%)	0 (0%)
Critical	5 (300%)	-1.6 (-19%)
All	4.2 (340%)	-0.8 (-13%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

[a] Days were used in the Sacramento River and months were used in the Feather River.

[b] Based on the modeling period of 1922 to 2003.

Stranding Potential

As noted for H3_ELT, because the improvements to Yolo Bypass such as Fremont Weir modifications would occur under the NAA_ELT and therefore would exist under Alternative 4A, there would be no difference in stranding potential between H4_ELT and NAA_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. The effects of H3_ELT on splittail spawning would consist of negligible effects and beneficial effects in some months on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough generally <5% change in flow) and the Feather River (increases in mean monthly flow up to 119%), and negligible or beneficial effects on water temperatures in the Sacramento and Feather Rivers (<5% change).

CEQA Conclusion: In general, Alternative 4A would have no effect on splittail spawning habitat relative to Existing Conditions. There would be negligible flow- and temperature-related effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River. Yolo Bypass improvements (e.g., modification of Fremont Weir) would occur irrespective of Alternative 4A, but are not included in Existing Conditions, so there would be generally beneficial effects to splittail coinciding with the implementation of Alternative 4A (but not as a result of Alternative 4A).

H3_ELT/ESO_ELT

Floodplain Habitat

As noted elsewhere in the analysis of Alternative 4A for splittail, increases in floodplain habitat because of Fremont Weir modifications during Yolo Bypass improvements are assumed to occur independently of Alternative 4A and would be part of NAA_ELT as well as Alternative 4A. Comparisons of splittail weighted inundation frequencies for H3_ELT and Existing Conditions show relatively small increases in drier years under H3_ELT. In wet years, there are reductions under H3_ELT in the frequencies of the shorter inundation periods and an increase in the frequency of the longest inundation periods (70 days or more) because a number what would be shorter inundation periods under Existing Conditions merge to produce longer inundation periods under H3_ELT (Table 11-4A-93).The availability of suitable spawning habitat would be greater under H3_ELT than under Existing Conditions (Table 11-4A-94), with increases of between 5 and 979 Habitat Units (HUs; see footnote in Table 11-5A-61) of suitable spawning habitat depending on water year type. Increased HUs for wet, above normal, and below normal water years are predicted to be 73%, 62%, and 257%, respectively for H3_ELT. Comparisons for dry and critical water years indicate project-related increases of 8 and 5 HUs of suitable spawning habitat, respectively, compared to 0 HUs for Existing Conditions. There would generally be no or small differences (8% lower in below normal years) in splittail spawning and rearing habitat in the Sutter Bypass under H3_ELT relative to Existing Conditions (Table 11-4A-95). These results indicate that under H3_ELT the extent of suitable spawning habitats would be up to 257% greater than under Existing Conditions, although the difference would not be as a result of implementation of Alternative 4A, but instead from separate Yolo Bypass improvements that are assumed to take place regardless of Alternative 4A.

Channel Margin and Side-Channel Habitat

Flows were compared between H3_ELT and Existing Conditions for the Sacramento River at Wilkins Slough (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) during February through June Flows under H3_ELT would generally not differ (<5%) from those under Existing Conditions during February through May although flows during June would be up to 18% higher under H3_ELT. Due to the low magnitude and frequency of flow changes during June, this increase is not expected to have a biologically meaningful effect on splittail spawning conditions.

Results for the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) show variable effects of H3_ELT depending on month and water year type. Results for all months except April include negligible effects (<5%), small to large increases in mean monthly flow (to 71%), and small to moderate decreases (up to -15%). During April. Flows would be generally similar between H3_ELT and Existing Conditions. Based on a prevalence of negligible (<5%) or beneficial effects on flow (increases to 71%), and isolated decreases that would be of small magnitude, these results indicate that effects of Alternative 4A on flow would not have biologically meaningful negative effects on splittail spawning conditions in channel margin and side-channel habitats in the Feather River.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively, were used to investigate the potential effects of H3_ELT on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected as the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between Existing Conditions and H3_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F regardless of water year type (Table 11-4A-96). In the Feather River, there would be differences between Existing Conditions and H3_ELT in temperatures below 45°F. There would be a 7% increase in the exceedance above the 75°F threshold under H3_ELT relative to Existing Conditions in critical water years, but no other differences.

Stranding Potential

As noted for other alternatives, and due to a lack of quantitative tools and historical data to evaluate possible stranding effects, the following provides a narrative summary of potential effects in relation to stranding potential. The Yolo Bypass is exceptionally well-drained because of grading for agriculture, which likely helps limit stranding mortality of splittail. Moreover, water stage decreases on the bypass are relatively gradual (Sommer et al. 2001). Stranding of Sacramento splittail in perennial ponds on the Yolo Bypass does not appear to be a problem under Existing Conditions (Feyrer et al. 2004). Yolo Bypass improvements (occurring independently of Alternative 4A) would be designed, in part, to further reduce the risk of stranding by allowing water to inundate certain areas of the bypass to maximize biological benefits, while keeping water away from other areas to reduce stranding in isolated ponds. Actions to increase the frequency of Yolo Bypass inundation that are separate from Alternative 4A but that would coincide with Alternative 4A would increase the frequency of potential stranding events in relation to Existing Conditions. For splittail, an increase in inundation frequency would also increase the production of Sacramento splittail in the bypass. While total stranding losses may be greater under Alternative 4A than under Existing Conditions (although not as a result of Alternative 4A), the total number of splittail would be expected to be greater under Alternative 4A (again, not as a result of Alternative 4A, but coincident with it).

In the Yolo Bypass, Sommer et al. (2005) found these potential losses are offset by the improvement in rearing conditions. Henning et al. (2006) also noted the potential for stranding risk as wetlands desiccate and oxygen concentrations decline, but the seasonal timing of use by juveniles may decrease these risks. Sommer et al. (2005) addressed the question of stranding and concluded the potential improvements in habitat capacity outweighed the potential stranding problems that may exist in some years. Overall, these effects are less than significant.

H4_ELT/HOS_ELT

Floodplain Habitat

Floodplain habitat conditions for splittail under H4_ELT would be similar to conditions under H3_ELT, and would not differ from NAA_ELT because Yolo Bypass improvements are assumed to occur independently of Alternative 4A and therefore would be part of Alternative 4A as well as NAA_ELT.

Channel Margin and Side-Channel Habitat

Flows under H4_ELT in the Sacramento River at Wilkins Slough during February through June would generally be similar to flows under Existing Conditions with some increases (up to 11%) and decreases (up to 12%) depending on month and water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the Feather River at the Sacramento River confluence under H4_ELT would generally be similar to those under Existing Conditions between February and May and up to 77% higher during June, a benefit to splittail.

There would be no biologically meaningful difference (>5% absolute scale) between Existing Conditions and H4_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F regardless of water year type (Table 11-4A-97). In the Feather River, there would be differences between Existing Conditions and H4_ELT in temperatures below 45°F. There would be a 6% increase in the exceedance above the 75°F threshold for above normal water and dry years under H4_ELT relative to Existing Conditions, but no other differences. These increases are not expected to cause a biologically meaningful negative effect to splittail due to their low magnitude and frequency.

Summary of CEQA Conclusion

Collectively, these results indicate that the impact is not significant because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline, but not as a result of Alternative 4A, and the net result would be expected to be beneficial. No mitigation is necessary.

Impact AQUA-113: Effects of Water Operations on Rearing Habitat for Sacramento Splittail

H3_ELT/ESO_ELT

Because both Alternative 4A and NAA_ELT are assumed to include Yolo Bypass improvements including Fremont Weir modification, there would be little to no difference in the quantity and quality of rearing habitat in the Yolo Bypass. There would be no effect on rearing conditions in channel margin and side-channel habitats due to negligible changes in mean monthly flow and water temperatures during most of the rearing period in the Sacramento River and the Feather River.

Floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for H3_ELT. The small and infrequent changes to flow under H3_ELT described above would also not substantially affect splittail rearing habitat conditions.

H4_ELT/HOS_ELT

Because flows and water temperatures under H4_ELT would be similar to those under H3_ELT, conclusions for H4_ELT are similar to those under H3_ELT.

NEPA Effects: Based on the analyses above, the effect of Alternative 4 on splittail rearing habitat is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion: In general, there would be no effect of Alternative 4A on splittail rearing habitat relative to Existing Conditions.

H3_ELT/ESO_ELT

As described above, floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. Alternative 4A would not result in changes in floodplain habitat, although there would be a greater extent of floodplain habitat available coincident with implementation of Alternative 4A because of Yolo Bypass improvements (e.g., Fremont Weir modification) that would occur regardless of Alternative 4A but that are not current present under Existing Conditions. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for H3_ELT.

H4_ELT/HOS_ELT

Because flows and water temperatures under H4_ELT would be similar to those under H3_ELT, conclusions for H4_ELT are similar to those under H3_ELT.

Summary of CEQA Conclusion

Based on the analyses above, the impact of Alternative 4 on splittail rearing habitat is not significant because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 4A. No mitigation is necessary.

Impact AQUA-114: Effects of Water Operations on Migration Conditions for Sacramento Splittail

Upstream of the Delta

In general, Alternative 4A would not affect migration conditions for juvenile or adult splittail in the Sacramento River or the Feather River relative to the NAA_ELT based on negligible or beneficial effects on mean monthly flow during the migration period and negligible effects on exposure to critical water temperatures in the Feather River. Adults migrate upstream primarily in December through March and juvenile migrate primarily in April through July (Moyle et al. 2004).

H3_ELT/ESO_ELT

The effects of H3_ELT on splittail migration conditions would be the same as described for channel margin and side-channel habitats in the Sacramento River and Feather River for Impact AQUA-112 above. There would be no effect of H3_ELT on channel margin and side-channel habitat in either location because there would be negligible changes in mean monthly flow and water temperatures compared to NAA_ELT.

H4_ELT/HOS_ELT

The effects of H4_ELT on splittail migration conditions would be the same as described for channel margin and side-channel habitats in the Sacramento River and Feather River for Impact AQUA-112 above. These effects would be similar to those for H3_ELT.

Through-Delta

Alternative 4A would generally improve OMR reverse flows during the period of juvenile splittail migration through the Delta under all flow scenarios. Modeled OMR flows under Alternative 4A would be reduced slightly in May compared to other months under all flow scenarios, but flows would still be less negative than under NAA_ELT. Modeled OMR flows would be increased in June and July under Alternative 4A flow scenarios compared to baseline conditions (NAA_ELT). Based on the modeling, overall OMR flows improve during the splittail migration period. For juvenile splittail migrating down the Sacramento River past the north Delta intakes, migration flows downstream of the north Delta intakes under Alternative 4A generally would be somewhat reduced relative to NAA_ELT, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). As noted in the analysis of entrainment potential above, the greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 4A because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences.

NEPA Effects: The effect of Alternative 4A is not adverse because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion: Overall, the effects of water operations on migration conditions for Sacramento splittail are less than significant.

Upstream of the Delta

In general, effects of Alternative 4A would have no effect on splittail migration conditions relative to Existing Conditions due to a lack of effects to flows and water temperatures in the Sacramento River and the Feather River during the splittail migration period.

H3_ELT/ESO_ELT

Effects of H3_ELT on splittail migration conditions are the same as described for channel margin and side-channel habitats in Impact AQUA-112.

H4_ELT/HOS_ELT

The effects of H4_ELT on splittail migration conditions would be the same as described for channel margin and side-channel habitats in the Sacramento River and Feather River for Impact AQUA-112 above. These effects would be similar to those for H3_ELT.

Through-Delta

Average modeled OMR flows would be greater under Scenario H3_ELT than the CEQA baseline during the majority of the juvenile splittail migration through the Delta. OMR flow conditions under Scenario H4 would further improve migration conditions for juvenile splittail. For juvenile splittail migrating down the Sacramento River past the north Delta intakes, migration flows downstream of the north Delta intakes under Alternative 4A generally would be somewhat reduced relative to NAA_ELT, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). As noted in the analysis of entrainment potential above, the greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 4A because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences. The greater availability of the Yolo Bypass under Alternative 4A compared to Existing Conditions would improve migration conditions for splittail that are able to access the Bypass. Therefore the impact on splittail migration survival is concluded to be less than significant.

Summary of CEQA Conclusion

The impact is less than significant because it would not substantially reduce suitable migration habitat or substantially reduce the number of fish as a result of mortality and no mitigation is necessary. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 4A. No mitigation is necessary.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for winter-run Chinook salmon generally would be similar for splittail, which could overlap restoration measure effects. However, because the extent of restoration is limited to offsetting losses from construction of water facilities under the water conveyance facilities, any such effects would be greatly limited compared to Alternative 1A and 4, for example.

Impact AQUA-115: Effects of Construction of Restoration Measures on Sacramento Splittail

As noted for Alternative 1A's discussion of Impact AQUA-115, in-water and shoreline construction activities (e.g., riprap removal and levee breaching; shoreline excavation and recontouring) could increase turbidity, but splittail are tolerant of such increases. In addition, implementation of the environmental commitments described under Impact AQUA-1 for delta smelt and in Appendix 3B, *Environmental Commitments,* of the Draft EIR/EIS (*Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*), would minimize or eliminate any potential negative effects on splittail from construction of the restoration measures.

NEPA Effects**:** The effects of short-term construction activities would not be adverse to splittail. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on splittail. The relevant environmental commitments are: *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*. Pertinent details of these plans are provided under Impact AQUA-1.

CEQA Conclusion**:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on splittail but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce splittail habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-116: Effects of Contaminants Associated with Restoration Measures on Sacramento Splittail

As noted in the more detailed analysis of Impact AQUA-116 for Alternative 1A, potential impacts on Sacramento splittail from effects of methylmercury, selenium, copper, ammonia, and pesticides associated with habitat restoration activities would be similar to those discussed in detail for delta smelt (see Impact AQUA-8) except that Sacramento splittail is a benthic forager so the release of sediment borne contaminants may result in greater effects for this species. Alternative 4A would restore 59 acres of tidal wetlands that have the potential to temporarily increase contaminant exposure to fish in the Delta. Additionally, depending on the specific site conditions of the restoration, benthic grazers that bioaccumulate selenium, which splittail feed on, may colonize and increase the potential for splittail exposure to selenium. However, this restoration and its potential contaminant effects would be negligible given the very small area that would be restored.

NEPA Effects: As noted for other species, while Alternative 4A habitat restoration actions may result in a very small increase in production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in splittail. Overall, the effects of contaminants associated with restoration measures would not be adverse for splittail.

CEQA Conclusion: Habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in splittail. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Regarding selenium, the amount of restoration (59) acres would have a negligible effect on the potential for benthic grazers to colonize and bioaccumulate selenium that could be consumed by splittail and substantially affect them. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect splittail either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-117: Effects of Restored Habitat Conditions on Sacramento Splittail

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on splittail would not be adverse because restoration is intended to provide habitat benefits for splittail.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on splittail would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for other covered species, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for splittail remains the same.

Impact AQUA-118: Effects of Methylmercury Management on Sacramento Splittail (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to splittail because they have similar potential to be exposed to methylmercury in the Delta.

NEPA Effects: The effects of methylmercury management on splittail would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on splittail would be less than significant. Consequently, no mitigation is required.

Impact AQUA-121: Effects of Localized Reduction of Predatory Fish on Sacramento Splittail (Environmental Commitment 15)

NEPA Effects: Potential impacts on Sacramento splittail from predator removal at the north Delta intakes and at the south Delta export facilities is expected to slightly reduce the predation rates on Sacramento splittail. However and as concluded for Alternative 1A (Impact AQUA-121), because the affected proportion of the population would be very small this effect would not be detectable. There would not be an adverse effect on splittail.

CEQA Conclusion: Because the proportion of the population affected by Environmental Commitment 15 would be very small and not measurable, there would be a less than significant impact to splittail. Consequently, no mitigation would be required.

Impact AQUA-122: Effects of Nonphysical Fish Barriers on Sacramento Splittail (Environmental Commitment 16)

As described for Alternative 1A, although the NPB at the divergence of Georgiana Slough from the Sacramento River under Alternative 4A would be constructed and operated to benefit salmonids, Sacramento splittail are likely to also be deterred by the NPB based on their hearing ability and strong swimming ability as young juveniles. This would reduce the risk of predation for juvenile splittail by reducing their entry into the low-survival interior Delta.

NEPA Effects: The NPB also has the potential to attract predatory fish, which often hold around underwater human-made structure. Therefore, there is a slightly increased risk of predation for juvenile Sacramento splittail in the area immediately around the NPB. However, the structure is intended to promote successful survival of salmonids and designs are being tested to minimize any risk of predation associated with the structure. Additionally, the 2011 pilot study of the NPB at Georgiana Slough did not find that predation near the NPB was more frequent than predation farther from the NPB (DWR 2012). As such, the overall effects of NPB would not be adverse.

CEQA Conclusion: As described for Alternative 1A, the first months of the juvenile Sacramento splittail migration to the Delta overlap with the latter portion of the main juvenile salmonid outmigration period during which the NPB would be implemented. Deterrence away from the interior Delta would reduce the risk of predation for juvenile splittail, although the NPB also has the potential to attract predatory fish, which often hold around underwater human-made structures. Therefore, there is a slightly increased risk of predation for juvenile Sacramento splittail in the area immediately around the NPB. However the overall impacts of the NPB are expected to be less than significant on Sacramento splittail because they would reduce entry into the low-survival interior Delta, where entrainment and predation potential increases. Consequently, no mitigation would be required.

Green Sturgeon

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to green sturgeon. Adult and juvenile green sturgeon would have the potential to encounter construction and maintenance because of their presence in the Delta for considerable periods of time (Table 11-8).

Impact AQUA-127: Effects of Construction of Water Conveyance Facilities on Green Sturgeon

The potential effects of construction of the water conveyance facilities on green sturgeon or their designated critical habitat would be the same as described for Alternative 4 (Impact AQUA-127). This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-127 in Alternative 4.

Table 11-8 presents the life stages of green sturgeon and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Based on the proposed timing of pile driving activities and the occurrence of sensitive life stages of the covered species in the affected reaches, green sturgeon are considered most vulnerable to pile driving impacts because of their potential year-round presence in the plan area.

Under Alternative 4A, impact pile driving could result in exposure of juvenile and adult green sturgeon to underwater noise levels exceeding the injury thresholds at a number of construction sites where in-water pile driving is proposed. The potential for exposure of adults and juveniles to pile driving noise is highest in the north Delta (Sacramento River in the vicinity of the three proposed intakes) which serves as the primary migration route utilized by adults to access upstream spawning areas, and the primary migration route for juveniles entering the Delta from natal rearing areas in the upper Sacramento River. Restricting impact pile driving to June 1 to October 31 avoids the peak periods of upstream migration of adults (late February to early May) although some adults may migrate through the Delta as late as June or July. Some adults may also be exposed to pile driving noise during their outmigration; outmigration of tagged adults has been observed during summer (June–August) and late fall or winter (November-December) coincident with increases in flow from the first significant rain events (Heublein et al. 2009). Juvenile and sub-adult green sturgeon may be present in the Delta year-round and therefore subject to pile driving noise during pile driving activities at the proposed intakes, barge landings, and other in-water structures. Following the larval rearing period, young-of-the-year juveniles enter the Delta where they continue to rear for up to three years before entering the ocean. Fish salvage data collected at the state and federal water export facilities in the southern Delta indicate that juvenile green sturgeon in the Delta range in length from 100 to 600 mm, with most being greater than 200 mm (Adams et al. 2002, Beamesderfer et al. 2007).

Several factors likely reduce the potential for injury or mortality of adult and juvenile sturgeon during pile driving activities at the proposed intake structures. As described earlier, the estimated impact distances above are worst-case estimates based on impact driving in open water with no attenuation measures and an unimpeded underwater propagation path. To mitigate potential adverse effects, DWR proposes to use vibratory driving to the extent feasible to minimize both the area and duration of potentially harmful underwater noise levels associated with impact driving in open water outside the work window (Mitigation Measure AQUA-1a). In addition, construction of the intake facilities would be spread out over a period of five years, limiting the number of sites where pile driving will take place and the duration of impact driving in any given year (Table 4.3.7-1 under Delta Smelt). Although pile driving activities could occur 42 to 55 days per season at each intake location, in-water pile driving will not be continuous and limited to daylight hours only, resulting in 12-16 hour periods each day for migrating fish to pass the construction sites undisturbed.

Several aspects of green sturgeon life history and biology also affect the potential for injury or mortality of adult and juvenile green sturgeon to pile driving noise. All in-water pile driving will be performed after June 1 and before October 31, avoiding the primary upstream and downstream migration periods of pre- and post-spawning adults. Adult sturgeon are large (>19 kilograms) and presumably much less vulnerable to pile driving noise than smaller fish (approximately 2 grams or smaller) protected by the SPL and SEL injury criteria. In addition, adult sturgeon are highly mobile and thus able to rapidly avoid or swim away from areas of elevated noise. Their exposure would also be limited by their rapid migration rate; recent telemetry studies indicate that adult green sturgeon migrate rapidly to and from spawning areas in the upper Sacramento River, traversing the estuary and Delta in less than one week (Heublein et al. 2009). The behavioral responses of green sturgeon to pile driving noise are unknown but could include disruptions of normal migratory behavior and potential delays in migration. However, given the intermittent nature of pile driving and the daily cessation of pile driving at night, such delays are expected to be minor and not affect the ability of adults to successfully reach the spawning grounds.

Because of their relatively small body size, widespread distribution, and year-round presence in the Delta and estuary, juvenile and sub-adult green sturgeon are at higher risk of injury and mortality to pile driving noise than adults. Similar to adults, the potential for exposure to pile driving noise is highest in the North Delta (Sacramento River in the vicinity of the three proposed intakes) which serves as the primary migration route for young-of-the-year juveniles entering the Delta from natal rearing areas in the upper Sacramento River. Based on the size distribution of juveniles observed at the export facilities in the southern Delta, most juveniles entering the Delta would be expected to be actively swimming juveniles (>100 mm in length) capable of avoiding or swimming away from areas of elevated noise. Because juveniles spend the majority of their lives in deep brackish portions of the estuary before entering the ocean (Moyle 2002), the Sacramento River adjacent to the proposed intake locations likely serves primarily as a migratory corridor, reducing the duration of potential exposures of juveniles to pile driving sound. Another factor that may contribute to reducing the exposure of juveniles to pile driving noise would be the cessation of pile driving activities at night when juveniles appear to be most active and higher in the water column (Kynard et al. 2005).

A number of data sources suggest that the distribution of juvenile green sturgeon is widespread in the Delta and estuary, indicating that juvenile green sturgeon could be exposed to pile driving sounds at a number of construction sites in the Delta. In the absence of information on the movements and distribution of juveniles, potential impacts to the population can be generally assessed based on the proportion of total habitat subject to pile driving sounds. Under existing conditions, the Delta comprises an estimated 84,280 acres of subtidal aquatic habitat. Using this estimate as a measure of the total amount of potential foraging and rearing habitat available to juveniles, Table 4.3.7-2 shows the percentage of habitat that would be subjected to pile driving noise exceeding the injury thresholds during each year of pile driving activities.

Table 4.3.7-2. Potential underwater noise impact areas in each year of pile driving activities as a percentage of the total amount of subtidal aquatic habitat in the Delta (Alternative 4A).

Construction Year	Facilities/Structures	Potential Impact Area (acres)	Approximate Percentage of Subtidal Habitat
2	Intake 5 cofferdams	69	<0.1%
3	Intake 3 cofferdams Intake 5 foundation piles	153	0.2%
4	Intake 2 cofferdams Intake 3 foundation piles Intake 5 bridge piles	204	0.2%
5	Intake 2 foundation piles Intake 3 bridge piles Barge unloading facilities (5)	3,436	4.1%
6	Intake 2 bridge piles	45	<0.1%
7	HOR barrier cofferdams and foundation	36	<0.1%
8	CCF cofferdams	364	0.4%
9	CCF siphons	175	0.2%

These estimates represent a general order-of-magnitude estimate of the potential exposure of the population to pile driving noise. Thus, potential for exposure of the population to project pile driving noise is very low in most years. The exception is year 5 when an estimated 3,436 acres or 4.1% of the total amount of subtidal habitat would be subject to pile driving noise levels that could harm juvenile green sturgeon. This potential impact is due largely to the construction of six barge unloading facilities at various locations along the pipeline/tunnel alignment. Factors that may further limit exposure of the population to adverse effects include the short duration of pile driving activities at most locations (Table 4.3.7-1 under Delta Smelt). In addition, the total area of habitat available to juvenile green sturgeon expands beyond the Delta into the lower estuary and bays as juveniles grow and develop salinity tolerance. Juvenile typically achieve full tolerance by the end of their first year at sizes larger than 250 mm (Adams et al. 2002). Thus, there is a low likelihood of significant population-level effects on green sturgeon due to pile driving noise.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-127, the effect would not be adverse for green sturgeon. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by green sturgeon. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on green sturgeon that may be present could be adverse if sturgeon are exposed. However, considering the ability of green sturgeon to move away from the noise and migrate during the night or other times that pile driving is not occurring, the relatively few green sturgeon in the area of pile driving, and the implementation of Mitigation Measures AQUA-1a and AQUA-1b, that would minimize exposure, this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-127, the impact of the construction of the water conveyance facilities on green sturgeon would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect green sturgeon. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-128: Effects of Maintenance of Water Conveyance Facilities on Green Sturgeon

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-128. As concluded in Alternative 4, Impact AQUA-128, the impact would not be adverse for green sturgeon.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-128, the impact of maintenance of water conveyance facilities on green sturgeon or their designated critical habitat would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-129: Effects of Water Operations on Entrainment of Green Sturgeon

Water Exports

The potential entrainment effects under Alternative 4A would be the same as those under Alternative 4, which reflects the analysis for Alternative 1A. Operating new north Delta intakes and conveyance for SWP have the potential to avoid or reduce entrainment as described for Alternative 1A; there would be no adverse effect.

Scenario H3_ELT would substantially reduce entrainment of juvenile green sturgeon at the south Delta export facilities. Entrainment loss would be reduced 56% in wetter years and by 37% in drier years under Scenario H3_ELT compared to NAA_ELT (Table 11-4A-98). Entrainment losses of green sturgeon would be somewhat less under HOS_ELT. Under both the H3_ELT and H4_ELT scenarios, however, entrainment at the south Delta facilities would be substantially reduced compared to the NAA_ELT.

Table 11-4A-98. Juvenile Green Sturgeon Entrainment Index at the SWP and CVP Salvage Facilities—Differences (Absolute and Percentage) between Model Scenarios for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year Type[b]	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet and Above Normal	-68 (-58%)	-62 (-56%)
Below Normal, Dry, and Critical	-21 (-43%)	-17 (-37%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[a] Estimated annual number of fish lost, based on non-normalized data.

[b] Sacramento Valley water year-types.

Predation Associated with Entrainment

Entrainment-related predation loss of juvenile green sturgeon would not be greater under Alternative 4A and may be lower relative to baseline due to a reduction in entrainment loss. Conditions under Scenario H4_ELT would likely reduce predation loss relative to Scenario H3_ELT. The impact and conclusion for predation risk associated with NPB structures and the north Delta intakes would be the same as described for Alternative 1A (Impact AQUA-129).

NEPA Effects: In conclusion, the effect of Alternative 4A on entrainment and associated predation of green sturgeon would not be adverse and may provide modest benefit due to reduced losses at the south Delta facilities.

CEQA Conclusion: Similar to differences in south Delta entrainment described above for the NAA_ELT, there would be decreases in south Delta entrainment under H3_ELT relative to Existing Conditions (58% in wetter years; 43% in drier years; Table 11-4A-90). Therefore, the impact of the water operations on green sturgeon related to entrainment and associated predation losses would be less than significant and no mitigation would be required.

Impact AQUA-130: Effects of Water Operations on Spawning and Egg Incubation Habitat for Green Sturgeon

In general, Alternative 4A would not affect spawning and egg incubation habitat for green sturgeon relative to the NAA_ELT.

H3_ELT/ESO_ELT

Sacramento River

Mean flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Lower flows can reduce the instream area available for spawning and egg incubation. Mean flows under H3_ELT would generally be similar to or up to 12% greater than flows under NAA_ELT for all months and water year types at both locations

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River*

Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 63°F identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 63°F threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-99. There would be no substantial differences between NAA_ELT and H3_ELT in the number of years with each "level of concern".

Table 11-4A-99. Differences between Baseline and H3_ELT Scenarios in the Number of Years in Which Water Temperature Exceedances above 63°F are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Red	3 (75%)	0 (0%)
Orange	0 (0%)	0 (0%)
Yellow	1 (50%)	-1 (-25%)
None	-4 (-5%)	1 (1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Total degree-days exceeding 63°F at Bend Bridge were summed by month and water year type during May through September (Table 11-4A-100). Total degree-days (all water years combined) under H3_ELT would be 18% lower than under NAA_ELT during July and similar to the total under NAA_ELT in the remaining 4 months.

Table 11-4A-100. Differences between Baseline and H3_ELT Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
May	Wet	17 (131%)	0 (0%)
	Above Normal	0 (NA)	-2 (-100%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	2 (NA)	1 (100%)
	All	19 (146%)	-1 (-3%)
June	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
July	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	129 (1613%)	-30 (-18%)
	All	129 (1613%)	-30 (-18%)
August	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	28 (NA)	-1 (-3%)
	Critical	610 (303%)	-56 (-6%)
	All	638 (317%)	-57 (-6%)
September	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	4 (NA)	3 (300%)
	Dry	137 (442%)	7 (4%)
	Critical	497 (186%)	-44 (-5%)
	All	638 (214%)	-34 (-4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and during the February through June green sturgeon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT at Thermalito would generally be similar to or up to 106% greater (June of below normal years) than flows under NAA_ELT, with minor exceptions. Differences at the confluence with the Sacramento River would generally be similar to but smaller than those at Thermalito. These results indicate that flows in the Feather River would increase overall under H3_ELT independent of climate change.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) between NAA_ELT and H3_ELT in mean water temperatures for any month or water year type during the period.

Water temperature-related effects of H3_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures exceed a 64°F temperature threshold at Gridley (Table 11-4A-101). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. The percent of months exceeding the threshold during May and June under H3_ELT would generally be similar to or up to 26% lower (absolute difference) than that under NAA_ELT with few exceptions.

Table 11-4A-101. Differences between Baselines and H3_ELT in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
May	25 (77%)	16 (87%)	7 (75%)	9 (233%)	4 (150%)
June	2 (3%)	1 (1%)	-1 (-2%)	1 (2%)	-1 (-3%)
July	0 (0%)	0 (0%)	0 (0%)	9 (10%)	20 (29%)
August	0 (0%)	0 (0%)	7 (8%)	14 (17%)	19 (30%)
September	-9 (-13%)	-9 (-16%)	5 (17%)	14 (183%)	5 (200%)
NAA_ELT vs. H3_ELT					
May	-4 (-6%)	-1 (-3%)	-5 (-22%)	0 (0%)	0 (0%)
June	-1 (-1%)	-6 (-6%)	-14 (-15%)	-21 (-24%)	-26 (-36%)
July	0 (0%)	0 (0%)	0 (0%)	-1 (-1%)	4 (4%)
August	0 (0%)	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-2%)
September	10 (20%)	6 (16%)	5 (17%)	1 (6%)	-1 (-14%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Water temperature-related effects of H3_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-4A-102). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. Combining water years, total degree-months exceeding the threshold during May and June under H3_ELT would be 6% to 23% lower relative to NAA_ELT. Within months, total degree-months under H3_ELT would be similar or up to 45% lower than that under NAA_ELT depending on month and water year type. These results indicate that there would be a small to moderate benefit of H3_ELT to green sturgeon spawning and egg incubation temperature-related conditions in the Feather River.

Table 11-4A-102. Differences between Baselines and H3_ELT in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
May	Wet	11 (183%)	0 (0%)
	Above Normal	4 (36%)	-4 (-21%)
	Below Normal	12 (150%)	-1 (-5%)
	Dry	16 (114%)	-1 (-3%)
	Critical	12 (71%)	-1 (-3%)
	All	55 (98%)	-7 (-6%)
June	Wet	12 (16%)	-32 (-27%)
	Above Normal	-6 (-12%)	-23 (-34%)
	Below Normal	-19 (-29%)	-37 (-45%)
	Dry	10 (11%)	-16 (-13%)
	Critical	21 (38%)	1 (1%)
	All	18 (5%)	-107 (-23%)
July	Wet	11 (7%)	6 (3%)
	Above Normal	5 (9%)	0 (0%)
	Below Normal	19 (28%)	4 (5%)
	Dry	46 (53%)	20 (18%)
	Critical	58 (73%)	32 (30%)
	All	139 (31%)	62 (12%)
August	Wet	5 (3%)	8 (5%)
	Above Normal	15 (33%)	7 (13%)
	Below Normal	25 (36%)	7 (8%)
	Dry	69 (101%)	26 (23%)
	Critical	18 (21%)	-8 (-7%)
	All	132 (30%)	40 (7%)
September	Wet	-26 (-67%)	7 (117%)
	Above Normal	-4 (-25%)	11 (1100%)
	Below Normal	6 (21%)	-7 (-17%)
	Dry	13 (46%)	2 (5%)
	Critical	20 (100%)	2 (5%)
	All	9 (7%)	15 (12%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

San Joaquin River

Flows in the San Joaquin River under H3_ELT would be similar to those under NAA_ELT throughout the March through June period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

H4_ELT /HOS_ELT

Sacramento River

Mean flows in the Sacramento River at Keswick and upstream of Red Bluff during the March through July spawning and egg incubation period for green sturgeon under H4_ELT would generally be similar to flows under NAA_ELT for all months and water year types at both locations (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

There would be no differences between NAA_ELT and H4_ELT in the number of years with each level of concern in the Sacramento River at Bend Bridge (Table 11-4A-103).

Table 11-4A-103. Differences between Baseline Scenarios and H1 and H4_ELT Scenarios in the Number of Years in Which Water Temperature Exceedances above 63°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Red	2 (50%)	-1 (-14%)
Orange	-1 (-100%)	-1 (-100%)
Yellow	-2 (-100%)	-4 (-100%)
None	1 (1%)	6 (9%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Total degree-days (all water year types combined) exceeding the 63°F NMFS threshold in the Sacramento River at Bend Bridge under H4_ELT during May through September would range from no different than to 54% lower than those under NAA_ELT for all months during the period (Table 11-4A-104). This represents a moderate benefit of H4_ELT to green sturgeon temperature-related spawning conditions in the Sacramento River.

Table 11-4A-104. Differences between Baseline Scenarios and H4_ELT in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
May	Wet	17 (131%)	0 (0%)
	Above Normal	1 (NA)	-1 (-50%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	19 (146%)	-1 (-3%)
June	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
July	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	69 (862.5%)	-90 (-54%)
	All	69 (863%)	-90 (-54%)
August	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	23 (NA)	-6 (-21%)
	Critical	352 (175%)	-314 (-36%)
	All	375 (187%)	-320 (-36%)
September	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	5 (NA)	4 (400%)
	Dry	112 (361%)	-18 (-11%)
	Critical	223 (84%)	-318 (-39%)
	All	340 (114%)	-332 (-34%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Feather River

Flows under H4_ELT in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June period would generally be similar to or up to 548% greater (April of below normal water years) than flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) between NAA_ELT and H4_ELT in any month or water year type during the period.

The percent of months exceeding the 64°F NMFS threshold during May and June under H4_ELT would be similar to or up to 28% lower (absolute difference) than that under NAA_ELT, representing a small to moderate benefit of H4_ELT (Table 11-4A-105).

Table 11-4A-105. Differences between Baselines and H4_ELT Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISITING CONDITIONS vs. H4_ELT					
May	0 (0%)	-2 (-13%)	0 (0%)	6 (167%)	2 (100%)
June	4 (4%)	5 (6%)	6 (8%)	14 (21%)	12 (26%)
July	0 (0%)	0 (0%)	0 (0%)	7 (8%)	22 (32%)
August	0 (0%)	0 (0%)	9 (9%)	19 (23%)	33 (54%)
September	-7 (-11%)	-6 (-11%)	2 (9%)	11 (150%)	4 (150%)
NAA_ELT vs. H4_ELT					
May	-28 (-47%)	-20 (-55%)	-12 (-56%)	-2 (-20%)	-1 (-20%)
June	0 (0%)	-2 (-3%)	-6 (-7%)	-9 (-10%)	-12 (-17%)
July	0 (0%)	0 (0%)	0 (0%)	-2 (-2%)	6 (7%)
August	0 (0%)	0 (0%)	0 (0%)	4 (4%)	14 (17%)
September	11 (22%)	9 (22%)	2 (9%)	-1 (-6%)	-2 (-29%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Combining water years, total degree-months exceeding the 64°F NMFS threshold during the May and June spawning period under H4_ELT would be 5% to 29% lower relative to NAA_ELT. Within months, total degree-months under H4_ELT would be similar or up to 74% lower than that under NAA_ELT depending on water year type (Table 11-4A-106). These results indicate that there would be a small to moderate benefit of H4_ELT to green sturgeon spawning and egg incubation temperature-related conditions in the Feather River

Table 11-4A-106. Differences between Baselines and H1 and H4_ELT Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
May	Wet	0 (0%)	-11 (-65%)
	Above Normal	-6 (-55%)	-14 (-74%)
	Below Normal	6 (75%)	-7 (-33%)
	Dry	17 (121%)	0 (0%)
	Critical	12 (71%)	-1 (-3%)
	All	28 (50%)	-34 (-29%)
June	Wet	40 (53%)	-4 (-3%)
	Above Normal	14 (27%)	-3 (-4%)
	Below Normal	4 (6%)	-14 (-17%)
	Dry	22 (23%)	-4 (-3%)
	Critical	20 (36%)	0 (0%)
	All	100 (29%)	-25 (-5%)
July	Wet	37 (22%)	32 (18%)
	Above Normal	29 (55%)	24 (41%)
	Below Normal	33 (49%)	18 (22%)
	Dry	58 (67%)	32 (29%)
	Critical	49 (62%)	23 (22%)
	All	207 (45%)	130 (24%)
August	Wet	43 (24%)	46 (26%)
	Above Normal	30 (67%)	22 (42%)
	Below Normal	36 (51%)	18 (20%)
	Dry	71 (104%)	28 (25%)
	Critical	20 (24%)	-6 (-5%)
	All	199 (45%)	107 (20%)
September	Wet	-14 (-36%)	19 (317%)
	Above Normal	3 (19%)	18 (1800%)
	Below Normal	20 (71%)	7 (17%)
	Dry	9 (32%)	-2 (-5%)
	Critical	20 (100%)	2 (5%)
	All	37 (28%)	43 (34%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

San Joaquin River

Flows under H4_ELT in the San Joaquin River during the March through June period would be very similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

No water temperature modeling was in the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that there would not be adverse effects on green sturgeon spawning and egg incubation habitat because the amount of suitable habitat would not be substantially reduced. Flow and temperature conditions would generally be similar between Alternative 4A and the NEPA baseline in the Sacramento River and San Joaquin River and would be beneficial under Alternative 4A relative the NEPA baseline in the Feather River. Temperature conditions would be slightly improved under H4 relative to H3.

CEQA Conclusion: Collectively, the results of the Impact AQUA-130 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to the CEQA baseline.

H3_ELT /ESO_ELT

Sacramento River

Mean flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to those under Existing Conditions at both locations, with minor exceptions. These results indicate that there would be no effect on flows in the Sacramento River under H3_ELT relative to Existing Conditions.

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

There would be 3 more years with a “red” NMFS level of concern in the Sacramento River at Bend Bridge under H3_ELT than under Existing Conditions (Table 11-4A-99).

Total degree-days exceeding the 63°F NMFS threshold in the Sacramento River at Bend Bridge under H3_ELT (for all water years combined) would be up to 1,613% higher than under Existing Conditions during the May through September period (Table 11-4A-100). The very high increase between Existing Conditions and H3_ELT on the relative scale (1,613%) is a mathematical artifact resulting from the small value of the divisor (i.e., degree-days for Existing Conditions). On an absolute scale, the increase of 129 degree days constitutes an increase of only 0.3 degrees on each day over the 82-year period, which is a small change.

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June green sturgeon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). At Thermalito, mean flows under H3_ELT would generally be similar to or up to 48% lower than those under Existing Conditions during February and March, and would generally be similar to or up to 140% greater than those under Existing Conditions during April through June. At the confluence with the Sacramento River, flows under H3_ELT would generally be similar to those under Existing Conditions in all months and water year types of the period, except June, in which flows under H3_ELT would be up to 28% higher. These results indicate that there would generally be lower flows in the Feather River under H3_ELT relative to Existing Conditions early in the spawning and egg incubation period and greater flows later in the period.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between H3_ELT and Existing Conditions for any other month or water year type during the period.

Water temperature-related effects of H3_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures exceed a 64°F temperature threshold at Gridley (Table 11-4A-101). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. The percent of months exceeding the threshold during May and June under H3_ELT would be similar to or up to 25% greater (absolute difference) than that under Existing Conditions, representing a small to moderate negative effect of H3_ELT, although this comparison includes the effect of climate change.

Water temperature-related effects of H3_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-4A-102). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. Combining water years, total degree-months exceeding the threshold during May and June under H3_ELT would be 5% to 98% greater relative to Existing Conditions. Within months, total degree-months under H3_ELT would be similar or up to 183% higher than that under Existing Conditions depending on water year type. These results indicate that there would be a moderate negative effect of H3_ELT on green sturgeon spawning and egg incubation temperature-related conditions in the Feather River, although this comparison includes the effect of climate change.

San Joaquin River

Mean flows in the San Joaquin River under H3_ELT would generally be up to 16% lower than those under Existing Conditions throughout the March through June spawning and egg incubation period for green sturgeon except during May, in which there would be no differences in flows between H3_ELT and Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

No water temperatures modeling was conducted in the San Joaquin River.

H4_ELT /HOS_ELT

Sacramento River

Mean flows under H4_ELT in the Sacramento River at Keswick and upstream of Red Bluff during the March through July spawning and egg incubation period for green sturgeon would generally be similar to flows under Existing Conditions for all months and water year types in the period. (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

There would be 2 more years with a "red" NMFS level of concern in the Sacramento River at Bend Bridge under H4_ELT than under Existing Conditions (Table 11-4A-103).

Total degree-days exceeding the 63°F NMFS threshold in the Sacramento River at Bend Bridge under H4_ELT would be up to 863% higher than under Existing Conditions during the May through September period (Table 11-4A-104). On an absolute scale this increase is 69 degree days, which constitutes a small change relative to the 82-year period of record used for the analysis.

Feather River

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay during the February through June period would generally be similar to or up to 19% lower than flows under Existing Conditions in February. (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). However, flows under H4_ELT during April through June would be up to 509% greater than flows under Existing Conditions. Flows would be variable during March, but generally similar between Existing Conditions and H4_ELT. Mean flows under H4_ELT at the confluence with the Sacramento River would generally be similar to or up to 112% greater than those under Existing Conditions.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in any month or water year type during the period.

The percent of months exceeding the 64°F NMFS threshold during May and June under H4_ELT would be similar to or up to 14% greater than (absolute difference) that under Existing Conditions, representing a small negative effect of H4_ELT (Table 11-4A-105). This analysis includes climate change.

Combining water years, total degree-months exceeding the threshold during May and June under H4_ELT would be 29% to 50% greater relative to Existing Conditions. Within months, total degree-months under H4_ELT would be 55% lower to 121% higher than that under Existing Conditions depending on water year type (Table 11-4A-106). These results indicate that there would be a moderate to large negative effect of H4_ELT on green sturgeon spawning and egg incubation temperature-related conditions in the Feather River. This analysis includes the effect of climate change.

San Joaquin River

Flows in the San Joaquin River under H4_ELT would be similar to or up to 16% lower than those under Existing Conditions throughout the March through June spawning and egg incubation period for green sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

No water temperature modeling was in the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 4A, flows would generally not differ in the Sacramento River. However, flows would be lower under Alternative 4A in the Feather and San Joaquin rivers and water temperature conditions would be degraded in all rivers examined relative to Existing Conditions. Results would generally be consistent between H3 and H4. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of green sturgeon as a result of elevated exceedances above temperature thresholds.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flow and water temperature conditions under Alternative 4A would be similar to or better than those under NAA_ELT. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-131: Effects of Water Operations on Rearing Habitat for Green Sturgeon

In general, Alternative 4A would not affect the quantity and quality of green sturgeon larval and juvenile rearing habitat relative to the NAA_ELT.

Water temperature was used to determine the potential effects of alternatives on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

H3_ELT/ESO_ELT

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Water temperature-related effects of H3_ELT on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures exceed a 64°F temperature threshold at Gridley (Table 11-4A-101). The percent of months exceeding the threshold under H3_ELT would be similar to or up to 26% lower (absolute difference) than that under NAA_ELT during May and June, similar to that under NAA_ELT during July and August, and similar to or up to 10% greater than that under NAA_ELT during September.

Water temperature-related effects of H3_ELT on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-4A-102). Combining water years, total degree-months exceeding the threshold under H3_ELT would be 6% to 23% lower relative to NAA_ELT during May and June and 7% to 112% higher during July through September. These results indicate that there would be both beneficial and negative temperature-related effects to green sturgeon rearing in the Feather River. However, the largest change in degree-months (62 degree-months during July) would equate to an increase of less than 0.8 degrees per month. Given the highly variable nature of the Feather River outside of the low-flow channel, this change is not expected to be biologically meaningful. In fact, it is not unexpected that this amount of change would occur daily on a diel cycle.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River, however flows in all months and water year types, based on CALSIM II, were the same or very similar between NAA_ELT and H3_ELT and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), and therefore no temperature effects would occur as a result of Alternative 4A.

H4_ELT/HOS_ELT

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The percent of months exceeding the 64°F NMFS threshold under H4_ELT would be similar to or up to 28% lower (absolute difference) than that under NAA_ELT during May and June, and similar or up to 14% greater than that under NAA_ELT during July through September. (Table 11-4A-105).

Combining water years, total degree-months exceeding the 64°F NMFS threshold under H4_ELT would be 5% to 29% lower relative to NAA_ELT during May and June and 20% to 34% higher (relative scale) during July through September (Table 11-4A-106). These results indicate that there would be both beneficial and negative temperature-related effects of H4_ELT on green sturgeon rearing in the Feather River. However, the largest change in degree-months (130 degree-months during July) would equate to an increase of less than 1.6 degrees per month. Given the highly variable nature of the Feather River outside of the low-flow channel, this change is not expected to be biologically meaningful. In fact, it is not unexpected that this amount of change would occur daily on a diel cycle.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River, however flows in all months and water year types, based on CALSIM II, were the same or very similar between NAA_ELT and H3_ELT and H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), and therefore no temperature effects would occur as a result of Alternative 4A.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially reduce the amount of suitable habitat. Water temperatures in the Sacramento and Feather rivers and exceedances of NMFS temperature thresholds in the Feather River under Alternative 4A would be similar to those under NAA_ELT. Although degree-months would be higher on a relative scale under Alternative 4A during some months, these changes would not be biologically meaningful when considering the high variation in water temperatures relative to these increases. These modeling results would generally be consistent among scenarios.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions.

Water temperature was used to determine the potential effects of Alternative 4A on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

H3_ELT /ESO_ELT

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water*

Quality Model and Reclamation Temperature Model Results Utilized in the Fish Analysis). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT for any month or water year type of the period, except a 6% higher mean temperature for August of critical water years.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period, except during July of critical water years (7% higher under H3_ELT) and August of dry years (6% higher under H3_ELT).

Water temperature-related effects of H3_ELT on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures would exceed a 64°F temperature threshold at Gridley (Table 11-4A-101). The percent of months exceeding the threshold under H3_ELT would generally be greater by up to 25% (absolute difference) than the percent under Existing Conditions during all months, except in September for the >1.0°F and >2.0°F exceedance categories, in both of which exceedances would be 9 percent lower under H3_ELT. These modeling results include the effects of climate change.

Water temperature-related effects of H3_ELT on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-4A-102). Combining water years, total degree-months exceeding the threshold under H3_ELT would be 5% to 98% higher in all months. These results indicate that there would be negative temperature-related effects of H3_ELT on green sturgeon rearing in the Feather River. These modeling results include the effects of climate change.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

H4_ELT /HOS_ELT

Sacramento River

Mean monthly water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT during May through July and 5% lower during August and October.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period, except for 6% lower means under H4_ELT during July of critical water years and August of dry years.

The percent of months exceeding the 64°F NMFS threshold under H4_ELT would generally be greater by up to 33% than the percent under Existing Conditions during all months and water year types, except in September for the >1.0°F and >2.0°F exceedance categories, in which exceedances would be 7 and 6 percent lower, respectively, under H3_ELT (Table 11-4A-105). These modeling results include the effects of climate change.

Combining water years, total degree-months exceeding the 64°F NMFS threshold under H4_ELT would be 28% to 50% higher in all months (Table 11-4A-106). These results indicate that there would be negative temperature-related effects of H4 on green sturgeon rearing in the Feather River. These modeling results include the effects of climate change.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 4A, water temperatures would be similar in the Sacramento River, although the exceedance above NMFS temperature thresholds in the Feather River would be higher under Alternative 4A than those under the CEQA baseline, which could increase stress, mortality, and susceptibility to disease for larval and juvenile green sturgeon. These modeling results are consistent among scenarios. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of green sturgeon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on water temperatures would be negligible and exceedances above thresholds would be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact would be less than significant and no mitigation is required.

Impact AQUA-132: Effects of Water Operations on Migration Conditions for Green Sturgeon

In general, effects of Alternative 4A on green sturgeon migration conditions relative to the NAA are not adverse.

Upstream of the Delta

H3_ELT/ESO_ELT

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through June adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River mean flows at Keswick under H3_ELT would generally be up to 23% lower than flows under NAA_ELT during November, and similar to flows under NAA_ELT in the remaining months, with minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Sacramento River flows at Wilkins Slough under H3_ELT would generally be up to 20% lower than flows under NAA_ELT during September and November, up to 12% greater during May and June, and similar to flows under NAA_ELT in the remaining eight months (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Differences between H3_ELT and NAA_ELT in Feather River mean flows at Thermalito would vary a great deal with month and water year type. In general, mean flows under H3_ELT would be up to 48% lower than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be 23% and 25% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows would generally be up to 106% greater during May and June, and similar to flows under NAA_ELT in the remaining seven months, with a number of exceptions.

Feather River flows at the confluence with the Sacramento River under H3_ELT would generally be up to 50% lower (critical water years) than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be 21% and 14% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows would generally be greater under H3_ELT during June (up to 77% greater) and similar to flows under NAA_ELT in the remaining eight months, with minor exceptions.

Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the project planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

Larval transport flows were also examined by utilizing the positive correlation between white sturgeon year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved green sturgeon larval transport that results in improved year class strength. However, there is high uncertainty about what the mechanism responsible for this relationship is because many flow variables correlate throughout the Central Valley. One hypothesis suggests that the correlation is caused by high flows in the upper river resulting in improved migration, spawning, and rearing conditions in the upper river. Another hypothesis suggests that the positive correlation is a result of higher flows through the Delta triggering more adult sturgeon to move up into the river to spawn. In addition, this correlation was developed using data collected in the absence of north Delta intakes. Also, there are temporal and spatial differences between green and white sturgeon larval presence that make using white sturgeon as a surrogate in this analysis highly uncertain and potentially not applicable (Murphy et al. 2011). In particular, unlike white sturgeon, during April and May, green sturgeon adults would be spawning and larvae would be rearing in the upper Sacramento River and Feather River. This mismatch in timing and location limits the confidence in using this as a surrogate for green sturgeon and suggests that year-class strength correlated with flow at another location upstream or during a different period, if at all.

Regardless, for lack of a known relationship for green sturgeon year-class strength, the results using white sturgeon as a surrogate for green sturgeon were examined here. Results for white sturgeon presented in Impact AQUA-150 below suggest that, using the positive correlation between Delta outflow and year class strength, green sturgeon year class strength would be lower under H3_ELT than those under NAA_ELT (up to 50% lower). Given the increased spring outflow in April and May under H4, it is expected that year-class strength would be similar or greater to NAA_ELT under H4_ELT.

H4_ELT /HOS_ELT

Year-round flows in the Sacramento River at Keswick under H4_ELT would be up to 20% lower than flows under NAA_ELT during November, and generally similar to flows under NAA_ELT in the remaining months (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows at Wilkins Slough under H4_ELT would generally be similar to those under NAA_ELT except during August, September, and November, when flows would be up to 20% lower under H4_ELT.

Differences between H4_ELT and NAA_ELT in Feather River mean flows at Thermalito would vary a great deal with month and water year type. In general, mean flows under H4_ELT would be up to 60% lower than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be 48% and 52% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows under H4_ELT would generally be up to 548% greater flows under NAA_ELT during April through June, and similar in the remaining six months, with a number of exceptions.

Feather River flows at the confluence with the Sacramento River under H3_ELT would generally be up to 42% lower than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be 42% and 34% higher (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The mean flows would generally be greater under H4_ELT during April through June (up to 119% greater) and similar to flows under NAA_ELT in the remaining six months, with minor exceptions.

Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the Alternative 4a planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows. The range of Alternative 4A operations (i.e., H3_ELT and H4_ELT) includes a range of Delta outflows, as discussed below. The effect on green sturgeon would not be adverse.

NEPA Effects: Upstream flows (above north Delta intakes) are generally similar between Alternative 4A and NAA_ELT. However, due to the removal of water at the North Delta intakes, there are substantial differences in through-Delta flows between Alternative 4A and NAA_ELT. An examination of monthly average Delta outflow exceedances above 15,000 cfs, 20,000 cfs, and 25,000 cfs during April and May of wet and above-normal years was used to provide context for differences in through-Delta migration conditions, per recommendations by the Anadromous Fish Restoration Program (USFWS 1995) (see Table 11-4A-114 in the discussion of white sturgeon below). This showed that the percentage of months exceeding the above Delta outflow thresholds in April and May of wet and above normal years was appreciably lower than NAA_ELT for Alternative 4A's H3_ELT scenario, but was similar or considerably greater than NAA_ELT for Alternative 4A's H4_ELT scenario. As noted for Alternative 4, analysis of white sturgeon year-class strength (USFWS 1995), used here as a surrogate for green sturgeon, found a positive correlation between year class strength and Delta outflow during April and May. However, this conclusion was reached in the absence of north Delta intakes and the exact mechanism that causes this correlation is not known at this time. One hypothesis suggests that the correlation is caused by high flows in the upper river resulting in improved migration, spawning, and rearing conditions in the upper river. Another hypothesis suggests that the positive correlation is a result of higher flows through the Delta triggering more adult sturgeon to move up into the river to spawn. It is also possible that some combination of these factors are working together to produce the positive correlation between high flows and sturgeon year-class strength.

The scientific uncertainty regarding which mechanisms are responsible for the positive correlation between year class strength and river/Delta flow will be addressed through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations as described in the adaptive management and monitoring section in Section 4.1. These investigations will inform decisions regarding Delta outflow within the range of H3_ELT/H4_ELT operations such that the effect on green sturgeon Delta flow conditions would not be adverse. This, combined with similarities in upstream flow conditions between Alternative 4A and NAA_ELT, indicate that Alternative 4A would not be adverse to migration conditions for green sturgeon.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of migration habitat for green sturgeon in upstream locations relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA comparison, Alternative 4A would not affect the quantity and quality of migration habitat for green sturgeon.

Upstream of the Delta

H3_ELT/ESO_ELT

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through July adult migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River flows at Keswick under H3_ELT would generally be up to 24% lower than flows under Existing Conditions during August, September, and November of dry and critical water years and up to 34% higher during September of wet and above normal water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In the other months and water year types, the mean flows would generally be similar between H3_ELT and Existing Conditions, with several exceptions. Mean flows at Wilkins Slough under H3_ELT would generally be up to 24% lower than flows under Existing Conditions during August, September, and November of dry and critical water years and up to 33% higher during September of wet and above normal water years. Mean flow in June would be up to 18% higher under H3_ELT, and flows would be similar in other months and water year types.

For Delta outflow, the percent of months exceeding outflow thresholds under H3_ELT would consistently be lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (see Table 11-4A-114 below).

Feather River flows at Thermalito Afterbay under H3_ELT would generally be up to 52% lower than flows under Existing Conditions during January, February, and July, higher than flows under Existing Conditions during April through June and September, and similar to flows under Existing Conditions during the remaining months (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flow under H3_ELT at the confluence with the Sacramento River would generally be up to 140% greater than flows under Existing Conditions during February, June, and September, up to 55% lower than flows under Existing Conditions during July, and similar to flows under Existing Conditions during the remaining months.

H4_ELT /HOS_ELT

Year-round flows were examined in the Sacramento River at Keswick and Wilkins Slough. Flows at Keswick under H4_ELT would generally be similar to flows under Existing Conditions, except during September and November, in which mean flows would be up to 20% lower, and during February, in which flows would be up to 12% higher. Flows at Wilkins Slough would generally be similar to flows under Existing Conditions except during September and October, in which flows would be up to 21% lower, and during July, in which flows would be up to 8% greater. (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Year-round flows in the Feather River below Thermalito Afterbay (high-flow channel) and at the confluence under H4_ELT would generally be similar to or up to 36% lower than flows under Existing Conditions during January through March, and up to 55% lower during July through

September, although flow would be up to 55% higher during critical water years in August and September, (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). During April through June, mean flow under H4_ELT would be up to 509% greater than flow under Existing Conditions. During September, mean flow under H4_ELT would be up to 49% lower in below normal and dry water years and up to 166% higher in wet, above normal, and critical water years. Reductions in flows in the Feather River would be persistent and large enough to have biologically meaningful effects to green sturgeon migration.

Through-Delta

Given the improved OMR flows and the range of Delta outflows under Alternative 4A's H3_ELT and H4_ELT that would be refined through the Adaptive Management Program to avoid negative impacts to green sturgeon (see NEPA Effects discussion above), the potential impact of Alternative 4A on in-Delta conditions for green sturgeon is considered less than significant, and no mitigation would be required.

Summary of CEQA Conclusion

Under Alternative 4A, there would be frequent small to large reductions in flows in the Sacramento and Feather Rivers upstream of the Delta that would reduce the ability of all three life stages of green sturgeon to migrate successfully. Exceedance of Delta outflow thresholds would be lower under Alternative 4A's H3_ELT scenario than under Existing Conditions, but would be similar or greater than under Existing Conditions for the H4_ELT scenario. Note that there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows co-vary with another unknown factor. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce upstream migration conditions for green sturgeon.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on green sturgeon migration conditions in upstream areas. Within the Plan Area, the Adaptive Management Program will evaluate water operations through the adaptive management and monitoring program as described in Section 4.1 and ensure the impacts of water operations on migration conditions for green sturgeon are less than significant. Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for winter-run Chinook salmon generally would be similar for green sturgeon. Because green sturgeon may inhabit the Delta year-round, they would be more likely to encounter any effects from restoration measures. However, because the extent of restoration is limited to offsetting losses from construction of the water conveyance facilities, any such effects would be greatly limited compared to Alternative 1A and 4, for example.

Impact AQUA-133: Effects of Construction of Restoration Measures on Green Sturgeon

As noted for Alternative 1A's discussion of Impact AQUA-133, in-water and shoreline construction activities (e.g., riprap removal and levee breaching; shoreline excavation and recontouring) could increase turbidity, but green sturgeon are tolerant to such increases and implementation of the environmental commitments described under Impact AQUA-1 for delta smelt and in Appendix 3B, Environmental Commitments (Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material), would minimize or eliminate effects on green sturgeon.

***NEPA Effects*:** The effects of short-term construction activities would not be adverse to green sturgeon because environmental commitments would limit the potential for construction-related effects.

***CEQA Conclusion*:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on green sturgeon but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce green sturgeon habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-134: Effects of Contaminants Associated with Restoration Measures on Green Sturgeon

The factors influencing the potential effects of contaminants from restored areas on green sturgeon are discussed in the analysis of Impact AQUA-134 under Alternative 1A. Because the extent of habitat restoration under Alternative 4A is considerably reduced relative to Alternative 1A, any effects from contaminants also would be considerably reduced.

NEPA Effects: While Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in green sturgeon. Alternative 4A would restore 59 acres of tidal wetlands that, depending on the specific site conditions of the restoration, may result in the colonization of benthic grazers that bioaccumulate selenium. As sturgeon are benthic feeders, the increased habitat for grazers may result in increased exposure to selenium. However, the small amount of area to be restored would not result in a substantial change in exposure potential. Overall, the effects of contaminants associated with restoration measures would not be adverse for green sturgeon.

CEQA Conclusion: Habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in green sturgeon. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect green sturgeon either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-135: Effects of Restored Habitat Conditions on Green Sturgeon

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on green sturgeon would not be adverse because restoration is intended to provide habitat benefits for green sturgeon.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on green sturgeon would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for other covered species, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4A). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for green sturgeon remains the same.

Impact AQUA-136: Effects of Methylmercury Management on Green Sturgeon (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to green sturgeon.

NEPA Effects: The effects of methylmercury management on green sturgeon would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on green sturgeon would be less than significant. Consequently, no mitigation is required.

Impact AQUA-139: Effects of Localized Reduction of Predatory Fish on Green Sturgeon (Environmental Commitment 15)

Alternative 4A includes a predator removal program similar to Conservation Measure 15 included in Alternative 1A, although the environmental commitment under Alternative 4A is reduced in scope to focus solely on the north and south Delta export locations, whereas Alternative 1A would include predator removal at these and other potential hotspots. As described under Alternative 1A, it is possible, but not assured, that there would be some reduction in predation losses of green sturgeon under *Environmental Commitment 15 Localized Reduction of Predatory Fish*. As described for Alternative 1A, there is uncertainty in the potential efficacy of Environmental Commitment 15 and also uncertainty in the importance of predation to juvenile green sturgeon, given the likely limited period of vulnerability to predation in the Delta. Due to these uncertainties, there would be no demonstrable effect of this conservation measure on green sturgeon. As noted for Alternative 1A, there is a very small risk of sturgeon by-catch during implementation of Environmental Commitment 15, but the number of green sturgeon affected is expected to be very low.

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the overall effect would not be adverse because few, if any, sturgeon would be affected.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-140: Effects of Nonphysical Fish Barriers on Green Sturgeon (Environmental Commitment 16)

As described for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of Georgiana Slough from the Sacramento River would be implemented to guide juvenile salmonids away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to the Sacramento River (Perry et al. 2010). As described in the *BDCP Effects Analysis*, the effects of an NPB at this location would be expected to have little to no effect on green sturgeon because of their position in the water column (near the river bottom, whereas an NPB at this location would be likely to function in the upper half of the water column; DWR 2012) and their physiology (limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli; see section 5C.5.3.9 in *BDCP Effects Analysis Appendix 5.C* and section 5.B.6.1.11.1 *BDCP Effects Analysis Appendix 5.B, both hereby incorporated by reference*).

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the overall effect would not be adverse because green sturgeon are unlikely to encounter the NPB, which would not be located near the channel bottom and because green sturgeon have limited hearing within the range of acoustic sound generated by the NPB.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact is considered less than significant. Consequently, no mitigation would be required.

White Sturgeon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-145: Effects of Construction of Water Conveyance Facilities on White Sturgeon

The potential effects of construction of the water conveyance facilities on white sturgeon would be the same as those described for Alternative 4, Impact AQUA-145. This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-145 in Alternative 4.

Table 11-8 presents the life stages of white sturgeon and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Under Alternative 4A, white sturgeon adults and juveniles occur year-round in the Delta and therefore could be exposed to pile driving noise during construction of the proposed intakes, barge unloading facilities, CCF cofferdams, CCF siphons, and Head of Old River operable barrier. Larvae may also be exposed to pile driving noise but are generally at lower risk than juveniles and adults because of only minor spatial and temporal overlap with in-water pile driving activities. Because the majority of the population spawns in the Sacramento River, adults, larvae, and juveniles are most likely to encounter pile driving noise at the proposed intake locations in the north Delta as they migrate or disperse to and from upstream spawning areas. Similar to green sturgeon, adult white sturgeon are large (>15 kilograms) and less susceptible to noise from impact driving, and are able to avoid injurious exposure to underwater noise from pile driving. They may experience short delays in migration upon encountering pile driving noise; however, pile driving would occur only intermittently through a portion of the day, and minor migration delays are not expected to affect their ability to successfully reach the spawning grounds.

Because of their relatively small body size, larvae and juvenile white sturgeon are at higher risk of injury or mortality from pile driving noise. Juveniles are most likely to encounter pile driving noise because of their widespread distribution and year-round presence in the Delta. Although juvenile white sturgeon are capable of actively avoiding pile driving noise and other in-water disturbances, some may be injured or killed if they remain in the areas subject to cumulative SELs exceeding the injury thresholds (Table 4.3.7-1 under Delta smelt). In the absence of information on the movements and distribution of juveniles, potential impacts to the population can be generally assessed based on the proportion of total habitat subject to pile driving sounds. Under existing conditions, the Delta comprises an estimated 84,280 acres of subtidal aquatic habitat. Using this estimate as a measure of the total amount of potential foraging and rearing habitat available to juveniles, Table 4.3.7-2 shows the percentage of habitat that would be subjected to pile driving noise exceeding the injury thresholds during each year of pile driving activities.

These estimates represent a general order-of-magnitude estimate of the potential exposure of the population to pile driving noise. Thus, potential for exposure of the population to project pile driving noise is very low in most years. The exception is year 5 when an estimated 3,436 acres or 4.1% of the total amount of subtidal habitat would be subject to pile driving noise levels that could harm juvenile sturgeon. This potential impact is due largely to the construction of six barge unloading facilities at various locations along the pipeline/tunnel alignment. Factors that may further limit exposure of the population to adverse effects include the short duration of pile driving activities at most locations (Table 4.3.7-1 under Delta Smelt). In addition, the total area of habitat available to juvenile white sturgeon expands beyond the Delta into Suisun and San Pablo Bays as juveniles grow and develop salinity tolerance, further reducing the probability of encountering pile driving noise.

Based on these considerations and the implementation of Mitigation Measures AQUA-1a and AQUA-1b, there is a low likelihood of significant population-level effects on white sturgeon due to pile driving noise.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-145, the effect would not be adverse for white sturgeon. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by white sturgeon. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on white sturgeon that may be present could be adverse if sturgeon are exposed. However, considering the ability of white sturgeon to move away from the noise and migrate during the night or other times that pile driving is not occurring, the relatively few white sturgeon in the area of pile driving, and the implementation of Mitigation Measures AQUA-1a and AQUA-1b,that would minimize exposure, this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-145, the impact of the construction of the water conveyance facilities on white sturgeon would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect white sturgeon. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-146: Effects of Maintenance of Water Conveyance Facilities on White Sturgeon

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-146. As concluded in Alternative 4, Impact AQUA-146, the impact would not be adverse for white sturgeon.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-146, the impact of the maintenance of water conveyance facilities on white sturgeon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-147: Effects of Water Operations on Entrainment of White Sturgeon

Water Exports

The potential effects of the water operations under Alternative 4A would be the same as those described for green sturgeon (see Impact AQUA-129), which is a reduction in entrainment at the south Delta facilities, and avoidance or reduction of entrainment at the proposed north Delta diversion facilities. As concluded in Impact AQUA-129, the impact of Alternative 4A on white sturgeon would not be adverse.

Predation Associated with Entrainment

The potential effects would be the same as described for green sturgeon in Alternative 4A (see Impact AQUA-129).

NEPA Effects: In conclusion, the effect of Alternative 4A operations on entrainment and associated predation of white sturgeon would not be adverse and may provide modest benefit due to reduced losses at the south Delta facilities.

CEQA Conclusion: As described above for green sturgeon (Impact AQUA-129) the impact of water operations on white sturgeon would be less than significant and no mitigation would be required.

Impact AQUA-148: Effects of Water Operations on Spawning and Egg Incubation Habitat for White Sturgeon

In general, Alternative 4A would not affect spawning and egg incubation habitat for white sturgeon relative to the NAA_ELT. Alternative 4A would provide flow-related benefits to white sturgeon spawning in the Feather River.

H3_ELT/ESO_ELT

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon. Mean flows under H3_ELT would generally be similar to those under NAA_ELT throughout the spawning and egg incubation period at both locations (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean monthly water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

The number of days at Hamilton City on which temperature exceeded a 61°F optimal and 68°F lethal threshold by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period (Table 11-4A-13). The combination of number of days and degrees above each threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-107. For the 61°F threshold, there would be 5 fewer (14% fewer) "red" years under H3_ELT than under NAA_ELT. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between NAA_ELT and H3_ELT.

Table 11-4A-107. Differences between Baselines and H3_ELT in the Number of Years in Which Water Temperature Exceedances above the 61°F and 68°F Thresholds Are Within Each Level of Concern, Sacramento River at Hamilton City, March through June

Level of Concern	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
61°F threshold		
Red	23 (288%)	-5 (-14%)
Orange	4 (27%)	-2 (-10%)
Yellow	-12 (-39%)	2 (12%)
None	-15 (-54%)	5 (63%)
68°F threshold		
Red	0 (NA)	0 (NA)
Orange	0 (NA)	0 (NA)
Yellow	1 (NA)	-1 (-100%)
None	-1 (-1%)	1 (1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-4A-108, Table 11-4A-109). Total degree-days exceeding the 61°F threshold under H3_ELT would be 2 degree-day (67%) greater than those under NAA_ELT during March, which would not be biologically meaningful. During April through June, total degree days above 61°F would be 2 to 373 (1% to 11%) lower under H3_ELT than under NAA_ELT. These totals would not be biologically meaningful to white sturgeon considering that the daily reduction in temperature would be <0.2 degrees (2542 and 2460 total days during May and June, respectively over the 82-year modeling period. Total degree-days exceeding the 68°F threshold would be similar between NAA_ELT and H3_ELT, except during May, in which exceedances would be 10 degree-days (33%) fewer under H3_ELT.

Table 11-4A-108. Differences between Baseline and H3_ELT Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	2 (NA)	2 (NA)
	Dry	3 (NA)	0 (0%)
	Critical	0 (NA)	0 (NA)
	All	5 (NA)	2 (67%)
April	Wet	18 (150%)	0 (0%)
	Above Normal	15 (150%)	0 (0%)
	Below Normal	16 (267%)	-4 (-15%)
	Dry	47 (92%)	4 (4%)
	Critical	2 (200%)	-2 (-40%)
	All	98 (123%)	-2 (-1%)
May	Wet	478 (144%)	-1 (0%)
	Above Normal	123 (56%)	-113 (-25%)
	Below Normal	227 (123%)	-42 (-9%)
	Dry	209 (103%)	-105 (-20%)
	Critical	219 (108%)	-7 (-2%)
	All	1,256 (110%)	-268 (-10%)
June	Wet	425 (74%)	-65 (-6%)
	Above Normal	151 (50%)	-56 (-11%)
	Below Normal	177 (84%)	-70 (-15%)
	Dry	203 (61%)	-127 (-19%)
	Critical	181 (48%)	-55 (-9%)
	All	1,137 (63%)	-373 (-11%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Table 11-4A-109. Differences between Baseline and H3_ELT Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Mar	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
Apr	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
May	Wet	9 (129%)	0 (0%)
	Above Normal	3 (NA)	-10 (-77%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	13 (186%)	-10 (-33%)
Jun	Wet	2 (NA)	0 (0%)
	Above Normal	-1 (-100%)	-2 (-100%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	2 (200%)	-2 (-40%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows at Thermalito Afterbay under H3_ELT would generally be similar to or greater by up to 30% greater than those under NAA_ELT, with some exceptions. Mean flows at the confluence with the Sacramento River under H3_ELT would be similar to flows under NAA_ELT, with minor exceptions.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period. Mean water temperatures would not differ (<5%) between NAA_ELT and H3_ELT at either location throughout the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis under H3_ELT during February through May would be little different from flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperature modeling was not conducted for the San Joaquin River.

H4_ELT /HOS_ELT

Sacramento River

Flows under H4_ELT in the Sacramento River at Wilkins Slough and Verona during February to May would generally be similar to flows under NAA_ELT except during April and May at Verona, in which flows would be up to 36% and 25% higher, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 61°F optimal and 68°F lethal threshold identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above each threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-110. For the 61°F threshold, there would be 1 more (3% increase) "red" year and 3 fewer (14% reduction) "orange" years under H4_ELT than under NAA_ELT, which would not be biologically meaningful. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between NAA_ELT and H4_ELT.

Table 11-4A-110. Differences between Baselines and H4_ELT Scenario in the Number of Years in Which Water Temperature Exceedances above the 61°F and 68°F Thresholds are within Each Level of Concern, Sacramento River at Hamilton City, March through June

Level of Concern	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
61°F threshold		
Red	29 (363%)	1 (3%)
Orange	3 (20%)	-3 (-14%)
Yellow	-14 (-45%)	0 (0%)
None	-18 (-64%)	2 (25%)
68°F threshold		
Red	0 (NA)	0 (NA)
Orange	0 (NA)	0 (NA)
Yellow	1 (NA)	-1 (-50%)
None	-1 (-1%)	1 (1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
NA = could not be calculated because the denominator was 0.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-4A-111, Table 11-4A-112). Total degree-days exceeding the 61°F threshold under H4_ELT would be 2 degree-days (67%) greater than those under NAA_ELT during March and 3 degree-days (2%) greater during April, which would not be biologically meaningful. During the May and June, there would be reductions of 152 degree-days (6%) and 29 degree-days (1%) between NAA_ELT and H4_ELT in total degree-days exceeding the 61°F threshold. Total degree-days exceeding the 68°F threshold would be similar between NAA_ELT and H4_ELT for all four months.

Table 11-4A-111. Differences between Baselines and H4_ELT in Total Degree-Days (°F-days) by Month and Water Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	2 (NA)	2 (NA)
	Dry	3 (NA)	0 (0%)
	Critical	0 (NA)	0 (NA)
	All	5 (NA)	2 (67%)
April	Wet	18 (150%)	0 (0%)
	Above Normal	14 (140%)	-1 (-4%)
	Below Normal	20 (333%)	0 (0%)
	Dry	49 (96%)	6 (6%)
	Critical	2 (200%)	-2 (-40%)
	All	103 (129%)	3 (2%)
May	Wet	488 (147%)	9 (1%)
	Above Normal	158 (72%)	-78 (-17%)
	Below Normal	273 (148%)	4 (1%)
	Dry	267 (132%)	-47 (-9%)
	Critical	186 (92.1%)	-40 (-9%)
	All	1,372 (120%)	-152 (-6%)
June	Wet	487 (84%)	-3 (0%)
	Above Normal	265 (87%)	58 (11%)
	Below Normal	237 (112%)	-10 (-2%)
	Dry	325 (97%)	-5 (-1%)
	Critical	167 (45%)	-69 (-11%)
	All	1,481 (82%)	-29 (-1%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Table 11-4A-112. Differences between Baselines and H4_ELT in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
April	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
May	Wet	9 (129%)	0 (0%)
	Above Normal	12 (NA)	-1 (-8%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	22 (314%)	-1 (-3%)
June	Wet	2 (NA)	0 (0%)
	Above Normal	4 (400%)	3 (150%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	7 (700%)	3 (60%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

Feather River

Mean flows under H4_ELT in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February to May would be similar to or up to 518% greater than flows under NAA_ELT at Thermalito and up to 12% greater at the confluence.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period. Mean monthly water temperatures would not differ between NAA_ELT and H4_ELT at either location throughout the period.

San Joaquin River

Mean monthly flows in the San Joaquin River at Vernalis under H4_ELT during February through May would be similar to those under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperature modeling was not conducted for the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat. Flows under Alternative 4A would generally be higher in the Feather River relative to the NAA_ELT and generally similar to flows under the NAA_ELT in the Sacramento and San Joaquin Rivers. Alternative 4A would not affect temperatures in any river during the white sturgeon spawning and egg incubation period. Results would generally be similar between H3_ELT and H4_ELT.

CEQA Conclusion: Collectively, the results of the Impact AQUA-148 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 4A would not affect the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to the Existing Conditions.

H3_ELT /ESO_ELT

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). At Wilkins Slough, mean flows under H3_ELT would generally be similar to those under Existing Conditions. At Verona, mean flow under H3_ELT for most of the months and water year types would be slightly lower (less than 10% lower) than flows under Existing Conditions during February and April, and similar during March and May.

Mean water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period

The number of days when temperatures exceeded the analysis criterion (i.e., 61°F optimal and 68°F lethal threshold identified in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above each threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-107. For the 61°F threshold, there would be 23 more (288% increase) "red" years under H3_ELT than under Existing Conditions. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between Existing Conditions and H3_ELT.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-4A-108, Table 11-4A-109). Total degree-days exceeding the 61°F threshold under H3_ELT would be 5 degree-days (percent change unable to be calculated due to division by 0) to 1,256 degree-days (110%) higher depending on month. Total degree-days exceeding the 68°F threshold would not differ between Existing Conditions and H3_ELT during March and April. During May and June, total degree-days would be 13 (186%) and 2 (200%) degree-days higher under H3_ELT, although these small absolute differences would not have a biologically meaningful effect on white sturgeon.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in mean flows between H3_ELT and Existing Conditions at Thermalito Afterbay would vary greatly during the period. Mean flows during February and March would be up to 48% lower under H3_ELT in below normal and dry water years and would be similar or moderately higher in other water year types, while in April and May they would be up to 33% higher depending on water year type. Mean flows at the confluence with the Sacramento River under H3_ELT would generally be similar to or greater than flows under Existing Conditions, except in below normal years during February and March (14% and 15% lower, respectively). These results indicate that there would be some reductions in flows in the Feather River under H3_ELT relative to Existing Conditions.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would not differ (<5%) between Existing Conditions and H3_ELT at either location throughout the period.

San Joaquin River

Mean flows under H3_ELT were examined in the San Joaquin River at Vernalis during February through May. Flows under H3_ELT during March and April would be up to 12% lower than those under Existing Conditions, whereas flows under H3_ELT during February and May would be similar to those under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water temperature modeling was not conducted for the San Joaquin River.

H4_ELT/HOS_ELT

Sacramento River

Mean flows under H4_ELT in the Sacramento River at Wilkins Slough and Verona during February to May would generally be similar to or lower than flows under Existing Conditions, except during April and May at Verona, in which flows under H4_ELT would be up to 30% greater (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water*

Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 61°F optimal and 68°F lethal threshold identifies in Table 11-4A-13) by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above each threshold were further assigned a "level of concern", as defined in Table 11-4A-14. Differences between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-4A-110. For the 61°F threshold, there would be 29 more (363% increase) "red" years under H4_ELT than under Existing Conditions. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between Existing Conditions and H4_ELT.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-4A-108, Table 11-4A-109). Total degree-days exceeding the 61°F threshold under H4_ELT would be 5 degree-days (percent change unable to be calculated due to division by 0) to 1,481 degree-days (82%) higher depending on month. Total degree-days exceeding the 68°F threshold would not differ between Existing Conditions and H4_ELT during March and April. During May and June, total degree-days under H4_ELT would be 22 (314%) and 7 (700%) degree-days higher, although these small absolute differences would not have a biologically meaningful effect on white sturgeon.

Feather River

Mean flows under H4_ELT in the Feather River at Thermalito Afterbay and the confluence with the Sacramento River during the February to May would generally be similar to or up to 22% lower than flows under Existing Conditions during February and March and would be up to 509% greater than flows under Existing Conditions during April and May, except for critical water years in which flows would be similar for the two scenarios. (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean monthly water temperatures would not differ between Existing Conditions and H4_ELT at either location throughout the period.

San Joaquin River

Mean flows under H4_ELT in the San Joaquin River would generally be similar or up to 12% lower than flows under Existing Conditions.

Summary of CEQA Conclusion

Under Alternative 4A, there would be small to moderate, persistent reductions in flows in the Sacramento, Feather, and San Joaquin Rivers that would cause biologically meaningful effects to white sturgeon spawning and egg incubation habitat. Further, there would be increases in exceedances of NMFS temperature thresholds in the Sacramento River that would cause a biologically meaningful effect to white sturgeon spawning and egg incubation. Results would generally be consistent between H3_ELT and H4_ELT. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce the quantity and quality of suitable spawning and egg incubation habitat.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows under Alternative 4A would generally be higher in the Feather River and generally similar in the Sacramento and San Joaquin Rivers. Alternative 4A would not affect temperatures in any river during the white sturgeon spawning and egg incubation period. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-149: Effects of Water Operations on Rearing Habitat for White Sturgeon

In general, Alternative 4A would not affect quantity and quality of white sturgeon larval and juvenile rearing habitat relative to the NAA_ELT.

Water temperature was used to determine the potential effects of alternatives on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

H3_ELT/ESO_ELT

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

Mean water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period

Water temperatures were not modeled in the San Joaquin River.

H4_ELT /HOS_ELT

Mean monthly water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Mean monthly water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

Water temperatures were not modeled in the San Joaquin River.

NEPA Effects: These modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat. There would be no differences in water temperatures between Alternative 4A and the NAA_ELT. Results would be similar between H3_ELT and H4_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quantity and quality of white sturgeon larval and juvenile rearing habitat relative to Existing Conditions.

Water temperature was used to determine the potential effects of alternatives on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

H3_ELT /ESO_ELT

Mean water in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H3_ELT in any month or water year type throughout the period.

Mean water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would be similar between Existing Conditions and H3_ELT during all months and water year types except July of critical water years and August of dry years, in which the means would be 7% and 6% higher, respectively, under H3_ELT.

Water temperatures were not modeled in the San Joaquin River.

H4_ELT/HOS_ELT

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any month or water year type throughout the period.

Mean monthly water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would be similar between Existing Conditions and H4_ELT during all months and water year types except July of dry and critical water years, in which temperatures under H4_ELT would be 5% and 6% higher, and August of dry years, in which the temperature would be 6% higher.

Water temperatures were not modeled in the San Joaquin River.

Summary of CEQA Conclusion

These modeling results indicate that the effect is less than significant because it does not have the potential to substantially reduce the amount of suitable habitat and no mitigation is required. There would be few differences in water temperatures between Alternative 4A and the CEQA baseline. Results would be similar between H3_ELT and H4_ELT.

Impact AQUA-150: Effects of Water Operations on Migration Conditions for White Sturgeon

In general, effects of Alternative 4A on white sturgeon migration conditions relative to NAA_ELT are not adverse.

Upstream of the Delta

H3_ELT/ESO_ELT

Analyses for white sturgeon focused on the Sacramento River (North Delta to RM 143—i.e., Wilkins Slough and Verona CALSIM nodes). Larval transport flows were represented by the average number of months per year that exceeded thresholds of 17,700 cfs (Wilkins Slough) and 31,000 cfs (Verona) (Table 11-4A-113). Exceedances of the 17,700 cfs threshold for Wilkins Slough and the 31,000 cfs threshold at Verona under H3_ELT would generally be similar to those under NAA_ELT. Despite some large relative difference (up to 25%), the changes on an absolute scale would be small (up to 0.2 fewer months per year).

Table 11-4A-113. Difference and Percent Difference in Number of Months in Which Flow Rates Exceed 17,700 and 5,300 cfs in the Sacramento River at Wilkins Slough and 31,000 cfs at Verona

	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wilkins Slough, 17,700 cfs[a]		
Wet	-0.1 (-4%)	0 (0%)
Above Normal	0.1 (6%)	0 (0%)
Below Normal	-0.1 (-25%)	0 (0%)
Dry	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)
Wilkins Slough, 5,300 cfs[b]		
Wet	0 (-1%)	-0.1 (-1%)
Above Normal	-0.3 (-4%)	0 (0%)
Below Normal	-0.2 (-4%)	0.1 (3%)
Dry	-0.1 (-1%)	0 (0%)
Critical	0 (0%)	-0.1 (-2%)
Verona, 31,000 cfs[a]		
Wet	-0.4 (-16%)	-0.2 (-8%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-0.1 (-29%)	-0.1 (-17%)
Dry	-0.1 (-40%)	-0.1 (-25%)
Critical	0 (NA)	0 (NA)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

NA = could not be calculated because the denominator was 0.

[a] Months analyzed: February through May.

[b] Months analyzed: November through May.

The effects of changes in flow for white sturgeon under Alternative 4A was also examined by utilizing the positive correlation between year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved transport (e.g., for white sturgeon larvae or other early life stages) that results in improved year class strength. An examination of monthly average Delta outflow exceedances above 15,000 cfs, 20,000 cfs, and 25,000 cfs during April and May of wet and above-normal years was used to provide context for differences in through-Delta migration conditions, per recommendations by the Anadromous Fish Restoration Program (USFWS 1995). The percentage of months exceeding flow thresholds under H3_ELT would generally be lower than those under NAA_ELT (up to 50% lower) (Table 11-4A-114). These results indicate that, using the positive correlation between Delta outflow and year class strength, year class strength generally would be lower under H3_ELT.

Table 11-4A-114. Difference and Percent Difference in Percentage of Months in Which Average Delta Outflow is Predicted to Exceed 15,000, 20,000, and 25,000 Cubic Feet per Second (cfs) in April and May of Wet and Above-Normal Water Years

Flow	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
April					
15,000 cfs	Wet	-4 (-4%)	-4 (-4%)	4 (4%)	4 (4%)
	Above Normal	-17 (-18%)	-17 (-18%)	(0%)	(0%)
20,000 cfs	Wet	-8 (-9%)	-8 (-9%)	15 (18%)	15 (18%)
	Above Normal	-33 (-44%)	-33 (-44%)	8 (11%)	8 (11%)
25,000 cfs	Wet	-19 (-24%)	-19 (-24%)	12 (14%)	12 (14%)
	Above Normal	-17 (-29%)	-17 (-29%)	25 (43%)	25 (43%)
May					
15,000 cfs	Wet	-12 (-13%)	-12 (-13%)	8 (9%)	8 (9%)
	Above Normal	-33 (-40%)	-25 (-33%)	(0%)	8 (11%)
20,000 cfs	Wet	-27 (-32%)	-15 (-21%)	-4 (-5%)	8 (11%)
	Above Normal	-17 (-40%)	-8 (-25%)	25 (60%)	33 (100%)
25,000 cfs	Wet	-19 (-28%)	-12 (-19%)	-8 (-11%)	(0%)
	Above Normal	-17 (-50%)	-17 (-50%)	(0%)	(0%)
April/May Average					
15,000 cfs	Wet	-8 (-8%)	-4 (-4%)	4 (4%)	8 (8%)
	Above Normal	-17 (-17%)	-17 (-17%)	(0%)	(0%)
20,000 cfs	Wet	-15 (-17%)	-15 (-17%)	8 (9%)	8 (9%)
	Above Normal	-17 (-25%)	-8 (-14%)	17 (25%)	25 (43%)
25,000 cfs	Wet	-19 (-24%)	-12 (-16%)	(0%)	8 (11%)
	Above Normal	-17 (-33%)	-17 (-33%)	25 (50%)	25 (50%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows at Verona under H3_ELT would be lower by up to 22% relative to NAA_ELT during July, September and November, greater by up to 35% greater during June, and similar in the remaining eight months (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

For adults, the average number of months per year during the November through May adult migration period in which flows in the Sacramento River at Wilkins Slough exceed 5,300 cfs was determined (Table 11-4A-113). The average number of months exceeding 5,300 cfs under H3_ELT would be similar to the number of months under NAA_ELT.

H4_ELT/HOS_ELT

Year-round flows under H4_ELT in the Sacramento River at Verona would be similar to those under NAA_ELT, except during June, in which mean flows under H4_ELT would be up to 35% higher, during July through September and November, in which flows would be up to 22% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

For H4_ELT, the percentage of months exceeding the USFWS's (1995) recommended Delta outflow thresholds in April and May of wet and above normal years was similar or considerably greater than NAA_ELT (Table 11-4A-114). These results indicate that, using the positive correlation between Delta outflow and year class strength, year class strength generally would be similar or greater under H4_ELT relative to NAA_ELT.

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows. The range of Alternative 4A operations (i.e., H3_ELT and H4_ELT) includes a range of Delta outflows, as described above (see Table 11-4A-114), which is discussed further below.

NEPA Effects: Upstream flows (above north Delta intakes) would generally be similar between Alternative 4A and NAA_ELT. As noted for green sturgeon and described above, due to the removal of water at the North Delta intakes, there are substantial differences in through-Delta flows between Alternative 4A and NAA_ELT. The percentage of months exceeding the USFWS (1995) Delta outflow thresholds in April and May of wet and above normal years was appreciably lower than NAA_ELT for Alternative 4A's H3_ELT scenario, but was similar or considerably greater than NAA_ELT for Alternative 4A's H4_ELT scenario (Table 11-4A-114). As noted for Alternative 4 and in the analysis of green sturgeon, the exact mechanism for the correlation between white sturgeon year-class strength and Delta outflow is not known at this time.

The scientific uncertainty regarding which mechanisms are responsible for the positive correlation between year class strength and river/Delta flow will be addressed through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations as described in the adaptive management and monitoring program in Section 4.1 to inform decisions regarding Delta outflow such that the effect on white sturgeon Delta flow conditions would not be adverse. This uncertainty and the associated adaptive management and monitoring program, combined with similarities in upstream flow conditions between Alternative 4A and NAA_ELT, indicate that Alternative 4A would not be adverse to migration conditions for white sturgeon.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of migration habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of migration habitat for white sturgeon.

Upstream of the Delta

H3_ELT/ESO_ELT

The number of months per year with exceedances above the 17,700 cfs threshold for Wilkins Slough under H3_ELT would be similar to those under Existing Conditions on the relative scale (%), except in below normal years (25% lower) (Table 11-4A-113). The number of months per year exceeding

31,000 cfs at Verona under H3_ELT would be up to 40% lower than those under Existing Conditions. All of these changes would be small to moderate on the absolute scale (up to 0.4 fewer months per year).

For Delta outflow, the percent of months exceeding outflow thresholds under H3_ELT would consistently be lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (Table 11-4A-114).

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period. In general, mean flows under H3_ELT would be similar or lower relative to Existing Conditions during January through May and July through December, with the largest reductions in flow (up to 31% lower) during July through September. Flows under H3_ELT would be higher (up to 50%) during June of above normal, below normal, and dry water years and during September of wet and above normal water years (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

For adult migration, the average number of months per year exceeding 5,300 cfs at Wilkins Slough under H3_ELT would be similar to or slightly lower than the number of months under Existing Conditions (up to 4% lower) (Table 11-4A-113).

H4_ELT/HOS_ELT

Year-round flows under H4_ELT in the Sacramento River at Verona would be similar to or up to 43% greater than flows under Existing Conditions during April through June, September, and December, and up to 28% lower than flows under Existing Conditions in the remaining 7 months (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Through-Delta

Given the improved OMR flows and the range of Delta outflows under Alternative 4A's H3_ELT and H4_ELT that would be refined to avoid negative impacts to green sturgeon (see NEPA Effects discussion above), the potential impact of Alternative 4A on in-Delta conditions for white sturgeon is considered less than significant, and no mitigation would be required.

Summary of CEQA Conclusion

Under Alternative 4A, the exceedance of flow thresholds in the Sacramento River would be lower than under Existing Conditions. Exceedance of Delta outflow thresholds would be lower under Alternative 4A's H3_ELT scenario than under Existing Conditions, but would be similar or greater than under Existing Conditions for the H4_ELT scenario, although there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows are co-varying with another unknown factor. Juvenile migration flows in the Sacramento River at Verona would be up to 31% lower in six (for H3_ELT) or seven (for H4_ELT) of 12 months relative to Existing Conditions. These reduced flows would have a substantial effect on the ability to migrate downstream, delaying or slowing rates of successful migration downstream and increasing the risk of mortality. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce migration conditions for white sturgeon.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on upstream flows.

In addition and as noted for green sturgeon, Real Time Operations described for the water conveyance facilities allow for optimization of short-term adjustments. This will ensure that the impacts of water operations on migration conditions for white sturgeon are less than significant. The adaptive management and monitoring program will evaluate water operations to ensure the impacts of water operations on migration conditions for white sturgeon are less than significant. Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures (Environmental Commitment 2, Environmental Commitment 4–Environmental Commitment 7, and Environmental Commitment 10)

As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for winter-run Chinook salmon generally would be similar for white sturgeon. As noted for green sturgeon, white sturgeon may inhabit the Delta year-round and would be more likely to encounter any effects from restoration measures. However, because the extent of restoration is limited to offsetting losses from construction of the water conveyance facilities, any such effects would be greatly limited compared to Alternative 1A and 4, for example.

Impact AQUA-151: Effects of Construction of Restoration Measures on White Sturgeon

The discussion of Impact AQUA-133 for green sturgeon also is applicable to white sturgeon.

***NEPA Effects*:** The effects of short-term construction activities would not be adverse to white sturgeon because environmental commitments would limit the potential for construction-related effects.

***CEQA Conclusion*:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on white sturgeon but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce white sturgeon habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-152: Effects of Contaminants Associated with Restoration Measures on White Sturgeon

The discussion of Impact AQUA-134 for green sturgeon also is applicable to white sturgeon.

NEPA Effects: While Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in white sturgeon. Alternative 4A would restore 59 acres of tidal wetlands that, depending on the specific site conditions of the restoration, may result in the colonization of benthic grazers that bioaccumulate selenium. As sturgeon are benthic feeders, the increased habitat for grazers may result in increased exposure to selenium. However, the small amount of area to be restored would not result in a substantial change in exposure potential. Overall, the effects of contaminants associated with restoration measures would not be adverse for white sturgeon.

CEQA Conclusion: Habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in white sturgeon. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect white sturgeon either directly or through habitat modifications. Accordingly, no mitigation would be required.

Impact AQUA-153: Effects of Restored Habitat Conditions on White Sturgeon

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on white sturgeon would not be adverse because restoration is intended to provide habitat benefits for white sturgeon.

CEQA Conclusion: As described above, habitat restoration activities could result in short-term effects on white sturgeon, primarily as a result of increased potential for contaminated sediments to enter the water column. However, these effects are likely to be localized, sporadic, and of low magnitude. Adverse effects during restoration would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*. The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce white sturgeon habitat, restrict its range or interfere with its movement. Additionally, there would be substantial long-term net benefits of habitat restoration. Consequently, no additional mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for other covered species such as green sturgeon, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation

Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for white sturgeon remains the same.

Impact AQUA-154: Effects of Methylmercury Management on White Sturgeon (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to white sturgeon.

NEPA Effects: The effects of methylmercury management on white sturgeon would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on white sturgeon would be less than significant. Consequently, no mitigation is required.

Impact AQUA-157: Effects of Localized Reduction of Predatory Fish on White Sturgeon (Environmental Commitment 15)

The discussion of Impact AQUA-139 for green sturgeon also is applicable to white sturgeon.

NEPA Effects: The overall effect would not be adverse because it is unlikely that the targeted predators prey on white sturgeon and because the white sturgeon bycatch is expected to be minimal.

CEQA Conclusion: Consistent with the analysis for Alternative 1A, the impact is considered less than significant because it is unlikely that the targeted predators prey on white sturgeon and because the white sturgeon bycatch is expected to be minimal. Consequently, no mitigation would be required.

Impact AQUA-158: Effects of Nonphysical Fish Barriers on White Sturgeon (Environmental Commitment 16)

The discussion of Impact AQUA-140 for green sturgeon also is applicable to white sturgeon.

NEPA Effects: The overall effect would not be adverse because the NPB would not be located in the same portion of the channel that white sturgeon are expected to occur and because their hearing ability is low within the range of sound that the NPB generates.

CEQA Conclusion: Consistent with the analysis for Alternative 1A, the impact is considered less than significant because the NPB would not be located in the same portion of the channel that white sturgeon are expected to occur and because their hearing ability is low within the range of sound that the NPB generates. Consequently, no mitigation would be required.

Pacific Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-163: Effects of Construction of Water Conveyance Facilities on Pacific Lamprey

The potential effects of construction of the water conveyance facilities on Pacific lamprey would be the same as those described for Alternative 4, Impact AQUA-163. This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-163 in Alternative 4.

Table 11-8 presents the life stages of Pacific lamprey and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Potential impacts of pile driving noise on Pacific lamprey are different from other fish species. In a study of hearing in sturgeon and lamprey, Popper (2005) found that lamprey do not have the typical hearing structures of other fish. Although there have been no studies to determine responses of lamprey to sound (Popper 2005), ammocoetes are partially buried in the substrate, and the substrate dampens vibrations and noise. As a result, at least some life stages of Pacific lamprey may be less susceptible to injury from impact pile driving than other fish species.

Under Alternative 4A, adult, ammocoete, and macropthalmia life stages could be present in the vicinity of the proposed in-water pile driving locations (intakes, barge unloading facilities, CCF cofferdams, CCF siphons, and Head of Old River operable barrier) during in-water pile driving activities. While adults would primarily occur between June and July and macropthalmia in June, ammocoetes would occur throughout the year. However, the abundance of ammocoetes is low at all in-water pile driving sites. Adults are considered moderately abundant in June and July near the intakes, but of low abundance in the east and south Delta where barge landings would be located. Macropthalmia would be primarily migrating downstream, and during only a portion of the in-water construction period. Therefore their exposure to pile driving sound levels would likely be limited.

Given the likely low numbers in the east and south Delta, the relatively small areas affected by underwater noise in the east and south Delta, and the intermittent nature of pile driving activities, exposure of Pacific lamprey to potentially harmful pile driving noise is expected to be limited to a small proportion of the total population. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce the magnitude of these effects. Overall, underwater construction noise would be expected to adversely affect small numbers of Pacific lamprey and not result in significant population-level effects.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-163, the effect would not be adverse for Pacific lamprey. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity, would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by Pacific lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on Pacific lamprey that may be present could be adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-

1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-163, the impact of the construction of the water conveyance facilities on Pacific lamprey would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect Pacific lamprey. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-164: Effects of Maintenance of Water Conveyance Facilities on Pacific Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-164. As concluded in Alternative 4, Impact AQUA-164, the impact would not be adverse for Pacific lamprey.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-164, the impact of the maintenance of water conveyance facilities on Pacific lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-165: Effects of Water Operations on Entrainment of Pacific Lamprey

Water Exports

The potential entrainment impacts of Alternative 4A on Pacific lamprey and river lamprey would be similar to Alternative 4 for operating SWP/CVP south Delta export facilities and the proposed new SWP/CVP North Delta intakes (Impact AQUA-165). Alternative 4A operational criteria are designed to avoid or reduce potential entrainment and the effect would not be adverse.

The analysis of Pacific lamprey and river lamprey entrainment at the SWP/CVP south Delta export facilities is combined because the salvage facilities do not distinguish between the two lamprey species. Under Scenario H3_ELT, average annual entrainment of lamprey at the south Delta export facilities would be substantially reduced by about 45% (Table 11-4A-115) across all year types compared to the NAA_ELT. Entrainment losses would be further reduced under Scenario H4_ELT compared to NAA_ELT. Therefore, Alternative 4A would not have adverse effects on lamprey.

Predation Associated with Entrainment

Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater under this Alternative compared to the NNA-ELT and would be lower due to a reduction in entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta.

NEPA Effects: Overall, the effect of entrainment and entrainment-related predation would not be adverse because entrainment, and predation associated with entrainment, would be reduced under Alternative 4A.

CEQA Conclusion: Annual entrainment losses of lamprey would be decreased under Scenario H3_ELT by 45% relative to Existing Conditions, and would be further decreased under Scenario H4_ELT. Lamprey predation loss at the south Delta facilities would not be increased relative to Existing Conditions and may be decreased due to reduction entrainment losses. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta. Overall, the effect of predation loss on lamprey under Alternative 4A would be similar or lower than existing conditions, consistent with the change in entrainment. Overall, the impacts of Alternative 4A water operations to Pacific lamprey are considered less than significant because they would reduce entrainment and potentially entrainment-related predation. Consequently, no mitigation would be required.

Table 11-4A-115. Lamprey Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities for Alternative 4A (Scenario H3_ELT)

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
All Years	-1,526 (-45%)	-1,504 (-45%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).
[a] Estimated annual number of fish lost, based on non-normalized data.

Impact AQUA-166: Effects of Water Operations on Spawning and Egg Incubation Habitat for Pacific Lamprey

In general, Alternative 4A would not affect the quality and quantity of spawning and egg incubation habitat for Pacific lamprey relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to Pacific lamprey spawning habitat were evaluated by estimating effects of flow alterations on egg exposure, called redd dewatering risk, and effects on water temperature. Rapid reductions in flow can dewater redds leading to mortality. Locations for each river used in the dewatering risk analysis were based on available literature, personal conversations with agency experts, and spatial limitations of the CALSIM II model, and include the Sacramento River at Keswick, Sacramento River at Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence with the Sacramento River. Pacific lamprey spawn in these rivers between January and August so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage). Water temperature results from the SRWQM and the Reclamation Temperature Model were used to assess the exceedances of water temperatures under all model scenarios in the upper Sacramento, Trinity, Feather, and American rivers.

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, January to August.

There would be minimal differences between H3_ELT and NAA_ELT in exposure to flow reductions in all rivers except for a small (10%) increase in the Feather River at Thermalito Afterbay (Table 11-4A-116). These results indicate that H3_ELT would not have biologically meaningful effects on Pacific lamprey redd cohorts in all locations analyzed because the difference represents only 2 percent (11 out of 656) of total hypothetical redd cohorts.

Table 11-4A-116. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	13 (24%)	1 (-2%)
Sacramento River at Red Bluff	15 (28%)	5 (8%)
Trinity River downstream of Lewiston	-1 (-1%)	1 (1%)
Feather River at Thermalito Afterbay	-26 (-17%)	11 (10%)
American River at Nimbus Dam	27 (32%)	5 (5%)
American River at Sacramento River Confluence	31 (33%)	8 (7%)

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

Significant reduction in survival of eggs and embryos of Pacific lamprey were observed at 22°C (71.6°F; Meeuwig et al. 2005). Therefore, in the Sacramento River, this analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive 2 month periods during which at least one month exceeds 22°C (71.6°F) using monthly averaged data from the Reclamation temperature model. Each individual day or month starts a new “egg cohort” such that there are 19,928 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from January 1 through August 31, and 648 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Exact spawning locations of Pacific lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In most locations, egg cohort exposure would not differ between NAA_ELT and H3_ELT (Table 11-4A-117). However, the number of cohorts exposed under H3_ELT would be 92% lower than those under NAA_ELT in the Trinity River at Lewiston. Also, the number of cohorts exposed under H3_ELT would be 93% greater than those under NAA_ELT in the Feather River below Thermalito Afterbay. Although a 92% reduction and a 93% increase appear substantial, these values represent only 23 and 37 egg cohorts, respectfully, or 3.5% and 5.7% of the 648 total hypothetical cohorts. Therefore, these increases and decreases in egg cohort exposure are small relative to the total population. As a result, they would not have a biologically meaningful effect.

Table 11-4A-117. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	506 (NA)	23 (5%)
Trinity River at Lewiston	0 (0%)	-23 (-92%)
Trinity River at North Fork	0 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	53 (221%)	37 (93%)
American River at Nimbus	42 (382%)	2 (4%)
American River at Sacramento River Confluence	96 (171%)	2 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	23 (1150%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F during January to August on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for in other rivers each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-118). Although relatively large, this value represents <4% of the population of ammocoetes (23 out of 648 total cohorts). Therefore, it is not expected that this increase in exposure would have a biologically meaningful effect to the population.

Table 11-4A-118. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts in the Feather River at Thermalito Afterbay[a]

Measurement	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Difference (Percent Difference)	-14 (-9%)	23 (20%)

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H4 than in Existing Conditions or NAA_ELT.

Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for H3_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because Alternative 4A would not have substantial effects on spawning and egg incubation habitat for Pacific lamprey. There would be no biologically meaningful differences in flow reductions that increase redd dewatering risk between the NAA_ELT and H3_ELT at all locations evaluated. Also, there would be increases and decreases in exposure risk of eggs to elevated temperatures but would not have a biologically meaningful effect due to their small absolute values relative to total egg cohort sizes. These modeling results are consistent between H3_ELT and H4_ELT.

CEQA Conclusion: Collectively, the results of the Impact AQUA-166 CEQA analysis show that there would be no effect of Alternative 4A on Pacific lamprey spawning and egg incubation habitat relative to the CEQA baseline.

H3_ELT/ESO_ELT

Effects of H3_ELT on month-over-month flow reduction compared to Existing Conditions consist of negligible effects (<5% difference) in the Trinity River, a decrease in egg cohorts exposed to flow reductions (-17%) in the Feather River, and moderate to substantial increases in exposures in the Sacramento River and American River (Table 11-4A-116). Changes would be most substantial for the American River (increased risk of dewatering exposure to 27 cohorts or 32% at Nimbus Dam, and 31 cohorts or 33% at the confluence). In the Sacramento River, there would be increased exposure to flow reductions for 13 cohorts or 24% at Keswick, and to 15 cohorts or 28% at Red Bluff. These results indicate that effects of Alternative 4A on flow would not negatively affect Pacific lamprey redd dewatering risk in the Feather River and Trinity River. Further, an increase of 13 to 31 cohorts out of 656 cohorts would represent fewer than 5 percent of total redd cohorts. Therefore, Alternative 4A would not affect dewatering risk in the Sacramento River or the American River.

The number of egg cohorts exposed to 22°C (71.6°F) under H3_ELT would be greater than that under Existing Conditions in at least one location in all rivers, except the Trinity River (Table 11-4A-117). In the American River, the difference in the number of cohorts exposed would represent 6 to 15 percent of total cohorts.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 14 fewer cohorts (9%) exposed to a 50% month over month drop in flow rate under H1 relative to NAA_ELT (Table 11-4A-118). Although relatively large, this value represents <5% of the population of ammocoetes. Therefore, it is not expected that this decrease in exposure would have a biologically meaningful effect to the population.

Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined. Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impacts to Pacific lamprey spawning and egg incubation conditions would be less than significant. There would be no increases in exposure to redd dewatering that would affect more than 5 percent of the population in all rivers. Temperature exposure in the American River at the Sacramento River confluence would affect 15 percent more cohorts under H3_ELT, but there would be no other differences that would have a biologically meaningful effect to Pacific lamprey in any of the other 9 locations evaluated. Therefore, the impact is less than significant and no mitigation is required.

Impact AQUA-167: Effects of Water Operations on Rearing Habitat for Pacific Lamprey

In general, the effect of Alternative 4A on Pacific lamprey rearing habitat would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to Pacific lamprey rearing habitat were evaluated by estimating of the frequency of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. An ammocoete remains relatively immobile in the sediment in the same location for 5 to 7 years, after which it migrates downstream. During the upstream rearing period there is potential for ammocoete stranding from rapid reductions in flow.

The analysis of ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (January through August) and spend 7 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than a given flow reduction (50%–90% in 5% increments)at any time during the seven-year period.

Comparisons of month-over-month flow reductions for the Sacramento River at Keswick (Table 11-4A-119) indicate that H3_ELT would have either no effect (0%) or negligible effects (<5%) on cohort exposures to all flow reductions. These results indicate that there would be no difference in Pacific lamprey stranding risk between H3_ELT and NAA_ELT in the Sacramento River at Keswick.

Table 11-4A-119. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	4	4
-65%	1	-2
-70%	0	-3
-75%	3	2
-80%	4	0
-85%	104	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Results of comparisons for the Sacramento River at Red Bluff (Table 11-4A-120) indicate that there would be no or negligible changes in flow reductions. These results indicate that there would no effect of H3_ELT on Pacific lamprey ammocoete exposure to flow reductions in the Sacramento River at Red Bluff.

Table 11-4A-120. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	4	4
-60%	1	-1
-65%	-1	-2
-70%	3	0
-75%	10	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the Trinity River indicate that there would be no or small (5%) differences in cohort exposure between NAA_ELT and H3_ELT for all flow reductions evaluated (Table 11-4A-121). These results indicate that there would be no biologically meaningful effects of H3_ELT on Pacific lamprey stranding risk in the Trinity River.

Table 11-4A-121. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	22	1
-80%	20	1
-85%	20	1
-90%	34	5

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort exposure at the 50% through 75% flow reductions (Table 11-4A-122). For the 80% through 90% flow reductions, ammocoete exposure would be 1% to 64% lower, which would have a beneficial effect on ammocoete rearing. These results indicate that there will be beneficial effects of H3_ELT on Pacific lamprey ammocoete rearing in the Feather River.

Table 11-4A-122. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	-3	-1
-85%	-19	-30
-90%	-64	-64

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with the Sacramento River (Table 11-4A-124) have similar results. There would be no or negligible differences in cohort exposure between NAA_ELT and H3_ELT for the 50% to 70% flow reductions range and the 85% to 90% flow reductions range. There would be higher cohort exposure under H3_ELT relative to NAA_ELT at Nimbus Dam at the 75% flow reduction (7% higher) and at the confluence with the Sacramento River at the 75% (12% higher) and 80% (23% higher) flow reductions. At the confluence with the Sacramento River, there would be no differences in cohort exposure for all flow reduction levels except the 85% level, at which exposure would be 33% greater under H3_ELT. These results indicate that there would generally be no effect of H3_ELT on stranding risk in the American River with few small exceptions that would be infrequent and would therefore not result in biologically meaningful effects.

Table 11-4A-123. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	-1
-70%	34	4
-75%	85	12
-80%	238	23
-85%	104	0
-90%	-100	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Table 11-4A-124. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	1
-70%	7	1
-75%	22	4
-80%	192	4
-85%	223	33
-90%	104	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

To evaluate water temperature-related effects of H3_ELT on Pacific lamprey ammocoetes, we examined the predicted number of ammocoete "cohorts" that experience water temperatures greater than 71.6°F for at least one day in the Sacramento River (because daily water temperature data are available) or for at least one month in the Feather, American, Stanislaus, and Trinity rivers over a 7 year period, the maximum likely duration of the ammocoete life stage (Moyle 2002). Each individual day or month starts a new "cohort" such that there are 18,244 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 593 cohorts for the other rivers using monthly data over the same period.

The number of ammocoete cohorts exposed to temperatures greater than 71.6°F would be similar between NAA_ELT and H3_ELT in most of the rivers (Table 11-1A-125). Ammocoetes in the Feather River at Thermalito Afterbay would experience a 15% increase in exposure to temperatures greater than 71.6°F, although there would be no difference relative to the NAA at the fish dam. Overall, the effects would be minimal to the Pacific lamprey population.

Table 11-4A-125. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Ammocoete Cohorts Exposed to Temperatures Greater than 71.6°F in at Least One Day or Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	7,721 (NA)	476 (7%)
Trinity River at Lewiston	56 (NA)	0 (0%)
Trinity River at North Fork	56 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	164 (43%)	70 (15%)
American River at Nimbus	265 (137%)	-14 (-3%)
American River at Sacramento River Confluence	151 (35%)	9 (2%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	283 (505%)	0 (0%)

NA = could not be calculated because the denominator was 0.
[a] Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.
[b] Based on daily data; all other locations use monthly data; 1922–2003.

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 9 and 53% higher, respectively. The 85% and 90% flow reductions would occur rarely: 19 and 7 times under NAA_ELT and 22 and 10 times, respectively under H4_ELT throughout the 985 total months evaluated. Therefore, these reductions would affect a small proportion of the population. As a result, these results indicate that there would be no biologically meaningful effect of H4_ELT on stranding risk.

Table 11-4A-126. Percent Difference between Baselines and H4_ELT Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

Percent Flow Reduction	Percent Difference[a]	
	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	25	9
-90%	53	53

[a] Negative values indicate reduced cohort exposure under H4_ELT.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85% and 90% flow reductions under H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. There would generally be negligible effects or beneficial effects of H3_ELT on Pacific lamprey ammocoete stranding risk in all rivers evaluated. There would be minimal differences in exposure risk of ammocoetes to elevated temperatures within each river evaluated.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of rearing habitat for Pacific lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for Pacific lamprey relative to NAA_ELT.

H3_ELT/ESO_ELT

Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate negligible changes (<5%) in occurrence of flow reductions for all flow reduction categories, with the exception of a 104% increase in occurrence of month-over-month flow reductions of 85% (Table 11-4A-119). Comparisons for the Sacramento River at Red Bluff indicate no effect (0%) or negligible effects (<5%) for all flow reduction categories with the exception of 10% and 23% increases in exposure for the 75% and 80% flow reduction events, respectively (Table 11-4A-120). Based on the fact that increases in exposure would only be substantial for one or two flow reduction categories depending on location, H3_ELT would not be expected to have biologically meaningful negative effects on spawning success in the Sacramento River but would contribute incrementally to regional effects.

Increases from Existing Conditions to H3_ELT of 20–34% are predicted for egg cohort exposed to flow reductions from 75% to 90% for the Trinity River (Table 11-4A-121); the percentages correspond generally to increased occurrences from approximately 350 events for Existing Conditions to approximately 450 events for H3_ELT. Despite the prevalence of increased exposure risk to the higher flow reduction events, the percentage of cohorts exposed to stranding risk is relatively small compared to the total number of cohorts and therefore effects on rearing success in the Trinity River would not be biologically meaningful but would contribute incrementally to regional effects.

Comparisons for the Feather River at Thermalito Afterbay (Table 11-4A-122) indicate that there would be negligible (<5%) differences in exposure of Pacific lamprey ammocoete cohorts to all flow reductions except the 85% and 90% reductions, in which exposure would be 19% and 64% lower under H3_ELT. This suggests that flow conditions would improve for Pacific lamprey ammocoetes under H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with the Sacramento River (Table 11-4A-124) indicate an increase in exposure risk to stranding between 70% and 85% or 90% for H3_ELT compared to Existing Conditions; predicted increases ranged from 34 to 238% for Nimbus Dam and from 7 to 223% for the confluence. These persistent and substantial increases in exposures to larger flow reduction events would have biologically meaningful effects on Pacific lamprey ammocoete cohort stranding and therefore spawning success in the American River.

The number of ammocoete cohorts exposed to 71.6°F under H3_ELT would be higher than those under Existing Conditions in most locations examined, except in the Sacramento River at Keswick, in the Feather River at the Fish Barrier Dam, and the Stanislaus River at Knights Ferry (Table 11-4A-125).

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 25% and 53% higher, respectively. These results indicate that there would generally be no effect of H4_ELT on stranding risk with exceptions that very high flow reductions that would not be common enough to have biologically meaningful effects.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT.

Summary of CEQA Conclusion

Under Alternative 4A, the risk of redd dewatering would increase to some degree under some flow reductions in the Sacramento and Trinity rivers, and substantially in the American River at Nimbus Dam (increases from 34% to 238%). Flow reductions would increase the risk of ammocoete stranding and desiccation in these rivers. There would be a beneficial effect from decreased occurrence of flow reduction events (=reduced ammocoete stranding risk) in the Feather River (-19% to -64% for the 85% and 90% flow reduction categories) but this effect would not offset the more substantial reductions in the other locations. There would be an increase in exposure to critical water temperatures in most locations examined. Increased exposure to higher water temperatures would increase stress and mortality of ammocoetes. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of Pacific lamprey as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be negligible effects or beneficial effects of Alternative 4A on Pacific lamprey ammocoete stranding risk in all rivers evaluated. There would be increase and decreases in exposure risk of ammocoetes to elevated temperatures within each river evaluated that would balance out such that there would be no net effect on Pacific lamprey ammocoetes. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions).

Impact AQUA-168: Effects of Water Operations on Migration Conditions for Pacific Lamprey

In general, the effect of Alternative 4A on Pacific lamprey migration conditions would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

After 5 to7 years, Pacific lamprey ammocoetes migrate downstream and become macropthalmia (juveniles) once they reach the Delta. Migration generally is associated with large flow pulses in winter months (December through March) (USFWS unpublished data) meaning alterations in flow have the potential to affect downstream migration conditions. The effects of H3_ELT water operations on seasonal migration flows for Pacific lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of Pacific lamprey during the likely macropthalmia migration period (December through May) were examined for the Sacramento River at Rio Vista and Red Bluff, the Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

The adult Pacific lamprey upstream migration period occurs between January and June. CALSIM II flow outputs were examined during these periods for each model scenario.

Sacramento River

Macropthalmia

Flows the Sacramento River at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December to May macropthalmia migration period. Flows under H3_ELT would generally be lower by up to 24% under H3_ELT relative to NAA_ELT. Based on the prevalence of moderate decreases in flow in drier water years for much of migration period, H3_ELT would affect Pacific lamprey macropthalmia migration conditions at this location. In the Sacramento River upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), flows under H3_ELT during December through May would be similar to or up to 9% greater than flows under NAA_ELT.

Adults

Flows in the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January to June adult migration period. Flows under H3_ELT would be similar to or up to 9% greater than flows under NAA_ELT. These results indicate that H3_ELT would generally not affect adult migration conditions in the Sacramento River.

Feather River

Macropthalmia

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December to May macropthalmia migration period. Flows under H3_ELT during would generally be similar to or greater (up to 12% greater) than flows under NAA_ELT. These results indicate that effects of H3_ELT on macropthalmia migration flows in the Feather River would generally be negligible.

Adults

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January through June adult migration period. Flows under H3_ELT would generally be similar to flows under NAA_ELT during January through May and greater by up to 77% during June. These results indicate that H3_ELT would have no effect or a beneficial effect on adult migration conditions in the Feather River.

American River

Macropthalmia

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the December through May macropthalmia migration period. Flows under H3_ELT would generally be similar to flows under NAA_ELT with few small exceptions. These results indicate that H3_ELT would not have negative effects on macropthalmia migration conditions in the American River.

Adults

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the January to June adult migration period. Flows under H3_ELT during January through May would generally be similar to flows under NAA_ELT with few small exceptions. Flows under H3_ELT during June would generally be greater by up to 25% than flows under NAA_ELT. These results indicate that H3_ELT would have no effect or a beneficial effect on adult migration conditions in the American River.

H4_ELT/HOS

Flows at Rio Vista would be up to 12% lower under H4_ELT relative to NAA_ELT during December through April and there would be no differences during May. Flows in the Sacramento River upstream of Red Bluff under H4_ELT during the December through May macropthalmia migration period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia in this reach would be unaffected under. Flows in the Sacramento River at Red Bluff under H4_ELT during the January through June migration period would generally be similar to flows under NAA_ELT. Overall, flows at Rio Vista under H4_ELT would be slightly lower on average than flows under NAA_ELT and flows would not differ between NAA_ELT and H4_ELT at Red Bluff.

Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period would generally be similar to or greater than (up to 119% greater) flows under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia would be improved under H4_ELT relative to NAA_ELT in the Feather River. Flows under H4_ELT during the January through June adult migration period would generally be similar to or greater than (up to 119% greater) flows under H3_ELT, indicating that migration conditions for adults would also be improved under H4_ELT relative to NAA_ELT in the Feather River.

Flows in the American River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period and the January through June adult migration period would generally be similar to or greater than flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

These results indicate that there would be small negative effects of Alternative 4A on lamprey migration flows in the Sacramento River, moderately large benefits in the Feather River, and no effect in the American River.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality. There would be small to moderate negative effects of Alternative 4A on lamprey migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or moderately large benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento River at Red Bluff and in the American River. Combined, these effects would not result in adverse effects on migration conditions for Pacific lamprey.

CEQA Conclusion: In general, Alternative 4A would not reduce the quantity and quality of migration habitat for Pacific lamprey relative to Existing Conditions.

H3_ELT/ESO_ELT

Sacramento River

Macropthalmia

Comparisons of mean monthly flow rates for H3_ELT to Existing Conditions in the Sacramento River at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate that flows would be up to 47% lower under H3_ELT compared to Existing Conditions.

Comparisons for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate negligible effects (<5%) or small increases or decreases in flow (up to 10%) under H3_ELT that would not have biologically meaningful effects on migration conditions relative to Existing Conditions.

Adults

Comparisons of mean monthly flow for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January through June for H3_ELT relative to Existing Conditions indicate that for most months and water year types, flows under H3_ELT would be similar to (<5% difference) or greater than flows under Existing Conditions, with some increases and decreases in mean monthly flow that would not have biologically meaningful effects on migration.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of H3_ELT relative to Existing Conditions by month and water year type, with negligible effects (<5%), moderate increases in flow (to 18%) that would be beneficial for migration conditions, with occasional occurrences of moderate decreases in flow to -19%. These results indicate that the effects of H3_ELT on flows would not have negative effects on macropthalmia migration in the Feather River.

Adults

Comparisons of mean monthly flow for the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June indicate variable effects of H3_ELT relative to Existing Conditions depending on the month and water year type, with primarily negligible effects (<5%), small to substantial increases in flow (to 71%) that would have a beneficial effect on migration conditions, and occasional small to moderate decreases in flow (up to 19%). Based on the prevalence of negligible effects and increases in flow which would have a beneficial effect on migration conditions, and only occasional reductions in flow of small to moderate magnitude, these results indicate that effects of H3_ELT on flow would not have biologically meaningful negative effects on adult migration conditions in the Feather River.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of H3_ELT relative to Existing Conditions, with negligible effects (<5%) during April, increases (up to 15%) during February and March that would be beneficial on migration conditions, and decreases (up to -18%) during January and May. Due to the low magnitude and frequency of increases and decreases in flow, these differences would not have biologically meaningful positive or negative effects on macropthalmia migration conditions in the American River.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June indicate variable effects of H3_ELT relative to Existing Conditions, with negligible effects (<5%), increases (up to 15%) that would be beneficial on migration conditions, and decreases (to -35%). Based on the balance of increases and decreases in flows, these results indicate that effects of H3_ELT on flow would not have biologically meaningful negative effects on adult migration conditions in the American River.

H4_ELT/HOS

Flows in the Sacramento River at Rio Vista during the December through May macropthalmia migration period under H4_ELT would be mostly lower by up to 17% than flows under Existing Conditions. Flows upstream of Red Bluff under H4_ELT during December through May would generally be similar to or greater than (up to 9% greater) flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for Pacific lamprey macropthalmia would be largely unaffected by H4_ELT. Flows in the Sacramento River at Red Bluff under H4_ELT during the January through June migration period would generally be similar to or greater than (up to 9% greater) flows under NAA_ELT, indicating that migration conditions for adults would be largely unaffected by H4_ELT.

Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period would generally be similar to or greater than (up to 112% greater) flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for macropthalmia would be similar to or improved under H4_ELT. Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the January through June migration period would generally be similar to or greater than (up to 112% greater) flows under Existing Conditions, except during June in which flows under H4_ELT would be up to 28% lower. Overall, flows in the Feather River would be higher under H4_ELT than those under Existing Conditions during the adult migration period.

Differences in flows in the American River at the confluence with the Sacramento River under H4_ELT during the December through May macropthalmia migration period and the January through June adult migration period would generally be similar. Flows under H4_ELT would be similar to those under Existing Conditions during December, March, and April, higher during January, February, and March, and lower during May and June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Due to the wide variation in results, it is concluded that the effects will not be negative.

These results indicate that the effects of H4_ELT on Pacific lamprey migration conditions would generally be similar to those under Existing Conditions.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect is less than significant because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality. There would be small to moderate negative effects of Alternative 4A on lamprey migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or moderately large benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento River at Red Bluff and in the American River. Combined, these effects would not have a population level effect on Pacific lamprey. Therefore, the impact is less than significant and no mitigation is required.

Restoration Measures (Environmental Commitments 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat restoration discussed for other covered species such as winter-run Chinook salmon generally would be similar for Pacific lamprey. Pacific lamprey would have the potential to encounter restoration-related effects. However, because the extent of restoration is limited to offsetting losses from construction of the water conveyance facilities, any such effects would be greatly limited compared to Alternative 1A and 4, for example.

Impact AQUA-169: Effects of Construction of Restoration Measures on Pacific Lamprey

As noted for Alternative 1A's discussion of Impact AQUA-133, in-water and shoreline construction activities (e.g., riprap removal and levee breaching; shoreline excavation and recontouring) could increase turbidity, but Pacific lamprey are tolerant to such increases and implementation of the environmental commitments described under Impact AQUA-1 for delta smelt and in Appendix 3B, *Environmental Commitments* (Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material), would minimize or eliminate effects on Pacific lamprey.

NEPA Effects: The effects of short-term construction activities would not be adverse to Pacific lamprey because environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion: As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on Pacific lamprey but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental*

Commitments). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce Pacific lamprey habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-170: Effects of Contaminants Associated with Restoration Measures on Pacific Lamprey

The factors influencing the potential effects of contaminants from restored areas on Pacific lamprey are discussed in the analysis of Impact AQUA-170 under Alternative 1A. Because the extent of habitat restoration under Alternative 4A is considerably reduced relative to Alternative 1A, any effects from contaminants also would be considerably reduced.

NEPA Effects: As noted for other covered fishes, while Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in Pacific lamprey. Overall, the effects of contaminants associated with restoration measures would not be adverse for Pacific lamprey.

CEQA Conclusion: As noted for other covered fishes, habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in Pacific lamprey. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect Pacific lamprey either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-171: Effects of Restored Habitat Conditions on Pacific Lamprey

Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat loss/modification caused by construction and operation of the water facilities proposed under Alternative 4A.

NEPA Effects: The effects of restored habitat conditions on Pacific lamprey would not be adverse restoration could provide habitat benefits for lamprey.

CEQA Conclusion: As described above, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on Pacific lamprey would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As noted for other covered species, Alternative 4A includes three other conservation measures, which are reduced in their extent relative to other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms for Pacific lamprey remains the same.

Impact AQUA-172: Effects of Methylmercury Management on Pacific Lamprey (Environmental Commitment 12)

The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to Pacific lamprey.

NEPA Effects: The effects of methylmercury management on Pacific lamprey would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on Pacific lamprey would be less than significant. Consequently, no mitigation is required.

Impact AQUA-175: Effects of Localized Reduction of Predatory Fish on Pacific Lamprey (Environmental Commitment 15)

It is possible, but not assured, that there would be some reduction in predation losses of Pacific lamprey under *Environmental Commitment 15 Localized Reduction of Predatory Fish*; for Alternative 4A, such efforts would be focused at the NDD and at the south Delta export facilities. There is uncertainty in the potential efficacy of Environmental Commitment 15 and also uncertainty in the importance of predation to Pacific lamprey. Due to these uncertainties, there would be no demonstrable effect of this conservation measure on Pacific lamprey.

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the overall effect would not be adverse.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-176: Effects of Nonphysical Fish Barriers on Pacific Lamprey (Environmental Commitment 16)

As described for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of Georgiana Slough from the Sacramento River would be implemented to guide juvenile salmonids away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to the Sacramento River (Perry et al. 2010). As described in the *BDCP Effects Analysis*, the effects of an NPB at this location would be expected to have little to no effect on Pacific lamprey because of their physiology (limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli; see section 5C.5.3.9 in *BDCP Effects Analysis Appendix 5.C* and section 5.B.6.1.11.1 *BDCP Effects Analysis Appendix 5.B, both hereby incorporated by reference*). As noted in the discussion of Impact AQUA-180 for Alternative 1A, the NPB may attract piscivorous predators but the additional predation on Pacific lamprey is expected to be low.

NEPA Effects: The overall effect of the NPB on Pacific lamprey would not be adverse because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli. Consequently, no mitigation would be required.

River Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-181: Effects of Construction of Water Conveyance Facilities on River Lamprey

The potential effects of construction of water conveyance facilities on river lamprey would be the same as those described for Alternative 4 Impact AQUA-181. This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-181 in Alternative 4.

Table 11-8 presents the life stages of river lamprey and months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Little is known about the distribution and abundance of river lamprey, but salvage records at the south Delta export facilities indicate that they could be present in the Delta during this period. It is assumed that the discussion above for Pacific lamprey generally applies to river lamprey. Thus, underwater construction noise could adversely affect small numbers of river lamprey but would not result in significant population-level effects.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-181, the effect would not be adverse for river lamprey. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. This species' natural tolerance to turbidity would likely avoid the risk of any adverse turbidity effects resulting from project construction. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats used by river lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat. The direct effects of underwater construction noise on river lamprey that may be present could be adverse if river lamprey are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-181, the impact of the construction of water conveyance facilities on river lamprey would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect river lamprey. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-182: Effects of Maintenance of Water Conveyance Facilities on River Lamprey

The potential effects of the maintenance of water conveyance facilities under Alternative 4 would be the same as those described for Alternative 1A (see Impact AQUA-182) except that only three intakes would need to be maintained under Alternative 4 rather than five under Alternative 1A, resulting in less impacts. As concluded in Alternative 1A, Impact AQUA-182, the impact would not be adverse for river lamprey.

CEQA Conclusion: As described in Alternative 1A, Impact AQUA-182, the impact of the maintenance of water conveyance facilities on river lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-183: Effects of Water Operations on Entrainment of River Lamprey

Water Exports

The impact on entrainment of river lamprey at water operations facilities in the south and north Delta is expected to be the same as described for Pacific lamprey (see Impact AQUA-165). Entrainment losses at the south Delta facilities would be reduced for both flow scenarios under Alternative 4A compared to NAA_ELT. The potential impacts at the proposed new north Delta intakes are unknown since little is known about the river lamprey life history in the Delta.

Predation Associated with Entrainment

Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater under this Alternative compared to the NAA_ELT and may be lower due to a reduction in entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the installation of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown because of the lack of knowledge about their distribution and population abundances in the Delta.

NEPA Effects: Overall, the effect of entrainment and entrainment-related predation would not be adverse because entrainment, and predation associated with entrainment, would be reduced under Alternative 4A.

CEQA Conclusion: As described above for Pacific lamprey (which is assumed to have the same entrainment effects as river lamprey), annual entrainment losses of lamprey would be substantially reduced under both flow scenarios for Alternative 4A relative to existing biological conditions. Lamprey predation loss at the south Delta facilities would not be increased relative to Existing Conditions and may be decreased due to reduction entrainment losses. The impact of predation loss at the north Delta is unknown, since there is little available knowledge on the distribution and abundance in the Delta, especially in the vicinity of the proposed new north Delta intakes. Overall, the impacts of Alternative 4A water operations to river lamprey are considered less than significant because they would reduce entrainment and potentially entrainment-related predation. No mitigation would be required.

Impact AQUA-184: Effects of Water Operations on Spawning and Egg Incubation Habitat for River Lamprey

In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to river lamprey spawning habitat were evaluated by estimating effects of flow alterations on redd dewatering risk as described for Pacific lamprey with appropriate time-frames for river lamprey incorporated into the analysis. The same locations were analyzed as for Pacific lamprey: the Sacramento River at Keswick and Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence with the Sacramento River. River lamprey spawn in these rivers between February and June so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage).

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, as described for Pacific lamprey, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, February to June.

There would be negligible differences between H3_ELT and NAA_ELT in exposure to flow reductions in all rivers except for a small decrease (8% lower) in the American River at Nimbus Dam (Table 11-4A-127). These results indicate that H3_ELT would not have biologically meaningful effects on river lamprey redd cohorts predicted to experience a month-over-month change in flow of greater than 50% in all locations analyzed.

Table 11-4A-127. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	3 (9%)	0 (0%)
Sacramento River at Red Bluff	4 (11%)	1 (3%)
Trinity River downstream of Lewiston	-2 (-3%)	0 (0%)
Feather River below Thermalito Afterbay	-3 (-4%)	-3 (-4%)
American River at Nimbus	4 (7%)	-5 (-8%)
American River at Sacramento River confluence	12 (20%)	0 (0%)

[a] Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

River lamprey generally spawn between February and June (Beamish 1980; Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey "adults need… temperatures [that] do not exceed 25°C," although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from USRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau's temperature model. Each individual day or month starts a new "egg cohort" such that there are 12.320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

For both thresholds, there would be few differences in egg cohort exposure between NAA_ELT and H3_ELT among all sites (Table 11-4A-128). In most cases, absolute differences account for <5% of the total number of cohorts. The two exceptions are for the 71.6 °F threshold in the Feather River at Thermalito Afterbay (7% absolute increase) and for the 77 °F threshold in American River at the Sacramento River Confluence (11% absolute decrease). However, due to the low magnitude and frequency, there would be no population level effects of this increase and decrease in temperature exposure to river lamprey eggs.

Table 11-4A-128. Differences (Percent Differences) between Model Scenarios in River Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Temperatures above 71.6°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	100 (NA)	-1 (-1%)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	1 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	11 (122%)	7 (54%)
American River at Nimbus	12 (240%)	-2 (-11%)
American River at Sacramento River Confluence	18 (64%)	-11 (-19%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	11 (1100%)	0 (0%)
Temperatures above 77°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	0 (NA)	0 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	2 (NA)	2 (NA)
American River at Nimbus	1 (NA)	0 (0%)
American River at Sacramento River Confluence	3 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of river lamprey egg cohorts experiencing water temperatures above 71.6°F and 77°F during February through June on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period in other rivers for each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

H4_ELT/HOS

Flows during January through August under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-129). This change of 23 cohorts out of 410 cohorts equated to ~6% of all cohorts, which is not considered substantial to the population.

Table 11-4A-129. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Feather River at Thermalito Afterbay	-14 (-9%)	23 (20%)

[a] Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H1 or H4_ELT than in Existing Conditions or NAA_ELT.

Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for H3_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and exposure risk of eggs to elevated water temperatures would be small or negligible for all locations analyzed.

CEQA Conclusion: Collectively, the results of the Impact AQUA-166 CEQA analysis show that the difference between the CEQA baseline and Alternative 4A is less than significant.

H3_ELT/ESO_ELT

Dewatering risk during the river lamprey spawning period from February to June would generally be similar to slightly higher under H3_ELT relative to Existing Conditions (Table 11-4A-127). The largest difference would be in the American River at the Sacramento River confluence (12 cohorts, or 20% increase). An increase in 12 cohorts of the 410 total cohorts would represent <3% of total cohorts. As a result, it is concluded that this increase would not represent a biological meaningful effect to river lamprey.

Egg cohort temperature exposure results are reported in Table 11-4A-128. There would be either negligible differences or an increase in exposure of egg cohorts (11 to 18 cohorts, or 64% to 1,100%) under H3_ELT relative to Existing Conditions to temperatures above 71.6°F in the Feather River, American River, and Stanislaus River and an increase of up to 100 cohorts in the Sacramento River. However, none of these increases would compose more than 5% of the 410 total ammocoete cohort count and, therefore, would not be biologically relevant to the species. There would be negligible differences in the number of cohorts exposed to temperatures above 77°F under H3_ELT relative to Existing Conditions.

H4_ELT/HOS

Flows during February through June under H4_ELT would generally be similar to or greater than flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as those for H3_ELT.

In the Feather River at Thermalito Afterbay, there would be 14 (9%) more cohorts (Table 11-4A-129). This increase would be too small to have a biologically meaningful effect on river lamprey.

Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined. Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT.

Overall, results for H4_ELT would be similar to those for H3_ELT.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect is less than significant because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and exposure risk of eggs to elevated water temperatures would be small or negligible for all locations analyzed. No mitigation is necessary.

Impact AQUA-185: Effects of Water Operations on Rearing Habitat for River Lamprey

In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flow-related impacts to river lamprey rearing habitat were evaluated by estimating of the frequency of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts, as described for Pacific lamprey, in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River.

As for Pacific lamprey, the analysis of river lamprey ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (February through June) and spend 5 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period.

Comparisons of H3_ELT to NAA_ELT for the Sacramento River at Keswick (Table 11-4A-130) indicate that there would be no effect (0%) or negligible effects (≤5%) attributable to H3_ELT in all flow reduction categories.

Table 11-4A-130. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	2	0
-60%	6	5
-65%	1	-4
-70%	0	-5
-75%	4	3
-80%	7	0
-85%	111	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Results of comparisons for the Sacramento River at Red Bluff indicates that H3_ELT would have negligible effects (<5%) in all but the 55% flow increase category, which would cause a 6% increase in cohort exposure (Table 11-4A-131). Overall, this indicates that there would be minimal effect on ammocoete exposure.

Table 11-4A-131. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	2
-55%	6	6
-60%	4	-2
-65%	-2	-3
-70%	2	0
-75%	19	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the Trinity River indicate that there would be no or negligible differences in ammocoete cohorts exposed flow reductions between H3_ELT and NAA_ELT for all flow reduction categories except 80-90%, which would be 5 to 11% higher under H3_ELT (Table 11-4A-132).

Table 11-4A-132. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	27	0
-80%	30	5
-85%	33	6
-90%	49	11

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort exposure at the 50% through 75% flow reductions (Table 11-4A-133). For the 80% through 90% flow reductions, ammocoete exposure would be 5% to 64% lower, which due to the low frequency with which 85% and 90% reductions in flow would occur, would not be frequent enough to have a biologically meaningful effect on river lamprey ammocoete rearing. These results indicate that there will be no effects of H3_ELT on river lamprey ammocoete rearing in the Feather River.

Table 11-4A-133. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	-1	-1
-80%	-7	-5
-85%	-27	-32
-90%	-61	-64

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with the Sacramento River (Table 11-4A-135) have similar results. There would be no or negligible differences in cohort exposure between NAA_ELT and H3_ELT for most flow reduction categories. There would be higher cohort exposure under H3_ELT relative to NAA_ELT at Nimbus Dam at the 75% and 80% flow reductions (19% and 22% higher, respectively) and at the confluence with the

Sacramento River at the 80% and 85% flow reductions (9% and 32% higher, respectively) flow reductions. These results indicate that there would generally be no effect of H3_ELT on stranding risk in the American River with few small exceptions that would not be common enough to have biologically meaningful effects.

Table 11-4A-134. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	-1	-1
-60%	2	-1
-65%	5	0
-70%	45	4
-75%	119	19
-80%	292	22
-85%	100	0
-90%	-100	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Table 11-4A-135. Relative Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	3	1
-65%	3	2
-70%	20	4
-75%	33	2
-80%	235	9
-85%	270	32
-90%	100	0

[a] Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

Because the thermal tolerance of river lamprey ammocoetes is unknown, the thermal tolerance of Pacific lamprey ammocoetes of 22°C (71.6°F) and of river lamprey adults of 25°C (77°F) (Moyle et al. 1995) was used. River lamprey ammocoetes rear upstream for 3–5 years (Moyle 2002). To be conservative, this analysis assumed a maximum ammocoete duration of 5 years. Each individual day or month starts a new "cohort" such that there are 18,730 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 380 cohorts for the other rivers using monthly data over the same period.

There would be differences in the number of ammocoete cohorts exposed to temperatures greater than the thresholds in most of the rivers, particularly for the 77°F threshold (Table 11-4A-136). However, each river with an increase in exposure would also have a site with a decrease in exposure of similar magnitude, except in the Feather River for the 77°F threshold. Overall, the increases and decreases are expected to balance out within rivers such that there would be no overall effect on river lamprey ammocoetes.

Table 11-4A-136. Differences (Percent Differences) between Model Scenarios in River Lamprey Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F and 77°F in at Least One Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
71.6°F Threshold		
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	5775 (NA)	-11 (-0.2%)
Trinity River at Lewiston	25 (NA)	0 (0%)
Trinity River at North Fork	25 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	135 (71%)	65 (25%)
American River at Nimbus	180 (200%)	0 (0%)
American River at Sacramento River Confluence	120 (49%)	5 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	155 (620%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick[b]	0 (0%)	0 (NA)
Sacramento River at Hamilton City[b]	0 (0%)	4404 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	50 (NA)	25 (100%)
American River at Nimbus	75 (NA)	25 (50%)
American River at Sacramento River Confluence	80 (NA)	-25 (-24%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

[b] Based on daily data; all other locations use monthly data; 1922–2003.

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-137). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 14% and 47% higher, respectively.

Table 11-4A-137. Percent Difference between Baselines and H4_ELT Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	2	5
-85%	22	14
-90%	57	47

[a] Negative values indicate reduced cohort exposure under H4_ELT.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85% and 90% flow reductions under H4_ELT. The 85% and 90% flow reductions would occur rarely—19 and 7 times under NAA_ELT and 22 and 10 times, respectively—under H4_ELT, throughout the 985 months evaluated. Therefore, these reductions would affect a small proportion of the population. These results indicate that there would be no biologically meaningful effect of H4_ELT on stranding risk.

NEPA Effects: These modeling results indicate the effect would not be adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish through ammocoete mortality. Project-related effects on flow reductions and effects on water temperatures in all locations analyzed would be negligible and would not affect river lamprey ammocoete stranding risk and rearing success because the changes would not be large enough or frequent enough to be biologically meaningful.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of rearing habitat for river lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of rearing habitat for river lamprey relative to NAA_ELT.

H3_ELT/ESO_ELT

Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate negligible effects (<5%) or small increases (to 7%) for ammocoete cohort exposures to flow reductions from 50% to 80% and 90%, and a more substantial increase in exposure (111%) to 85% flow reduction events (Table 11-4A-130). Comparisons for the Sacramento River at Red Bluff indicate similar results with negligible effects (<5%) or small increases in exposure (to 6%) for 50% to 70% and 85% to 90% flow reduction categories, and a more substantial increases in exposure (19% to 23%) in the 80% and 85% flow reduction categories, respectively (Table 11-4A-131). Based on the prevalence of small and negligible effects, the effects of a more substantial increase in flow reductions in a single flow reduction category would not be considered biologically meaningful to river lamprey in the Sacramento River.

Comparisons for the Trinity River between H3_ELT and Existing Conditions indicated no effect (0%) for the lower flow reduction categories up to 70%, and increases in occurrence ranging from 27% to 49% for the 75% through 90% flow reduction categories (Table 11-4A-132). The prevalence of increased occurrence of higher-magnitude flow reductions would affect river lamprey ammocoete stranding in the Trinity River.

Comparisons for the Feather River between H3_ELT and Existing Conditions indicated no effect (0%) or reductions in frequency of occurrence for all flow reduction categories, with 7% to 61% reductions in cohorts exposed to 80% to 90% flow reduction events (Table 11-4A-133). Due to the low frequency with which 85% and 90% reductions in flow would occur, would not be frequent enough to have a biologically meaningful effect on river lamprey ammocoete rearing.

Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with the Sacramento River (Table 11-4A-135) between H3_ELT and Existing Conditions indicate a 45% to 292% increased chance of occurrence of flow reductions between 70 and 85% under H3_ELT compared to NAA_ELT at Nimbus Dam and a 20% to 270% increased chance of occurrence of flows reductions between 70% and 85% at the confluence with the Sacramento River. The prevalence of increased occurrence of higher-magnitude flow reductions would constitute a biologically meaningful effect on river lamprey ammocoete stranding in the American River.

The number of ammocoete cohorts exposed to 71.6°F under H3_ELT (including climate change) would be up to 620% higher than those under Existing Conditions in most locations examined (Table 11-A1-136). The number of ammocoete cohorts exposed to 77°F would be similar between Existing Conditions and H3_ELT in the Sacramento, Trinity, and Stanislaus Rivers, but 50 to 80 cohorts higher in the Feather and American Rivers (percent differences could not be calculated because there would be 0 cohorts under Existing Conditions).

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-137). There would be 22% and 57% more cohorts exposed to 85% and 90% flow reductions, respectively, under H3_ELT relative to Existing Conditions.

There would generally be no differences in mean water temperatures year-round between H4_ELT and H3_ELT in any river examined. As a result, no additional ammocoete temperature cohort exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for H3_ELT.

Overall, these results indicate that results for H4_ELT would generally be similar to those under H3_ELT.

Summary of CEQA Conclusion

Under Alternative 4A, there would be moderate to substantial persistent increases in occurrence of flow reduction events for Alternative 4A with respect to Existing Conditions for the Trinity River (up to 49%) and the American River at Nimbus Dam (up to 292%) and at the confluence with the Sacramento River (up to 270%) that would increase river lamprey ammocoete stranding risk and therefore rearing success for these locations. There would be a beneficial effect from reduced occurrence of flow reductions in the Feather River (up to 61% reduction) but this effect would not be sufficient to offset the negative effects from increased occurrence of flow reductions at the other locations. Further, stranding risk under H4_ELT in the Feather River would be higher than those under H3_ELT, such that the benefits under H3_ELT would not occur under these H4_ELT. There would also be increases under Alternative 4A in ammocoete cohort exposure to critical water temperatures in the Feather and American rivers that would have effects on rearing success through ammocoete mortality. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of river lamprey as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, project-related effects on flow reductions and effects on water temperatures in all locations analyzed would be negligible and would not affect river lamprey ammocoete stranding risk and rearing success. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the impact is less than significant and no mitigation is required.

Impact AQUA-186: Effects of Water Operations on Migration Conditions for River Lamprey

In general, the effect of Alternative 4A on river lamprey migration conditions would be negligible relative to the NAA_ELT.

H3_ELT/ESO_ELT

After 3 to 5 years, river lamprey ammocoetes migrate downstream and become macropthalmia once they reach the Delta. River lamprey migration generally occurs September through November (USFWS unpublished data). The effects of H3_ELT on seasonal migration flows for river lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of river lamprey during the likely migration period (September through November) were examined to predict how H3_ELT may affect migration flows for outmigrating macropthalmia. Analyses were conducted for the Sacramento River at Red Bluff, Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

The adult river lamprey upstream migration period also occurs between September and June. Therefore, results presented below represent effects to the migration of both macropthalmia and adult river lamprey. CALSIM II flow outputs were examined during these periods for each model scenario.

Sacramento River

Mean monthly flow rates for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September to November river lamprey macropthalmia and adult migration periods. Flows under H3_ELT would generally be similar to or up to 18% lower than flows under NAA_ELT during September and November and similar to flows under NAA_ELT during October. Because of the relatively small magnitude, reduced flows during November are not likely to cause biologically meaningful effects on river lamprey migration.

Feather River

Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September to November river lamprey macropthalmia and adult migration periods. Flows under H3_ELT would generally be up to 27% lower than flows under NAA_ELT during September, up to 17% higher than flows under NAA_ELT during October, and similar to flows under NAA_ELT during November. Based on occurrence of negligible effects or increases in flow that would have a beneficial effect on migration conditions, with decreases predicted for wetter water years when effects on migration conditions would not be as critical, these results indicate that effects of NAA_ELT on flows would not have biologically meaningful negative effects on migration conditions in the Feather River.

American River

Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) were examined during the September through November macropthalmia and adult migration periods. Flows under H3_ELT would be lower than flows under NAA_ELT during September and November and similar to flows during October. These results indicate that project-related effects would include small to moderate decreases in flow under H3_ELT for some months and water year types.

H4_ELT/HOS

Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to flows under NAA_ELT during September and October and up to 15% lower during November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at the confluence with the Sacramento River would generally be up to 38% lower than flows under H3_ELT in September and mixed (higher, lower, and similar) during October and November. Flows under H4_ELT in the American River at the confluence with the Sacramento River would generally be lower than those under NAA_ELT but up to 22% during September and November and similar during October. These results indicate that project-related effects would include small to moderate decreases in flow under H4_ELT for some months and water year types.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. H3_ELT would primarily have negligible effects (<5%), small increases or decreases in flow, or decreases in wetter water year types and/or during a limited portion of the migration period that would not have negative effects on migration conditions. There would be beneficial effects from moderate increases in flow for some months and water year types in the Feather River (to 34%) and American River (to 24%); however, the beneficial effect would be partially offset by flow reductions during other months of the migration periods. Flows under H4_ELT would be similar to those under H3_ELT.

CEQA Conclusion: In general, Alternative 4A would reduce the quantity and quality of migration habitat for river lamprey relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of migration habitat for river lamprey.

H3_ELT/ESO_ELT

For the Sacramento River at Red Bluff, comparisons of mean monthly flow rate for H3_ELT to Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate that flows under H3_ELT would be up to 22% lower than those under Existing Conditions during October and November. During September, flows would be higher in wetter years and lower in drier years.

Comparisons for the Feather River at the confluence with the Sacramento River indicate (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate highly variable effects of H3_ELT relative to Existing Conditions depending on month and water year type. Combining all water year types, flows would be 28% higher during September, 8% lower during October, and 5% lower during November.

Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for September through November indicate reductions in flows in September and November of up to 47% and variable changes of 11% lower to 15% higher during October depending on water year type. Overall, these results show that flows would be reduced in the American River during this period relative to Existing Conditions.

H4_ELT/HOS

Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to or greater than flows under Existing Conditions during September through November, although highly variable during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at the confluence with the Sacramento River would be higher and lower than flows under Existing Conditions depending on month and water year type, but lower overall. Flows under H4_ELT in the American River at the confluence with the Sacramento River would generally be up to 47% lower than flows under Existing Conditions. Overall, migration conditions for river lamprey under H4_ELT would be less favorable than conditions under Existing Conditions.

Summary of CEQA Conclusion

Under Alternative 4A, there would be moderate and persistent flow reductions for substantial portions of the river lamprey macropthalmia migration period in the American River, and less persistent and smaller magnitude flow reductions in the Sacramento River and Feather River. These flow reductions would affect juvenile migration success, increase straying, and delay access to the ocean. If in fact, lamprey use these cues to find natal spawning grounds, these flow reductions may also affect adult migration success, including a reduction in the ability for adults to sense olfactory cues. There would be beneficial effects from increases in flow for some months and water year types in each location. However, this effect would not be sufficient to offset the negative effects of flow reductions for the remainder of the migration period and/or in other water year types, particularly drier water year types when effects of flow reductions would be more critical. Flows under H4_ELT would be less favorable than those under H3_ELT. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce migration conditions for river lamprey.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be negligible effects on mean monthly flow and water temperatures for river lamprey migration periods at all locations analyzed. Therefore, this impact is less than significant and no mitigation is required,

Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

The discussion of the effects of restoration measures for Pacific lamprey is also applicable to river lamprey.

Impact AQUA-187: Effects of Construction of Restoration Measures on River Lamprey

Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of construction of restoration measures on river lamprey.

NEPA Effects**:** The effects of short-term construction activities would not be adverse to river lamprey because environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion**:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on river lamprey but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce river lamprey habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-188: Effects of Contaminants Associated with Restoration Measures on River Lamprey

Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of contaminants associated with restoration measures on river lamprey, which are assumed to have similar potential for exposure and effects of exposure for contaminant-related effects.

NEPA Effects: As noted for other covered fishes, while Alternative 4A habitat restoration actions may result in a very small increase production, mobilization, and bioavailability of methylmercury, selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation of these contaminants in river lamprey. Overall, the effects of contaminants associated with restoration measures would not be adverse for river lamprey.

CEQA Conclusion: As noted for other covered fishes, habitat restoration under Alternative 4A may result in increased production, mobilization, and bioavailability of contaminants in the aquatic system, but these would be short-term and localized, and would be unlikely to result in measurable increases in the bioaccumulation in river lamprey. For methylmercury, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury in the limited restoration areas. Therefore, the impact of contaminants is considered less than significant because it would not substantially affect river lamprey either directly or through habitat modifications. Consequently, no mitigation would be required.

Impact AQUA-189: Effects of Restored Habitat Conditions on River Lamprey

Refer to Impact AQUA-170 under Pacific lamprey for a discussion of the effects of restored habitat conditions on river lamprey.

NEPA Effects: The effects of restored habitat conditions on river lamprey would not be adverse because restoration could provide habitat benefits for lamprey.

CEQA Conclusion: As described in the discussion for Pacific lamprey, habitat restoration would be undertaken to offset loss/modification of habitat from water facility construction and operation. The effects of restored habitat conditions on river lamprey would be less than significant. Consequently, no mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

The discussion of the effects of other conservation measures for Pacific lamprey is also applicable to river lamprey.

Impact AQUA-190: Effects of Methylmercury Management on River Lamprey (Environmental Commitment 12)

Refer to Impact AQUA-46 under winter-run Chinook salmon for a discussion of the effects of methylmercury management on river lamprey.

NEPA Effects: The effects of methylmercury management on river lamprey would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts on river lamprey would be less than significant. Consequently, no mitigation is required.

Impact AQUA-193: Effects of Localized Reduction of Predatory Fish on River Lamprey (Environmental Commitment 15)

Refer to Impact AQUA-175 under Pacific lamprey for a discussion of the effects of predator management on river lamprey.

NEPA Effects: Consistent with the analysis for Alternative 1A and reflecting the above discussion for Pacific lamprey, which is expected to have similar predators, the overall effect would not be adverse.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the discussion for Pacific lamprey, the impact is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-194: Effects of Nonphysical Fish Barriers on River Lamprey (Environmental Commitment 16)

Refer to Impact AQUA-176 under Pacific lamprey for a discussion of the effects of nonphysical fish barriers on river lamprey.

NEPA Effects: The overall effect of the NPB on Pacific lamprey would not be adverse because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.

CEQA Conclusion: Consistent with the analysis for Alternative 1A and reflecting the above discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli. Consequently, no mitigation would be required.

Non-Covered Aquatic Species of Primary Management Concern

Construction and Maintenance of Water Conveyance Facilities

The effects of construction and maintenance of the water conveyance facilities under Alternative 4A would be similar in nature for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-199: Effects of Construction of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-1 under delta smelt for a discussion of the types of effects of construction of water conveyance facilities that are relevant to non-covered species of primary management concern. That discussion under delta smelt addresses the type, magnitude and range of impact mechanisms that are relevant to the aquatic environment and aquatic species. The potential effects of the construction of water conveyance facilities under Alternative 4A would the same as those for Alternative 4. Implementation of the measures described in Appendix 3B, *Environmental Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of inadvertent spills of hazardous materials. Construction would not be expected to increase predation rates relative to baseline conditions. Construction will result in both temporary and permanent alteration of rearing and migratory habitats. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin habitat. The direct effects of underwater construction noise on species that may be present could be adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-1b, combined with the in-water work window that would minimize exposure, would reduce the potential for effects from underwater noise and this effect would not be adverse.

Consistent with the conclusion for Alternative 4, Impact AQUA-1, environmental commitments and mitigation measures would be available to avoid and minimize potential effects, and the effect would not be adverse for non-covered aquatic species of primary management concern.

CEQA Conclusion: Consistent with the conclusion for Alternative 4, Impacts AQUA-1 and AQUA-199, the impact of the construction of the water conveyance facilities on non-covered aquatic species of primary management concern would not be significant except for construction noise associated with pile driving. Construction of Alternative 4A involves several elements with the potential to affect these fish species. However, these turbidity and hazardous material spill effects will be effectively avoided and/or minimized through implementation of environmental commitments (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments*: *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-200: Effects of Maintenance of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4 (which draws on the analysis of Alternative 1A, Impact AQUA-2). California bay shrimp would not be affected because they do not occur in the vicinity and Sacramento-San Joaquin roach and hardhead are unlikely to be affected because their primary distributions are upstream. Consequently, the effects would not be adverse.

CEQA Conclusion: Consistent with the conclusion for Alternative 4, Impact AQUA-2 and Impact AQUA-200, the impact of the maintenance of water conveyance facilities on non-covered species of primary management concern would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

The effects of water operations of the water conveyance facilities under Alternative 4A include a detailed analysis of the following species.

- Striped bass
- American shad
- Threadfin shad
- Largemouth bass
- Sacramento tule perch
- Sacramento-San Joaquin roach – California species of special concern
- Hardhead – California species of special concern

Impact AQUA-201: Effects of Water Operations on Entrainment of Non-Covered Aquatic Species of Primary Management Concern

A revised analysis of Impact AQUA-201 for all alternatives, including Alternative 4A, is provided in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that analysis.

Striped Bass

NEPA Effects: Under Existing Conditions, striped bass are observed in salvage operations of the south Delta facilities throughout the year, with the majority of juvenile striped bass entrainment occurring during the summer (May through July). As described in Chapter 11, Section 11.3.5, in Appendix A, operation of the north Delta intakes under Alternative 4A would be expected to reduce overall entrainment of screenable life stages (i.e., early juveniles and older, around 20 mm long) because of the reduction in use of the south Delta facilities, which do not have the state of the art fish screens proposed for the north Delta intakes. Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile striped bass. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval striped bass are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of striped bass originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 4A, scenario H3_ELT, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220% increase. Note that entrainment of the early life stages of striped bass at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 4A during the spring to benefit covered fishes such as spring-run Chinook salmon, and that the results presented in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS for Alternative 4A reflect the H3_ELT scenario, whereas spring entrainment under the H4_ELT scenario would be somewhat less. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, density-dependence during the juvenile stages of the striped bass life cycle means that losses of early life stages do not necessarily translate into proportional reductions in abundance of older individuals, and entrainment has not recently been identified as a significant driver of juvenile abundance (Mac Nally et al. 2010; Thomson et al. 2010). Therefore it is concluded with some uncertainty that there would be an adverse effect on striped bass.

CEQA Conclusion: The impact of water operations on entrainment of striped bass would be similar to the effects described immediately above. Relative to Existing Conditions, particle tracking modeling for Alternative 4A scenario H3_ELT showed mean entrainment was increased by around 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, increased losses of striped bass eggs and larvae need not necessarily translate into reductions in abundance of later life stages. Nevertheless, there is no feasible mitigation that would reduce this potential impact. Thus, this impact is significant and unavoidable.

American Shad

As described for Alternative 4, American shad eggs and larvae would be vulnerable to entrainment at the proposed north SWP/CVP Delta intakes as these life stages are passively transported downstream to the north Delta. Most American shad spawning though takes place well upstream of the Delta and juveniles may rear to sufficiently large size to avoid entrainment as state-of-the-art fish screens on the proposed north Delta intakes would exclude juvenile and adult American shad.

NEPA Effects: Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile American shad. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval American shad are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of American shad originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 4A, scenario H3_ELT, and as discussed above for striped bass, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220% increase. As noted for striped bass, entrainment of the early life stages of American shad at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 4A during the spring to benefit covered fishes such as spring-run Chinook salmon; in addition, the results presented in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS for Alternative 4A reflect the H3_ELT scenario, whereas spring entrainment under the H4_ELT scenario would be somewhat less. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A, although American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment, they could also be entrained in appreciably greater magnitude than currently occurs and therefore it is also concluded that the effects of entrainment on American shad would be adverse.

CEQA Conclusion: The impact of water operations on entrainment of American shad would be similar to the effects described immediately above. Relative to Existing Conditions and as described above for striped bass, particle tracking modeling for Alternative 4A scenario H3_ELT showed mean entrainment was increased by around 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment. Nevertheless, there is no feasible mitigation that would reduce this potential impact. Thus, this impact is significant and unavoidable to American shad.

Threadfin Shad

NEPA Effects: The impact and conclusion would be the same as discussed for Alternative 1A (Impact AQUA-201 for Threadfin Shad). Entrainment at the south delta would be reduced due to overall decreased exports from the SWP/CVP south Delta facilities. Entrainment losses would be further reduced under Scenario H4 compared to the other flow scenarios for Alternative 4A. There would be potential entrainment of threadfin shad eggs and larvae to the north Delta intakes, although this risk is minimal because threadfin shad are most abundant in the south Delta (Baxter et al. 2010; see also discussion in Chapter 11, Section 11.3.5, in Appendix A). Overall, threadfin shad entrainment would be reduced because they are most abundant in the southern Delta and would particularly benefit from reduced south Delta exports. The effect would not be adverse.

CEQA Conclusion: The impact of water operations on entrainment of threadfin shad would be similar to the effects described immediately above in the NEPA Effects section. The impact would be less than significant and no mitigation would be required.

Largemouth Bass

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Impact AQUA-202: Effects of Water Operations on Spawning and Egg Incubation Habitat for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-202 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

In general, the effects of Alternative 4A on the quality and quantity of spawning, egg incubation, and initial rearing habitat conditions for striped bass would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or slightly greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through June regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in critical years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-138).

Table 11-4A-138. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay are outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	-5 (-10%)
Above Normal	-3 (-7%)	-13 (-24%)
Below Normal	-14 (-33%)	-16 (-36%)
Dry	0 (0%)	-10 (-18%)
Critical	8 (21%)	-3 (-6%)
All	-2 (-5%)	-9 (-18%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June striped bass spawning, embryo incubation, and initial rearing period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during April through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flow for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F suitable water temperature range in the Feather River below Thermalito Afterbay would be 10% higher than the percentage under NAA_ELT in wet years, 11% and 7% lower than the percentage under NAA_ELT in below normal and dry water years, respectively, and would be the same as the percentage under NAA_ELT in above normal and critical water years (Table 11-4A-139). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-139. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in which Water Temperatures in the Feather River below Thermalito Afterbay are Outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	10 (23%)	5 (10%)
Above Normal	10 (22%)	0 (0%)
Below Normal	-3 (-7%)	-5 (-11%)
Dry	6 (13%)	-4 (-7%)
Critical	11 (28%)	0 (0%)
All	7 (16%)	0 (0%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in striped bass spawning, incubation, or initial rearing habitat. Flows in all rivers examined during the April through June spawning, incubation, and initial rearing period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for striped bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June, with few exceptions.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers.

Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June would be the same as or lower than the percentage under Existing Conditions in all water years except critical years (21% higher on a relative scale; 8% higher on an absolute scale) (Table 11-4A-138). This is a relatively small effect that would not have biologically meaningful negative effects on the striped bass population because it only occurs in one water year type.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June striped bass spawning, embryo incubation, and initial rearing period would generally be similar to flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April through June, except for June of wet and dry water years, when flows under H3_ELT would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions throughout the period, with minor exceptions.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar or up to 28% higher than the percentage under Existing Conditions depending on water year type (Table 11-4A-139). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of striped bass relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to striped bass. There would be no substantial temperature effects under Alternative 4A on striped bass. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

American Shad

In general, the effects of Alternative 4A on the quality and quantity of spawning and egg incubation habitat conditions for American shad would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3 would generally be moderately to substantially greater than flows under NAA during April through June, except in critical years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the 60°F to 70°F water temperature range would be lower than the percentage under NAA_ELT regardless of water year type (Table 11-4A-140).

Table 11-4A-140. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-6 (-13%)	-2 (-5%)
Above Normal	-3 (-8%)	-15 (-31%)
Below Normal	-2 (-6%)	-7 (-19%)
Dry	-2 (-5%)	-4 (-10%)
Critical	-3 (-8%)	-6 (-15%)
All	-4 (-10%)	-6 (-15%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June American Shad migration and spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during April through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flows under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 60°F to 70°F suitable water temperature range in the Feather River below Thermalito Afterbay would be up to 10% higher and up to 8% lower on a relative scale than the percentage under NAA_ELT, in depending on water year type (Table 11-4A-141). On an absolute scale, these differences would be very small (≤4%) and, therefore, would not be biologically meaningful to American shad.

Table 11-4A-141. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (0%)	4 (10%)
Above Normal	16 (44%)	4 (8%)
Below Normal	2 (6%)	-3 (-8%)
Dry	2 (5%)	0 (0%)
Critical	0 (0%)	-3 (-8%)
All	3 (8%)	1 (2%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in American shad spawning or adult migration. Flows in all rivers examined during the April through June adult migration and spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for American shad relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 60°F to

70°F water temperature range would be lower than the percentage under Existing Conditions in all water year types (Table 11-4A-140).

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June American Shad migration and spawning period would generally be similar to flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April through June, except for June of wet and dry water years, when flows under H4_ELT would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions during April through June, except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions throughout the period, with minor exceptions. The percentage of months under H4_ELT with mean water temperatures outside the 60°F to 70°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar to the percentage under Existing Conditions in all water types except above normal water years, for which the percentage under H4_ELT would be 44% higher (Table 11-4A-141). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in American shad adult migration and spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the April through June adult migration and spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects. There would be no temperature related effects of Alternative 4A on American shad. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing conditions.

Threadfin Shad

In general, the effects of Alternative 4A on the quality and quantity of spawning habitat conditions for threadfin shad would not be adverse relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August threadfin shad spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through August, except in dry years during August (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April through August, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through August, except in critical years during July (14% lower) and in critical years during August (11% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be moderately to substantially greater than flows under NAA_ELT during April through June (to 106% greater), except during critical years in May (10% lower) and June (8% lower), and moderately to substantially lower than flows under NAA_ELT during July and August (to 48% lower), except during critical years in August (23% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

In the American River below Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April through July and lower than flows under NAA_ELT during August (to 21% lower) regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These flow reductions are small to moderate in magnitude and limited to late in the spawning period and, therefore, would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT below 68°F would be greater than those under NAA_ELT (4% to 25% greater) in all but dry and critical years (Table 11-4A-142). On an absolute scale, these are small increases (≤4%) that would not have biologically meaningful effects, except in below normal water years (14% increase).

Table 11-4A-142. Difference and Percent Difference in the Percentage of Months during April–August in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (1%)	2 (4%)
Above Normal	-9 (-12%)	4 (6%)
Below Normal	1 (2%)	14 (25%)
Dry	-26 (-34%)	-2 (-4%)
Critical	-22 (-33%)	-2 (-4%)
All	-10 (-14%)	3 (5%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August threadfin shad spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April through August, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT during April through August, except for 14% lower flow during July of critical water years and 11% higher flow in August of critical years.

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 10% lower and 12% lower flows during June of critical and wet years, respectively, and would be up to 46% lower than flows under NAA_ELT during July and August, except for 48% higher flows in August of critical water years. Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through August, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, and 18% greater flow in August of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures below the 68°F temperature threshold in the Feather River below Thermalito Afterbay would be similar to or lower than the percentage under NAA_ELT in all water years (Table 11-4A-143). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-143. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-7 (-11%)	-5 (-9%)
Above Normal	-27 (-36%)	-15 (-23%)
Below Normal	-13 (-18%)	0 (0%)
Dry	-29 (-39%)	-6 (-11%)
Critical	-22 (-33%)	-2 (-4%)
All	-18 (-26%)	-5 (-9%)

[a] A negative value indicates a reduction in percentage of months outside suitable range H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in threadfin shad spawning habitat. Flows in all rivers examined during the April through August spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. Some flow reductions would occur late in the spawning season in the Feather River and would be too small in magnitude or frequency to have a biologically meaningful effect on threadfin shad. The percentage of years below the spawning temperature threshold would be similar or lower under Alternative 4A relative to the NAA_ELT, except in below normal years, but this increase is not expected to have a biologically meaningful effect on the threadfin shad population because it occurs in only one water year type and is isolated to the Feather River. Flow conditions in the Feather River under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for threadfin shad relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in wet years during May (10% lower) and in dry and critical years during August (11% and 13% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These are relatively small-magnitude and infrequent flow reductions and would not have biologically meaningful effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in critical years during May and August (6% and 8% lower, respectively) and in wet years during July (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through August (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years during April (6% lower) and in wet years during May (15% lower), and would be lower than flows under Existing Conditions in dry and critical years during July (22% and 52% lower, respectively) and in below normal and dry years during August (7% and 45% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows under Existing Conditions during April and lower than flows under Existing Conditions during May through August (up to 46% lower)respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months below the 68°F water temperature threshold for threadfin shad spawning under H3_ELT would be similar to or 12% to 34% lower than the percentage under Existing Conditions, depending on water year type (Table 11-4A-142).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August threadfin shad spawning period would generally be similar to flows under Existing Conditions except during May of wet years, when flow would be 11% lower(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April through June, except for 38% and 6% lower flows during June of wet and critical water years, respectively, and would generally be up to 54% lower than flows under Existing Conditions during July and August, except for 26% higher flows in August of critical water years.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and similar to or up to 37% lower than flows under Existing Conditions during May through August, except during August of below normal years (9% greater flow)

Flows in the Trinity River below Lewiston Reservoir and in Clear Creek at Whiskeytown Dam H4_ELT would generally be similar to flows under Existing Conditions during April through August, with minor exceptions.

Flows in the San Joaquin River at Vernalis under H4_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

Flows in the Stanislaus River at the confluence with the San Joaquin River under H4_ELT would generally be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

The percentage of months under H4_ELT with mean water temperatures below the 68°F temperature threshold in the Feather River below Thermalito Afterbay would be lower than the percentage under Existing Conditions in all water years (Table 11-4A-143). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Collectively, flows would be lower under Alternative 4A during the threadfin shad spawning period relative to Existing Conditions. Flows would be moderately to substantially lower in the Feather, American, Stanislaus, and San Joaquin rivers during substantial portions of the spawning period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable spawning habitat as a result of flow reductions.

Summary of CEQA Conclusion

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Largemouth Bass

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for largemouth bass relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May and June (10% and 8% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the 59°F to 75°F water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-144).

Table 11-4A-144. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-2 (-4%)	0 (0%)
Above Normal	-2 (-4%)	0 (0%)
Below Normal	0 (0%)	0 (0%)
Dry	-5 (-11%)	0 (0%)
Critical	-9 (-20%)	-3 (-8%)
All	-3 (-6%)	0 (0%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June largemouth bass spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during March through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during March through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during March through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under NAA_ELT during March through June, except for 12% greater flow during March of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 75°F water temperature range in the Feather River below Thermalito Afterbay would be similar to or greater than the percentage under NAA_ELT in all water year types although these small increases on an absolute scale (≤5%) would not have biologically meaningful effects on largemouth bass spawning habitat conditions (Table 11-4A-145). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-145. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	3 (5%)	5 (9%)
Above Normal	0 (0%)	2 (4%)
Below Normal	1 (2%)	1 (2%)
Dry	-5 (-11%)	0 (0%)
Critical	-6 (-14%)	0 (0%)
All	-1 (-2%)	2 (4%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in largemouth bass spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (8% lower), above normal years during April (5% lower), and in wet and critical years during June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be lower than flows under Existing Conditions during May (to 16% lower) except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under H3_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 75°F water temperature range for largemouth bass spawning would be the same or lower than the percentage under Existing Conditions in all water year types (Table 11-4A-144).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June largemouth bass spawning period would generally be similar to or slightly lower than flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to 509% greater than flows under Existing Conditions during March through June, except during March of below normal and dry water years, when flows under H4_ELT would be 22% and 11% lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during March and April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under Existing Conditions during March through June, except during March of wet years, in which flow under H4_ELT would be 14% greater than flow under Existing Conditions.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under Existing Conditions during March through June, except during March of below normal and critical water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow under Existing Conditions.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 23% lower than to those under Existing Conditions during March through June, except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater than flow under Existing Conditions.

The percentage of months under H4_ELT with mean water temperatures below outside the 59°F to 75°F water temperature range in the Feather River below Thermalito Afterbay would be similar to the percentage under Existing Conditions in wet, above normal, and below normal water year types and would be lower than the percentage under Existing Conditions in dry and critical water year types (Table 11-4A-143). The reductions would not be large enough to have biologically meaningful effects on largemouth bass spawning habitat conditions. Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in largemouth bass spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to largemouth bass. There would be no substantial temperature effects under Alternative 4A on largemouth bass. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

Sacramento Tule Perch

NEPA Effects: The effects of water operations on spawning habitat for Sacramento tule perch under Alternative 4A would be similar to that described for Alternative 1A due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: As described under Alternative 1A, Impact AQUA-202 the impacts on Sacramento tule perch spawning would be not be significant and no mitigation is required.

Sacramento-San Joaquin Roach – California species of special concern

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May and June (10% and 8% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation under H3_ELT would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-146).

Table 11-4A-146. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Fall below the 60.8°F Water Temperature Threshold for the Initiation of Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-8 (-11%)	0 (0%)
Above Normal	-5 (-8%)	0 (0%)
Below Normal	-2 (-4%)	0 (0%)
Dry	-8 (-15%)	-3 (-6%)
Critical	-6 (-11%)	2 (4%)
All	-6 (-11%)	0 (-1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June Sacramento-San Joaquin roach spawning period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up to 548% greater than flows under NAA_ELT during March through June, except in June of wet and critical water years, when the flow would be 12% and 10% lower, respectively, than flow under NAA_ELT.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during March through June, except for 10% higher flow during April of critical water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during March through June, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under NAA_ELT during March through June, except for 12% greater flow during March of below normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period. The percentage of months under H4_ELT with mean water temperatures below the 60.8°F water temperature range in the Feather River below Thermalito Afterbay would be similar to or up to 18% greater than the percentage under NAA_ELT, although these small increases on an absolute scale (≤9%) would not have biologically meaningful effects on roach spawning habitat conditions. (Table 11-4A-147). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-147. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Fall below the 60.8°F Water Temperature Threshold for Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-4 (-6%)	4 (6%)
Above Normal	5 (8%)	9 (18%)
Below Normal	4 (7%)	5 (11%)
Dry	-4 (-8%)	1 (3%)
Critical	-11 (-19%)	-2 (-4%)
All	-3 (-4%)	3 (6%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in roach spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. The occurrence of flow reductions would not be of sufficient magnitude or frequency to have a biologically meaningful effect on roach. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin Roach relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (8% lower), above normal years during April (75% lower), and in wet and critical years during June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be lower than flows under Existing Conditions during May (to 16% lower), except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H3_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 11% lower, respectively.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under H3_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation would be lower than the percentage under Existing Conditions in all water year types (Table 11-4A-146).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June Sacramento-San Joaquin roach spawning period would generally be similar to or slightly lower than flows under Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to 509% greater than flows under Existing Conditions during March through June, except during March of below normal and dry water years, when flows under H4_ELT would be 22% and 11% lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during March and April, and generally up to 27% lower than flows under Existing Conditions during May and June.

Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under Existing Conditions during March through June, except during March of wet years, in which flow under H4_ELT would be 14% greater than flow under Existing Conditions.

Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under Existing Conditions during March through June, except during March of below normal and critical water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow under Existing Conditions.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower, respectively.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 23% lower than to those under Existing Conditions during March through June, except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater than flow under Existing Conditions.

The percentage of months under H4_ELT with mean water temperatures below the 60.8°F water temperature range in the Feather River below Thermalito Afterbay would be up to 7% and 8% higher than the percentage under Existing Conditions in above normal and below normal water years, respectively, and would be up to 19% lower than the percentage under Existing Conditions in the other three water year types (Table 11-4A-147). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 4A would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to Sacramento-San Joaquin roach. There would be no substantial temperature effects under Alternative 4A on Sacramento-San Joaquin roach. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under Existing Conditions.

Hardhead – California species of special concern

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April and May) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT during April and May, except in above normal years during April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be similar to moderately greater than flows under NAA_ELT during April and May, except in critical years in May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

Water Temperature

The percentage of years outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature-related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of years under H3_ELT outside the 59°F to 64°F suitable water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-148).

Table 11-4A-148. Difference and Percent Difference in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (2%)	0 (0%)
Above Normal	4 (6%)	-5 (-7%)
Below Normal	18 (42%)	4 (7%)
Dry	5 (9%)	-6 (-9%)
Critical	-8 (-15%)	-8 (-15%)
All	4 (7%)	-3 (-5%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would be similar to or up to 548% greater than flows under NAA_ELT during April and May.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April and May, except for 10% higher flow during April of critical water years and 14% lower flow for May of critical years.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT during April and May, except for 17% lower flow during April of above normal water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to flows under NAA_ELT in both April and May.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F suitable water temperature range in the Feather River below Thermalito Afterbay would be similar to or up to 19% lower than the percentage under NAA_ELT in all water years, except wet years (10% greater) (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the San Joaquin River.

Table 11-4A-149. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Fall outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	7 (11%)	6 (10%)
Above Normal	-5 (-8%)	-14 (-19%)
Below Normal	14 (33%)	0 (0%)
Dry	5 (9%)	-6 (-9%)
Critical	-4 (-7%)	-4 (-7%)
All	5 (9%)	-2 (-3%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in hardhead spawning habitat. Flows in all rivers examined during the April through May spawning period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to flows under Existing Conditions during April through May, except in wet years during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through May, except in critical years during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under Existing Conditions during April through May, except in critical years during May (6% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through May, except in below normal years during April (6% lower) and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower), but generally lower than flows under Existing Conditions during May, except in critical years (13% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These few flow reductions are relatively small in magnitude and, therefore would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 12% lower than to those under Existing Conditions during April and May.

Water Temperature

The percentage of months outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 59°F to 64°F water temperature range for hardhead spawning would be greater than the percentage under Existing Conditions in all water years types, except critical years (15% lower) (Table 11-4A-148).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May period would generally be similar to or up to 11% lower (May of wet years) than flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509% greater than flows under Existing Conditions during April and May.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under Existing Conditions during April, and up to 18% lower than flows under Existing Conditions during May.

Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during April and May.

Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 13% lower than to those under Existing Conditions during April and May.

Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing Conditions in both months, except for 10% higher flows in Clear Creek during April of critical water years.

The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F suitable water temperature range in the Feather River below Thermalito Afterbay would be slightly lower than the percentage under Existing Conditions in above normal and critical water years and would be up to 33% higher than the percentage under Existing Conditions in wet, below normal and dry water years (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would be less than significant because Alternative 4A would not cause a substantial reduction in roach spawning habitat, and no mitigation is necessary. Flows in most rivers examined during the April through May spawning period under Alternative 4A would generally be similar to or greater than flows under Existing Conditions. Flows in the San Joaquin and Stanislaus Rivers would be lower under Alternative 4A, although these reductions would not have population-level effects on hardhead. There would be no substantial temperature effects under Alternative 4A on roach. Therefore, the impact would be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: The effect of water operations on spawning habitat of California bay shrimp under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-202) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: The impact of water operations on spawning habitat of California bay shrimp would be the same as described immediately above. The impact would be less than significant and no mitigation would be required.

Impact AQUA-203: Effects of Water Operations on Rearing Habitat for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-203 for additional background information relevant to non-covered species of primary management concern. The analysis for striped bass, American shad, and bay shrimp includes new analysis across all alternatives that is described in detail in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that analysis.

Striped Bass

NEPA Effects: The discussion under Alternative 4A, Impact AQUA-202 for striped bass also addressed the embryo incubation and initial rearing period. That analysis indicates that there is no adverse effect on striped bass rearing during that period. As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect striped bass juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Several X2-abundance index or X2-survival index relationships from Kimmerer et al. (2009) were applied to striped bass in order to assess the potential effects on abundance or survival through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there generally would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ ELT (See Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). The exceptions were the mean bay midwater trawl abundance index (7% reduction; Table 11-mult-9) and the mean summer townet survival index (6% reduction; Table 11-mult-6). These results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for striped bass.

CEQA Conclusion: The analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions (see Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), there could be significant impacts of the Alternative 4A on survival or abundance of striped bass, in contrast to the conclusion presented above in the NEPA Effects section. As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both Alternative 4A and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in the ELT, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands. Because Alternative 4A modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for striped bass, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. When compared to NAA_ELT and informed by the NEPA analysis above, the change in rearing habitat would be less than significant. No mitigation would be necessary.

American Shad

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect American shad juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Two X2-abundance index relationships from Kimmerer et al. (2009) were applied to American shad in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ELT(See Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for American shad.

CEQA Conclusion: Similar to striped bass, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 4A on abundance of American shad (Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Threadfin Shad

NEPA Effects: The effects of water operations on rearing habitat for threadfin shad under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-203) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-203. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on threadfin shad rearing habitat would be less than significant and no mitigation would be required.

Largemouth Bass

H3_ELT/ESO_ELT

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during April through October with some exceptions (to 14% lower), and would be lower in all water year types during November (to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to flows under NAA_ELT with isolated exceptions, including flow reduction in above normal years during April (to 17% lower) and small flow reductions in above normal years during October (7% lower) and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT during April through November, except in critical years during August (11% greater) and in critical years during July, September, and October (to 14% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to substantially greater than flows under NAA during April through June (to 106% greater), except in critical years during May and June (to 10% lower); moderately to substantially lower than flows under NAA during July through September (to 48% lower), except in critical years during August and September (to 25% greater); and similar to or greater than flows under NAA_ELT during October and November (to 19% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions during July through September would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA during April through July and October, except in wet years during October (6% lower), and would be similar to or lower than flows under NAA_ELT during August, September, and November (to 22% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 88°F under NAA_ELT or H3_ELT. As a result, there would be no difference between NAA_ELT and H3_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-4A-150).

Table 11-4A-150. Difference and Percent Difference in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 1A indicates that there would be no differences in flows between H3 and NAA_ELT.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT and H3_ELT (Table 11-4A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and H3_ELT.

Table 11-4A-151. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT /HOS_ELT

Juveniles

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through November juvenile largemouth bass rearing period would generally be similar to flows under NAA_ELT, except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively, and would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT during April through November, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT, during April through November, except for 17% lower flow during April of above normal water years, 16% greater flow in September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT during April through November, except for 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

Water temperatures in the Feather River below Thermalito Afterbay during the April through November juvenile largemouth bass rearing period would not exceed the 88°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-4A-152).

Table 11-4A-152. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

Adults

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult largemouth bass residency period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round adult largemouth bass residency period would not exceed the 86°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-153).

Table 11-4A-153. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in juvenile rearing and adult spawning habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the largemouth bass population. Flow-related habitat conditions for both juvenile and adult largemouth bass under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4 would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

H3_ELT/ESO_ELT

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in wet years during

May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in above normal and below normal years during August (to 7% greater) and in wet and above normal years during September (to 32% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in critical years during May (6% lower) and in wet years during July (10% lower), and similar to or lower than flows under Existing Conditions during August through November (to 17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions years during August through November would have a localized effect on rearing conditions.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions during April through November, except in critical years during September (19% lower) and in below normal years during October (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively small, isolated effect limited to a single water year type and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during April through June, September, and October, with a few isolated exceptions (to 50% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions during July, August, and November (to 52% lower), except in wet and above normal years during July and August (to 50% greater) and in above normal years during November (5% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower), but generally lower, by up to 46%, during May through November (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May and September through November, and would be similar to or up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 14% lower than to those under Existing Conditions during April through July, except for 11% greater flow during June of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through November.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 88°F water temperature threshold for juvenile largemouth bass during the April through November rearing period under Existing Conditions or H3_ELT (Table 11-4A-150). As a result, there would be no difference in the percentage of months in which the 88°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions in critical years would have a localized effect on conditions for adults in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat for adults and increased stress and mortality of adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for adult largemouth bass under Existing Conditions or H3_ELT (Table

11-4A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

H4_ELT/HOS_ELT

Juveniles

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through July juvenile largemouth bass rearing period would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under in the Feather River at Thermalito Afterbay would be greater (up to 509%) than those under Existing Conditions June, with few exceptions. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to flows under Existing Conditions during April, but up to 27% lower than flows under Existing Conditions during May and June. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions with minor exceptions. Flows under H4_ELT in Clear Creek would be similar to flows under Existing Conditions. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be lower (up to 16% lower) than those under Existing Conditions. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be up to 14% lower than to those under Existing Conditions.

Based on these flow reductions, juvenile rearing habitat conditions would generally be less favorable under H4 relative to NAA_ELT in the Feather River.

Adults

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult largemouth bass residency period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through

November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water temperatures in the Feather River below Thermalito Afterbay would not exceed the 86°F water temperature threshold for adult largemouth bass under H4_ELT or Existing Conditions. As a result, there would be no difference between H4_ELT and Existing Conditions in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-153).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the adult largemouth bass residency period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce the quantity and quality of habitat for adults as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento Tule Perch

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to the NAA_ELT.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for rearing.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be partially offset by increases in flow in the adjoining months. In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal and critical years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 4A indicates that there would be no biologically meaningful differences in flows between H3 and NAA_ELT because flows would not be reduced enough or frequently enough to affect habitat conditions.

Water Temperature

The percentage of months exceeding water temperature thresholds of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced rearing habitat quantity and quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of years under H3_ELT exceeding the 72°F threshold would be higher than the percentage under NAA_ELT by up to 164% depending on water year type (Table 11-4A-154). Although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤2%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

The percentage of months under H3_ELT exceeding the 75°F threshold would be similar to or up to 29% lower than the percentage under NAA_ELT (Table 11-4A-154). As with the 72°F threshold, although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤1%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

Table 11-4A-154. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
72°F Threshold		
Wet	1 (59%)	2 (84%)
Above Normal	0 (NA)	0 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	4 (NA)	2 (164%)
Critical	5 (114%)	1 (18%)
All	2 (185%)	2 (76%)
75°F Threshold		
Wet	0 (NA)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	3 (400%)	-1 (-29%)
All	1 (500%)	0 (-25%)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March.

Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively.

Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years.

Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years.

Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be higher than the percentage under NAA_ELT, but absolute differences would be small (≤4%) and, therefore, would not represent a biologically meaningful effect to Sacramento tule perch (Table 11-4A-155).

Table 11-4A-155. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
72°F Threshold		
Wet	3 (145%)	4 (184%)
Above Normal	2 (NA)	2 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	5 (NA)	3 (229%)
Critical	7 (164%)	4 (46%)
All	4 (292%)	3 (143%)
75°F Threshold		
Wet	1 (NA)	1 (233%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	1 (NA)	1 (NA)
Critical	2 (300%)	-2 (-43%)
All	1 (700%)	0 (0%)

NA = could not be calculated because the denominator was 0.
[a] A negative value indicates a reduction in percentage of months outside suitable range under H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in the quantity or quality of Sacramento tule perch habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento tule perch population. There would be no substantial differences in water temperature between Alternative 4A and NAA_ELT in any river examined that would cause a biologically meaningful effect to Sacramento tule perch.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to Existing Conditions.

H3_ELT/ESO_ELT

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for tule perch.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions would have a localized effect on habitat conditions in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be persistent small to substantial flow reductions that would affect habitat conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months exceeding water temperatures of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced habitat quality and increased stress and mortality. Water temperatures were not modeled in Clear Creek or the San Joaquin River.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT exceeding 72°F relative to the percentage under Existing Conditions would be similar to or greater, by up to 114% (Table 11-4A-154). However, these relative increases correspond to small absolute increases (≤5%) that are not expected to have biologically meaningful effects.

The percentage of years under H3_ELT exceeding 75°F would be similar to the percentage under Existing Conditions in all water years except critical years (400% higher) (Table 11-4A-154). As with the 72°F threshold, this increase corresponds to a small absolute increase (3%) that is not expected to have biologically meaningful negative effects.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento tule perch occurrence period would generally be similar to those under Existing Conditions, except in wet and critical years for the 72°F threshold and in critical years for the 75°F threshold. Although these relative differences would be large, the absolute differences would be small (≤7%) and, therefore, would not have a biologically meaningful effect on the quantity or quality of habitat for Sacramento tule perch (Table 11-4A-155).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the juvenile and adult Sacramento tule perch occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the

alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento-San Joaquin Roach

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower)(Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years in August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal and critical years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced rearing habitat quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3 _ELT would generally be the same as those under NAA _ELT. Therefore, there would be no temperature related effects of H3 _ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT or H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and H3_ELT.

Table 11-4A-156. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round Sacramento-San Joaquin roach occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-157).

Table 11-4A-157. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in quantity and quality of habitat for juvenile and adult Sacramento-San Joaquin roach rearing habitat. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento-San Joaquin roach population. Flow-related habitat conditions for roach under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under H4_ELTwould generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions in critical years would have a localized effect on habitat conditions in that water year type.

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48% lower), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location. There would be persistent small to substantial flow reductions that would affect habitat conditions at this location.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for juvenile and adult Sacramento-San Joaquin roach. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for Sacramento-San Joaquin roach under Existing Conditions or H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water temperature threshold in H4_ELT or Existing Conditions. As a result, there would be no difference between H4_ELT and Existing Conditions in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-157).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Hardhead

In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT throughout the year except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than flows under NAA_ELT during January and July through September, except in critical years during August and September (23% and 25% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during February through June, except for below normal years during February and March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8% lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except critical years during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (to 11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22% lower) during August through November, except in below normal and critical years during October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year except below normal years (6% greater) (Table 11-4A-158).

Table 11-4A-158. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	1 (1%)
Above Normal	-3 (-4%)	-3 (-4%)
Below Normal	0 (0%)	4 (6%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	0 (0%)	1 (1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult hardhead occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead occurrence period would be similar to or lower than the percentage under Existing Conditions in all water year types (Table 11-4A-159).

Table 11-4A-159. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS	NAA_ELT vs. H4_ELT
Wet	-2 (-3%)	-1 (-1%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-4 (-6%)	0 (0%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	-2 (-3%)	-1 (-1%)

[a] A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 4A would not cause a substantial reduction in the quantity or quality of habitat for juvenile and adult hardhead. Flows in all rivers examined during the year under Alternative 4A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on hardhead. Flow-related habitat conditions for hardhead under H4_ELT would be less favorable than those under H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions for juvenile and adult hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through April and December, except in drier years during January (to 13% lower), in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (8% lower), in above normal years in April (5% lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or lower than flows under Existing Conditions during May through November (to 46% lower), except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively)*.* There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions during January through June and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), but would generally be similar to or lower than flows under Existing Conditions during July through November, except in below normal years during July (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)*.* The persistent, small to moderate flow reductions in critical years would have a localized effect on rearing conditions in that water year type. In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)*.* This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under Existing Conditions during February through June, September, and October, except in drier years during February (to 48%), in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), in wet years during May (155 lower), in below normal and critical years during September (26% and 50% lower, respectively), and in wet and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)*.* Flows under H3_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, July, August, November, and December, except in wet and above normal years during July (15% and 9% greater, respectively), in below normal and dry years during August (7% and 45% greater, respectively), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (8% and 6% lower, respectively), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*)*.* Flows under H3_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (13% greater), in below normal and dry years during June (8% and 25% greater, respectively), and in below normal and critical years during October (10% and 15% greater, respectively). The persistent, small to moderate flow reductions in critical years would have a localized effect on habitat conditions in that water year type.

In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions during April, May and September through November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or up to 11% greater than flows under Existing Conditions during December and January.

In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months in which year-round in-stream temperatures would be outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of H3_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead would be similar to or lower than the percentage under Existing Conditions in all water years (Table 11-4A-158).

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile and adult hardhead occurrence period would generally be similar to or up to 18% lower than flows under Existing Conditions throughout the year, except during September, when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater than those under Existing Conditions during April through June and September, except for 37% and 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower flows during September of below normal and dry years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions during July, August, and October through March, except in August through November of critical water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and below normal water years, and 14% greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions throughout the year, but would range from 10% to 29% higher during December through March of wet years, would be 22% higher in February of above normal years, would be 16% lower in January of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows under Existing Conditions throughout the year, but would be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher in December through April of critical water years, 11% higher in October of critical years, 13% higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly lower than those under Existing Conditions during January, April, May and September through

November, would be similar to or up to 23% lower than flows under Existing Conditions during February, March, and June through August, and would be similar to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow during February and June, respectively, of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead occurrence period would be similar to or less than the percentage under Existing Conditions in all water year types (Table 11-4A-159).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 4A during the juvenile and adult hardhead occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce habitat for juvenile and adult hardhead as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect California bay shrimp juvenile abundance through because of an increase in residual circulation in the estuary with increasing outflow (as indexed by X2) that could translate to more rapid or more complete entrainment into the estuary, or more rapid transport to rearing grounds, both of which presumably could increase survival from hatching to settlement (Kimmerer et al. 2009). An X2-abundance index relationship from Kimmerer et al. (2009) was applied to bay shrimp in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ELT(See Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for California bay shrimp.

CEQA Conclusion: Similar to striped bass and American shad, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 4A on abundance of California bay shrimp (Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass and American shad, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for California bay shrimp and as noted for striped bass and American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Impact AQUA-204: Effects of Water Operations on Migration Conditions for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-204 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

NEPA Effects: Under Alternative 4A Scenario H3_ELT, average spring (March–May) monthly flows in the Sacramento River downstream of the north Delta intake would be reduced 18–22% during the adult striped bass migration compared to baseline (NAA_ELT). The reduction would be less (4–18%) for the H4_ELT scenario. Sacramento River flows are highly variable inter-annually, but striped bass are still able to migrate upstream the Sacramento River during years of lower flows. The effect of reduced Sacramento flows under Alternative 4A would not be adverse.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because the changes in spring flow under Scenarios H3_ELT (21–23% lower compared to Existing Conditions) and H4_ELT (10–18% lower compared to Existing Conditions) would not interfere substantially with movement of pre-spawning striped bass through the Delta. No mitigation would be required.

American Shad

NEPA Effects: Flows in the Sacramento River below the north Delta diversion facilities under Scenarios H3_ELT and H4_ELT would be reduced 18–22% and 4–18%, respectively, relative to the NEPA point of comparison (NAA_ELT) during March–May, as described above for striped bass. River flows are highly variable inter-annually, and American shad are still able to migrate upstream the Sacramento River during lower flow years. Overall, the impact to American shad migration habitat conditions would not be adverse under Alternative 4A.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because, as described above for striped bass, the changes in flow under Scenario H3_ELT (21–23% lower compared to Existing Conditions) and H4_ELT (10–18% lower compared to Existing Conditions) would not interfere substantially with movement of American shad from the Delta to upstream spawning habitat. No mitigation would be required.

Threadfin Shad

NEPA Effects: Threadfin shad are semi-anadromous, moving between freshwater and brackish water habitats. Threadfin shad found in the Delta do not actively migrate upstream to spawn. Therefore there is no effect on migration habitat conditions.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because flow changes in the Delta under Alternative 4 would not alter movement patterns for threadfin shad. No mitigation would be required.

Largemouth Bass

NEPA Effects: Largemouth bass are non-migratory fish within the Delta. Therefore they do not use the Delta as a migration habitat corridor. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes under Alternative 4 would not affect largemouth movements within the Delta. Therefore, the impact is less than significant. No mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Similar with largemouth bass, Sacramento tule perch are a non-migratory species and do not use the Delta as a migration corridor as they are a resident Delta species. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes would not affect Sacramento tule perch movements within the Delta. Therefore, the impact is less than significant. No mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: For Sacramento-San Joaquin roach, the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 4, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to the NAA_ELT. These conditions would not be adverse.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-202, the impacts of water operations on migration conditions for Sacramento-San Joaquin roach would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: For hardhead the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 4, Impact AQUA-202 for spawning due to similar flows and temperatures. As described there, the flows would slightly improve the upstream conditions relative to the NAA_ELT. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for hardhead would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: The effect of water operations on migration conditions of California bay shrimp under Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-204) due to similar flows and temperatures. For a detailed discussion, please see Alternative 1A, Impact AQUA-204. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on California bay shrimp migration conditions would be less than significant and no mitigation would be required.

Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As noted previously, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small. The effects of restoration measures under Alternative 4A would be similar for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-205: Effects of Construction of Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-7 under delta smelt for a discussion of the effects of construction of restoration measures on non-covered species of primary management concern because effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*. The potential effects of the construction of restoration measures under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-7). For a detailed discussion, please see Alternative 1A, Impact AQUA-7. The effects would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of the construction of restoration measures would be less than significant and no mitigation would be required.

Impact AQUA-206: Effects of Contaminants Associated with Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-8 under delta smelt for a discussion of the effects of contaminants associated with restoration measures on non-covered species of primary management concern. The potential effects of contaminants associated with restoration measures under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-8), although would be greatly reduced in extent. For a detailed discussion, please see Alternative 1A, Impact AQUA-8. The effects would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of the contaminants associated with restoration measures would be less than significant and no mitigation would be required.

Impact AQUA-207: Effects of Restored Habitat Conditions on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: Refer to Impact AQUA-9 under delta smelt for a general discussion of the effects of restored habitat conditions on non-covered species of primary management concern. Although there are minor differences, the effects are similar because restoration would provide new habitat areas for those species that occur in the areas that are restored. The effect of restoration activities under Alternative 4A relative to NAA_ELT would not be adverse.

CEQA Conclusion: The impacts of restored habitat conditions would range from slightly beneficial to beneficial, depending on where the restoration occurs and how it is designed. No mitigation would be required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

The effects of other Environmental Commitments under Alternative 4A would be similar for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-208: Effects of Methylmercury Management on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 12)

NEPA Effects: Refer to Impact AQUA-10 under delta smelt for a discussion of the effects of methylmercury management on non-covered species of primary management concern. The potential effects of methylmercury management under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-10). For a detailed discussion, please see Alternative 1A, Impact AQUA-10. The effects would not be adverse because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

CEQA Conclusion: As described immediately above, the impacts of methylmercury management would be less than significant and no mitigation would be required.

Impact AQUA-211: Effects of Localized Reduction of Predatory Fish on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 15)

NEPA Effects: Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the effects of predatory fish (striped bass and largemouth bass) and predator management on non-predatory fish. The purpose of predatory fish management is to reduce predation pressure at predation hotspots and not to reduce the overall populations of these species. This management will have localized negative effects on predatory fish; under Alternative 4A, the efforts will be focused solely at the south Delta export facilities and the proposed north Delta intakes. Given that the numbers of predatory fish are high and the extent of the habitats in which they occur is extensive, the effects of Environmental Commitment 15 will not be adverse.

CEQA Conclusion: Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the effects of predatory fish and predator management on non-predatory fish. The purpose of predatory fish management is to reduce predation pressure at predation hotspots and not to reduce the overall populations of these species. This management will have localized negative effects on predatory fish; under Alternative 4A, the efforts will be focused solely at the south Delta export facilities and the proposed north Delta intakes. Given that the numbers of predatory fish are high and the extent of the habitats in which they occur is extensive, the effects of Environmental Commitment 15 will be less than significant. No mitigation is necessary.

Impact AQUA-212: Effects of Nonphysical Fish Barriers on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 16)

NEPA Effects: As described for Alternative 1A, nonphysical barriers (NPBs) are designed to alter juvenile salmon migration routes using sound, light, and bubbles and are not intended for other species. Alternative 4A proposes only one location for a NPB, at the divergence of Georgiana Slough from the Sacramento River. The in-water structures associated with this barriers may attract fish predators (including the non-covered aquatic species striped bass and largemouth bass), increasing localized predation risk for smaller individuals of the noncovered aquatic species migrating past the barriers, but the extent of this effect is highly uncertain. The general potential effects of nonphysical fish barriers under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A, Impact AQUA-14). For a detailed discussion, please see Alternative 1A, Impact AQUA-14. Whereas striped bass, American shad, threadfin shad, and largemouth bass could encounter the proposed barrier, Sacramento-San Joaquin roach and hardhead are unlikely to be present in the vicinity of the nonphysical barrier, and California bay shrimp do not occur in these habitats so there would be no effect. The effects on non-covered aquatic species of primary management concern would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of a nonphysical fish barrier would be less than significant and no mitigation would be required.

Upstream Reservoirs

Impact AQUA-217: Effects of Water Operations on Reservoir Coldwater Fish Habitat

NEPA Effects: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, this effect would not be adverse because coldwater fish habitat in the CVP and SWP upstream reservoirs under Alternative 4A would not be substantially reduced when compared to the No Action Alternative. Carryover storage thresholds for all CVP and SWP reservoirs would be similar between the No Action Alternative and Alternative 4A.

CEQA Conclusion: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, Alternative 4A would reduce the quantity of coldwater fish habitat in the CVP and SWP relative to Existing Conditions. There would be There would be 5 and 7 fewer years (7% and 9% lower, respectively) that exceed the 250 TAF carryover storage threshold in Folsom Reservoir under H3_ELT and H4_ELT, respectively, relative to Existing Conditions, which could result in a significant impact.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, there would be negligible effects on mean monthly reservoir storage. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in reservoir storage under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

4.3.8 Terrestrial Biological Resources

Section 4.1, *Description of Alternatives*, of the RDEIR/SDEIS provides details of Alternative 4A, and Figure 3-9 depicts the alternative.

Study Area

The study area for conducting the terrestrial biology analysis of Alternative 4A consists of all of the BDCP Plan Area and the areas of additional analysis identified for BDCP Alternative 4 (see Figure 12-1 in the Draft EIR/EIS).

Methods

The methods used to conduct the terrestrial biology analyses for Alternative 4A are generally the same as those used to analyze all BDCP alternatives (see Section 12.2.3.4 of the Draft EIR/EIS) except it is compared to the No Action Alternative at the early long-term. Also, the methods used for the analysis of effects on wetlands and waters of the United States (contained in Section 4.3.8.4, *General Terrestrial Biology*, of the RDEIR/SDEIS) for alternative 4A are different than the methods used for the BDCP alternatives. Modifications to this methodology are presented in a revised version of Section 12.3.2.4, *Methods Used to Assess Wetlands and Other Waters of the United States,* in Appendix D of this RDEIR/SDEIS.

Significance Criteria

The significance criteria used to determine the severity of potential Alternative 4A effects are the same as those used to analyze all BDCP alternatives. They are included in Section 12.3.1.2, *Significance Criteria for Terrestrial Biological Resources*, of the Draft EIR/EIS.

Organization

The impact analysis below includes separate sections for effects on natural communities, special-status wildlife species, special-status plant species and a number of other biological resources issues (wetlands and waters of the United States, waterfowl and shorebirds, wildlife corridors).

Natural Communities

Tidal Perennial Aquatic

Construction, operation, maintenance, and management associated with the implementation of Alternative 4A would have no long-term adverse effects on the habitats associated with the tidal perennial aquatic natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal or modification of this community (see Table 12-4A-1). A small amount of this community could also be lost to channel margin habitat enhancement (Environmental Commitment 6).

Table 12-4A-1. Changes in Tidal Perennial Aquatic Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	207	2,098[b]
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	207	2,098

[a] See discussion below for a description of applicable environmental commitments.
[b] The large acreage of tidal perennial aquatic habitat affected by Alternative 4A is related primarily to dredging of Clifton Court Forebay; the habitat would not be permanently removed, it would be expanded.

Impact BIO-1: Changes in Tidal Perennial Aquatic Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities for Alternative 4A would permanently affect an estimated 207 acres and temporarily remove 2,098 acres of tidal perennial aquatic natural community in the study area. The large temporary loss of this natural community would be primarily related to dredging of Clifton Court Forebay. These modifications represent less than 3% of the 86,263 acres of the community that is mapped in the study area. The permanent and temporary effects would occur during the construction period for Alternative 4A as water conveyance facilities are developed. An undetermined amount of this natural community could also be affected by channel margin habitat enhancement along the major Delta waterways. The 450-acre expansion of Clifton Court Forebay during the water conveyance facility construction would offset the permanent losses.

The effects of water conveyance facilities and Environmental Commitment 6 are addressed below. A summary statement of impacts and NEPA and CEQA conclusions follows the individual environmental commitment discussion.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 207 acres and temporarily remove 2,098 acres of tidal perennial aquatic community. Most of the permanent loss would occur where new facilities are constructed at Clifton Court Forebay and where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland (see the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of proposed facilities overlain on natural community mapping). The footings and the screens at the intake sites would be placed into the river margin and would displace moderately deep to shallow, flowing open water with a mud substrate and very little aquatic vegetation. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay, where Clifton Court Forebay levees are modified, and where permanent new transmission lines would be constructed along Lambert Road just west of Interstate 5.
- The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest effect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the

Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at four locations along the tunnel route. The barge unloading construction would temporarily affect Potato Slough at the south end of Boldin Island, Venice Reach of the San Joaquin River at the south end of Venice Island, Connection Slough at the north end of Bacon Island, and Old River just south of its junction with North Victoria Canal. The details of these locations can be seen in the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS. These losses would take place during the 14-year construction time period.

- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of tidal perennial aquatic habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would be implemented on tidal perennial aquatic habitat margins, including levees and channel banks. The improvements could be implemented on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the effects discussed above and describe other project actions that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the first 14 years of Alternative 4A implementation, the project would affect the tidal perennial aquatic community through water conveyance facilities construction losses (207 acres permanent and 2,098 acres temporary). These losses would occur primarily at Clifton Court Forebay due to dredging, and along the Sacramento River at intake sites.

NEPA Conclusion: The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A environmental commitments. Loss of tidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. The largest loss would occur at Clifton Court Forebay, and would be temporary. This tidal perennial habitat is of relatively low value to special-status terrestrial species in the study area. The permanent expansion of the Clifton Court Forebay aquatic habitat (approximately 450 acres) during the first 14 years of Alternative 4A implementation would offset the permanent loss; the restoration of Clifton Court Forebay aquatic habitat following construction-related dredging would offset the temporary project effects. These actions would avoid any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate 2,305 acres of restoration would be needed to offset (i.e., mitigate) the 2,305 acres of effect (the total permanent and temporary near-term effects listed in Table 12-4A-1) associated with water conveyance facilities construction.

The alternative also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. Therefore, changes in tidal perennial aquatic natural community as a result of implementing Alternative 4A would not be adverse.

CEQA Conclusion**:** Alternative 4A would result in the near-term loss or conversion of approximately 2,305 acres of tidal perennial aquatic natural community due to construction of the water conveyance facilities. The construction losses would occur primarily at Clifton Court Forebay, along the Sacramento River at intake sites, and along various Delta waterways at barge offloading sites. The losses and conversions would be spread across the 14-year water conveyance facilities construction period. These losses and conversions would be offset by planned restoration and expansion of Clifton Court Forebay (a combined acreage of approximately 2,595) following project-related dredging scheduled for the first 14 years of Alternative 4A implementation. AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting near-term restoration activities and AMMs, there would be no permanent loss of this sensitive natural community and impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 2,305 acres of restoration would be needed to offset (i.e., mitigate) the 2,305 acres of loss or conversion. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species. Therefore, impacts associated with changes in tidal perennial aquatic natural community as a result of implementing Alternative 4A would be less than significant. No mitigation is required.

Impact BIO-2: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Perennial Aquatic Natural Community

Alternative 4A would not result in periodic effects on the tidal perennial aquatic natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-3: Modification of Tidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the water conveyance facilities and conservation lands that could affect tidal perennial aquatic natural community in the study area. The ongoing actions include diverting Sacramento River flows in the north Delta, and reduced diversion from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities, levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with project mitigation requirements. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of a sensitive natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of tidal perennial aquatic community would be reduced on a permanent basis. Some increases and some decreases would be expected to occur during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal perennial aquatic community downstream of these diversions. Tidal influence on water levels in the Sacramento River and Delta waterways would continue to be dominant. Reduced diversions from the south Delta channels would not create a reduction in this natural community.

The periodic changes in flows in the Sacramento River, Feather River, and American River associated with Alternative 4A operations would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels, and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Section 4.3.4, *Water Quality*, of the RDEIR/SDEIS. Potentially substantial increases in electrical conductivity (salinity) are predicted for the Delta and Suisun Marsh as a result of increased export of Sacramento River water. These salinity changes are not expected to result in a permanent reduction in the acreage or value of tidal perennial aquatic natural community for terrestrial species in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and conservation sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with conservation activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River and at Clifton Court Forebay would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in tidal perennial aquatic natural community and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for movement corridor or foraging area. The individual species effects are discussed in Section 4.3.8.2, *Wildlife Species*, of this RDEIR/SDEIS.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal perennial aquatic natural community in the study area through changes in flow patterns and changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the alternative, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small reductions in acreage, these reductions would be greatly offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*, and the restoration and expansion of this community at Clifton Court Forebay. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal perennial aquatic habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be no adverse effect on the tidal perennial aquatic natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor losses in total acreage of tidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* and enlargement of Clifton Court Forebay would greatly expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the acreage or value of this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal perennial aquatic natural community.

Tidal Brackish Emergent Wetland

Construction associated with Alternative 4A water conveyance facilities and the alternative's environmental commitments would not affect the tidal brackish emergent wetland natural community. Operation, maintenance, and management activities associated with the alternative could result in minor changes in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation.

As explained below, with the restoration and enhancement of tidal marsh as part of Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Impact BIO-4: Changes in Tidal Brackish Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

No tidal brackish emergent wetland would be lost or converted under Alternative 4A.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Impact BIO-5: Modification of Tidal Brackish Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with water conveyance facilities and Environmental Commitment 4 of Alternative 4A are constructed and the water management practices associated with changed reservoir operations, diversions from the north Delta, and marsh restoration are in effect, there would be new ongoing and periodic actions that could affect tidal brackish emergent wetland natural community in the study area. The ongoing actions include water releases and diversions, access road and levee repair, and replacement of levee armoring, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of tidal brackish emergent wetland natural community in the study area. Flow levels in the upstream rivers would not directly affect this natural community because it does not exist upstream of the Delta. Increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in tidal brackish emergent wetland downstream of these diversions. Salinity levels in Suisun Marsh channels would be expected to increase with reduced Sacramento River outflows (see Section 4.3.4, *Water Quality*, of the RDEIR/SDEIS), but this change would not be sufficient to change the acreage of brackish marsh. This natural community persists in an environment that experiences natural fluctuations in salinity due to tidal ebb and flow. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for

Alternative 4A, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area Due to BDCP Shift in Export Location and Volume*, in the Draft BDCP for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

- Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal brackish emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*, of the Draft EIR/EIS). The project proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.1.19, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*, of the Draft EIR/EIS) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the study area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the study area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road and levee repair.* Periodic repair of access roads and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in tidal brackish emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. The activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan*. Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment (Environmental Commitment 11), would be a periodic activity associated with the long-term maintenance of restoration sites. Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal brackish emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to levees associated with tidal wetland restoration activities.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal brackish emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for special-status species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage and value of tidal brackish emergent wetland natural community in the study area through water operations, levee and road maintenance, and vegetation management in or adjacent to this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the alternative, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with tidal brackish emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the tidal brackish emergent wetland natural community within the study area. There would be no adverse effect on the tidal brackish emergent wetland natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of tidal brackish emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact.

Tidal Freshwater Emergent Wetland

Construction, operation, maintenance and management associated with the environmental commitments of Alternative 4A would have no long-term adverse effects on the habitats associated with the tidal freshwater emergent wetland natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of small acreages of this community (see Table 12-4A-2). Small areas of this community could also be lost to the development of channel margin habitat associated with Environmental Commitment 6.

As explained below, with the restoration and enhancement of tidal habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-2. Changes in Tidal Freshwater Emergent Wetland Natural Community Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Water Conveyance Facilities	3	15
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	3	15

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-6: Changes in Tidal Freshwater Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities for Alternative 4A would permanently eliminate an estimated 3 acres and temporarily remove 15 acres of tidal freshwater emergent wetland natural community in the study area. These modifications represent less than 1% of the 8,856 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the first 14 years of Alternative 4A implementation, as water conveyance facilities are constructed. Smaller areas of this natural community could be affected by levee breaching, grading, and contouring associated with Environmental Commitment 4 and Environmental Commitment 6 restoration activities. Natural communities restoration would add at least 59 acres of tidal wetland during the course of project restoration activities, which would expand the area of that habitat and offset the losses.

The individual effects of water conveyance facilities, Environmental Commitment 4, and Environmental Commitment 6 are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the environmental commitment discussion.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 3 acres and temporarily remove 15 acres of tidal freshwater emergent wetland community. Most of the loss would occur along rivers and canals in the central Delta from barge unloading facility construction (Old River on the east side of Victoria Island and Connection Slough at the north end of Bacon Island), and from transmission line construction (San Joaquin River and Potato Slough at the south and north ends of Venice Island, Connection Slough at the north end of Bacon Island, and Railroad Slough at the north end of Woodward Island; see Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). These losses would take place during the water conveyance facilities construction period.

- There is the potential for increased nitrogen deposition associated with construction vehicles during the construction phase of water conveyance facilities. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities,* of the Draft BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing tidal freshwater emergent wetland natural community because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: The restoration activities associated with Environmental Commitment 4 would result in other effects that could alter the habitat value of tidal freshwater emergent wetland. Disturbances associated with levee breaching and grading or contouring would increase opportunities for the introduction or spread of invasive species. Implementation of Environmental Commitment 11 would limit this risk through invasive species control and wetland management and enhancement activities to support native species. Flooding of dry areas for tidal marsh creation could also increase the bioavailability of methylmercury, especially in the Cache Slough and Cosumnes/Mokelumne ROAs. Site-specific conditions would dictate the significance of this hazard to marsh vegetation and associated wildlife. A detailed review of the methylmercury issues associated with implementation of Alternative 4A is contained in Appendix D, *Substantive BDCP Revisions*. Site-specific restoration plans that address the creation and mobilization of mercury, and monitoring and adaptive management as described in *Environmental Commitment 12 Methylmercury Management*, would be available to address the uncertainty of methylmercury levels in restored tidal marsh. Water temperature fluctuations in newly created marsh is also an issue of concern that is difficult to quantify at the current stage of restoration design. None of these effects is expected to limit the extent or value of tidal freshwater emergent wetland in the study area.

- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in filling of small amounts of tidal freshwater emergent wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on narrow strips of habitat, including levees and channel banks. The improvements could occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the construction phase of Alternative 4A, the project would affect the tidal freshwater emergent wetland natural community through water conveyance facilities construction losses (3 acres permanent and 15 acres temporary). These losses would occur in the central Delta from construction of barge unloading facilities and transmission lines on the fringes of Venice, Bacon and

Woodward Islands, and in various locations within the Yolo Bypass and the tidal restoration ROAs. An undetermined acreage would also be affected through channel margin habitat creation (Environmental Commitment 6) along the major Delta waterways.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A environmental commitments. Loss of tidal freshwater emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the creation of 59 acres of tidal wetland as part of Environmental Commitment 4 during the construction phase of Alternative 4A would more than offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 18 acres of restoration would be needed to offset (i.e., mitigate) the 18 acres of loss (the total permanent and temporary near-term effects listed in Table 12-4A-2).

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The creation of 59 acres of tidal wetland as part of Environmental Commitment 4 during the construction phase of Alternative 4A would more than offset the construction and restoration effects of implementing water conveyance facilities and Environmental Commitment 6, avoiding any adverse effect. Because of the 59 acres of tidal wetland restoration that would occur as part of Alternative 4A, the project would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 18 acres of tidal freshwater emergent wetland natural community (permanent and temporary) due to construction of the water conveyance facilities. The construction losses would occur in primarily in the central Delta on the fringes of Venice, Bacon and Victoria Islands, and in the Yolo Bypass and various tidal restoration ROAs. An unknown amount of tidal freshwater emergent wetland could also be lost to channel margin habitat creation (Environmental Commitment 6).The losses would be spread across the Alternative 4A construction timeframe and would be offset by planned restoration of 59 acres of tidal wetland scheduled for the first 14 years of Alternative 4A implementation (Environmental Commitment 4). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Because of these offsetting restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration) would indicate that 18 acres of restoration would be needed to offset (i.e., mitigate) the 18 acres of loss. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. The impact would be less than significant. No mitigation is required.

Impact BIO-7: Increased Frequency, Magnitude and Duration of Periodic Inundation of Tidal Freshwater Emergent Wetland Natural Community

Alternative 4A would not result in periodic effects on the tidal freshwater emergent wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-8: Modification of Tidal Freshwater Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect tidal freshwater emergent wetland natural community in the study area. The ongoing actions would include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Reduced diversions from the south Delta channels would not create a reduction in tidal freshwater emergent wetland in the study area. However, the periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4A (Operational Scenario H) would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Section 4.3.4, *Water Quality*, of the RDEIR/SDEIS. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of tidal freshwater emergent wetland along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the project. There is the potential that some tidal freshwater marsh may become brackish. These potential changes are not expected to result in a significant reduction in the acreage and value of tidal freshwater emergent wetland natural community in the study area.
- The increased diversion of Sacramento River flows in the north Delta would result in reductions in sediment load (annual mass) flowing into the central and west Delta, and Suisun Marsh. The reduction is estimated to be approximately 9% of the river's current sediment load for Alternative 4A, which would have a north Delta diversion capacity of 9,000 cfs under Operational Scenario H (see Appendix 5.C, Attachment 5C.D, Section 5C.D.3.3, *Summary of Changes to Sediment Supply in the Plan Area Due to BDCP Shift in Export Location and Volume*, in the Draft BDCP for a detailed analysis of this issue). This would contribute to a decline in sediment reaching the Delta and Suisun Marsh that has been occurring over the past 50-plus years due to a gradual depletion of sediment from the upstream rivers. The depletion has been caused by a variety of factors, including depletion of hydraulic mining sediment in upstream areas, armoring of river channels and a cutoff of sediment due to dam construction on the

Sacramento River and its major tributaries (Wright and Schoellhamer 2004; Barnard et al. 2013).

- Reduced sediment load flowing into the Delta and Suisun Marsh could have an adverse effect on tidal marsh, including tidal freshwater emergent wetland. Sediment trapped by the marsh vegetation allows the emergent plants to maintain an appropriate water depth as water levels gradually rise from the effects of global warming (see Chapter 29, *Climate Change*, of the Draft EIR/EIS). The project proponents have incorporated an environmental commitment (see Appendix 3B, Section 3B.1.19, *Disposal and Reuse of Spoil, Reusable Tunnel Material and Dredged Material*, of the Draft EIR/EIS) into the project that would lessen this potential effect. The Sacramento River water diverted at north Delta intakes would pass through sedimentation basins before being discharged to water conveyance structures. The commitment states that sediment collected in these basins would be periodically removed and reused, to the greatest extent feasible, in the study area for a number of purposes, including marsh restoration, levee maintenance, subsidence reversal, flood response, and borrow area fill. The portion of the sediment re-introduced to the Delta and estuary for marsh restoration would remain available for marsh accretion. With this commitment to reuse in the study area, the removal of sediment at the north Delta intakes would not result in a net reduction in the acreage and value of this special-status marsh community. The effect would not be adverse (NEPA) and would be less than significant (CEQA).

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to tidal freshwater emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering tidal aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within emergent wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (Environmental Commitment 11). Use of herbicides to control nuisance vegetation could pose a long-term hazard to tidal freshwater emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to tidal aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging would occur in waterways adjacent to tidal freshwater emergent wetlands and would result in short-term increases in turbidity and disturbance of the substrate. These conditions would not eliminate the community, but would diminish its value for special-status and common species that rely on it for cover or foraging area. The individual species effects are discussed in Section 4.3.8.2, *Wildlife Species*, of this RDEIR/SDEIS.
- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For tidal freshwater emergent wetland community, a management plan would be prepared that specifies actions to improve the value of the habitats for special-status species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of tidal freshwater emergent wetland natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with Alternative 4A, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 4 Tidal Natural Communities Restoration*. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with tidal freshwater emergent wetland habitats by improving water movement.

NEPA Effects: Ongoing operation, maintenance, and management activities would not result in a net permanent reduction in the tidal freshwater emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A, including changed water operations in the upstream reservoirs, would have the potential to create minor changes in total acreage of tidal freshwater emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Restoration activities associated with *Environmental Commitment 4 Tidal Natural Communities Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the tidal freshwater emergent wetland natural community.

Valley/Foothill Riparian

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the valley/foothill riparian natural community. Initial development and construction of water conveyance facilities, Environmental Commitment 4, and Environmental Commitment 6 would result in both permanent and temporary removal of this community (see Table 12-4A-3). Implementation of Alternative 4A would also include the following Environmental Commitments and Resource Restoration and Performance Principles over the term of the project to benefit the valley/foothill riparian natural community.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of mature riparian forest in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2).
- The mature riparian forest intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum patch size of 50 acres and minimum width of 330 feet(Resource Restoration and Performance Principle VFR3).

As explained below, with the restoration and enhancement of these amounts of habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-3. Changes in Valley/Foothill Riparian Natural Community Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Water Conveyance Facilities	42	31
Environmental Commitment 4[a]	5	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	47	31

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-9: Changes in Valley/Foothill Riparian Natural Community as a Result of Implementing Alternative 4A

Construction, land grading and habitat restoration activities that would accompany the implementation of water conveyance facilities, Environmental Commitment 4, and Environmental

Commitment 6 would permanently eliminate an estimated 47 acres and temporarily remove 31 acres of valley/foothill riparian natural community in the study area. These modifications represent approximately 0.5% of the 17,966 acres of the community that is mapped in the study area. The majority of the permanent and temporary losses would happen during the construction of Alternative 4A and as habitat restoration is initiated. Valley/foothill riparian protection (103 acres) and restoration (251 acres) would be initiated during the same period, which would offset the losses.

The individual effects of each relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 42 acres and temporarily remove 31 acres of valley/foothill riparian natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees (acacia) and scrub vegetation (see Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). Cottonwood, willow and mixed brambles would be permanently lost at manmade ponds located north and south of Twin Cities Road just west of Interstate 5, as these sites would be used to deposit reusable tunnel material. Some cottonwood and valley oak riparian would be lost due to construction of a permanent access road from the new forebay west to an RTM disposal area. Blackberry brambles would also be lost to deposit of reusable tunnel material at the east end of Bouldin Island. Smaller areas dominated by blackberry would be eliminated at the forebay site adjacent to Clifton Court Forebay and patches of willow and blackberry would be lost along the transmission line corridors where they cross waterways in the central and south Delta. Permanent losses would occur where the realigned SR 160 crosses Snodgrass Slough and along Lambert Road where temporary utility lines would be installed. Temporary losses would also occur adjacent to temporary intake work areas. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak, cottonwood, willow and scrub vegetation. These losses would take place during the Alternative 4A construction period.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Environmental Commitment 4 would permanently inundate or remove 5 acres of valley/foothill riparian community. The losses would occur in several of the ROAs established for tidal restoration (see Figure 12-1 in the Draft EIR/EIS). No losses would occur in the Suisun Marsh ROA. These ROAs support a mix of riparian vegetation types, including valley oak stands, extensive willow and cottonwood stringers along waterways, and areas of scrub vegetation dominated by blackberry. These areas are considered of low to moderate habitat value (see Section 5.4.5.1.1, *Permanent Loss and Fragmentation*, of the Draft BDCP). The actual loss of riparian habitat to marsh restoration would be expected to be smaller than predicted. As marsh restoration projects were identified and planned, sites could be selected that avoid riparian areas as much as possible.
- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur

within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *Environmental Commitment 7 Riparian Natural Community Restoration:* The valley/foothill riparian natural community would be restored primarily in association with the tidal (Environmental Commitment 4) and channel margin (Environmental Commitment 6) enhancements. A total of 251 acres of this community would be restored and 103 acres would be protected during the construction period (14 years) of the project. A variety of successional stages would be sought to benefit the variety of sensitive plant and animal species that rely on this natural community in the study area.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4Aenviornmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 4A would affect the valley/foothill riparian natural community through water conveyance facilities construction losses (42 acres permanent and 31 acres temporary) and the Environmental Commitment 4 restoration actions (5 acres permanent). The water conveyance facilities losses would occur along the eastern bank of the Sacramento River at intake sites; along transmission lines in the central and south Delta and along Lambert Road; and at RTM storage sites near Twin Cities Road, Clifton Court Forebay, and on Bouldin Island. The 5 acres of Environmental Commitment 4 losses would occur in one or several of the ROAs mapped in Figure 12-1.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and protection/restoration actions associated with Alternative 4A environmental commitments described in Section 4.1.2.3, *Environmental Commitments*, of this RDEIR/SDEIS. Loss of valley/foothill riparian natural community would be considered a loss in acreage of a sensitive natural community, and could be considered a loss of wetlands as defined in Section 404 of the CWA. As indicated above, most of the losses would be in small patches or narrow strips along waterways, with limited structural complexity. However, the restoration of 251 acres and protection (including significant enhancement) of 103 acres of valley/foothill riparian natural community as part of Environmental Commitment 7 and Environmental Commitment 3 during the Alternative 4A construction period would minimize this loss, avoiding any adverse effect. The restoration areas would be large areas providing connectivity with existing riparian habitats and would include a variety of trees and shrubs to produce structural complexity. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 78 acres of protection and 78 acres of restoration would be needed to offset (i.e., mitigate) the 78 acres of loss (the combination of permanent and temporary losses listed in Table 12-4A-3). The combination of the two approaches (protection and restoration) are designed to avoid a temporal lag in the value of riparian habitat available to sensitive species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM10 Restoration of Temporarily Affected Natural Communities, and AMM18 Swainson's Hawk and White-Tailed Kite*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6, and AMM18 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Implementation of Alternative 4A would result in the loss of approximately 0.5% of valley/foothill riparian natural community in the study area. These losses (47 acres of permanent and 31 acres of temporary) would be largely associated with construction of the water conveyance facilities and inundation during tidal marsh restoration (Environmental Commitment 4). Inundation losses would occur through the course of the project's tidal marsh restoration program at various tidal restoration sites throughout the study area. By the end of the project's construction period, a total of 251 acres of this natural community would be restored and 103 acres would be protected (Environmental Commitment 7 and Environmental Commitment 3, respectively), primarily in CZ 4 and CZ 7 in the Cosumnes/Mokelumne and South Delta ROAs (see Figure 12-1 in the Draft EIR/EIS).

NEPA Effects: The restoration of 251 acres and protection (including significant enhancement) of 103 acres of valley/foothill riparian natural community as part of Environmental Commitment 7 and Environmental Commitment 3 together with Resource restoration and performance principles VFR1-VFR3 during the construction period for Alternative 4A would minimize the loss of this community, avoiding any adverse effect. Because of the project's commitment to restoration of 251 acres and protection of 103 acres of valley/foothill riparian natural community during the course of the project, Alternative 4A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 78acres of valley/foothill riparian natural community due to construction of the water conveyance facilities and inundation during tidal marsh restoration (Environmental Commitment 4). The construction losses would occur primarily along the Sacramento River at intake sites; along transmission corridors in the central and south Delta and along Lambert Road; and at reusable tunnel material storage sites on Bouldin Island, Clifton Court Forebay and near Twin Cities Road, while inundation losses would occur at various tidal restoration sites throughout the study area. The construction losses would be spread across the 14-year construction time frame of the project. These losses would be minimized by planned restoration of 251 acres (Environmental Commitment 7) and protection (including significant enhancement) of 103 acres (Environmental Commitment 3) of valley/foothill riparian natural community scheduled for the construction period of Alternative 4A, which would be guided by Resource Restoration and Performance Principles VFR1-VFR3. AMM1, AMM2, AMM6, AMM7, AMM10, and AMM18 would also be implemented to minimize impacts. Because of these restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for protection and 1:1 for restoration) would indicate that 78 acres of protection and 78 acres of restoration would be needed to offset (i.e., mitigate) the 78 acres of loss. The combination of the two approaches (protection and restoration) is designed to avoid a temporal lag in the value of riparian habitat available to sensitive species. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Therefore, the impact would be less than significant.

Impact BIO-10: Increased Frequency, Magnitude and Duration of Periodic Inundation of Valley/Foothill Riparian Natural Community

Alternative 4A would not result in periodic effects on the valley/foothill riparian natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-11: Modification of Valley/Foothill Riparian Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect valley/foothill riparian natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect valley/foothill riparian natural community. The anticipated water levels over time with Alternative 4A, as compared to no action, would be slightly lower in the October to May timeframe. The small changes in frequency of higher water levels in these lakes would not substantially reduce the small patches of riparian vegetation that occupy the upper fringes of the reservoir pools. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area and their resultant changes in flows in the Sacramento, American and Feather Rivers (associated with Operational Scenario H) would not be expected to result in the permanent reduction in acreage of valley/foothill riparian natural community along these waterways. There is no evidence that flow levels in the upstream rivers would change such that the acreage of this community would be reduced on a permanent basis. Riparian habitats along the rivers of the Sacramento Valley have historically been exposed to significant variations in river stage. Based on modeling conducted for the BDCP (see Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis,* of the Draft EIR/EIS), flow levels in these upstream rivers could be reduced by as much as 19% in the July to November time frame when compared to No Action, while flow levels in the February to May time frame could increase as much as 48% with implementation of Alternative 4A. Similarly, increased diversions of Sacramento River flows in the north Delta would not be expected to result in a permanent reduction in valley/foothill riparian community downstream of these diversions, even though river flows are modeled to be reduced by 11–27% compared with No Action, depending on month and water-year type (see Appendix 11C, Section 11C.4, *Alternative 4*, in the Draft EIR/EIS). Reduced diversions from the south Delta channels would not create a reduction in this natural community.

- The periodic changes in flows in the Sacramento River, Feather River, and American River associated with modified reservoir operations, and the increased diversion of Sacramento River flows at north Delta intakes associated with Alternative 4A would affect salinity, water temperature, dissolved oxygen levels, turbidity, contaminant levels and dilution capacity in these rivers and Delta waterways. These changes are discussed in detail in Section 4.2.7, *Water Quality*, of the RDEIR/SDEIS. Potentially substantial increases in electrical conductivity (salinity) are predicted for the west Delta and Suisun Marsh as a result of these changed water operations. These salinity changes may alter the plant composition of riparian habitats along the lower Sacramento and San Joaquin Rivers and west Delta islands. The severity and extent of these salinity changes would be complicated by anticipated sea level rise and the effects of downstream tidal restoration over the life of the project. There is the potential that some valley/foothill riparian natural community may be degraded immediately adjacent to river channels. The riparian communities in the west Delta are dominated by willows, cottonwood and mixed brambles. These potential changes are not expected to result in a significant reduction in the acreage and value of valley/foothill riparian natural community in the study area.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in valley/foothill riparian habitats. This activity could lead to increased soil erosion, turbidity and runoff entering these habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within riparian habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to valley/foothill riparian natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to riparian areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to valley/foothill riparian natural community. This activity should not adversely affect riparian plants as long as dredging equipment is kept out of riparian areas and dredge spoil is disposed of outside of riparian corridors.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the valley/foothill riparian natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* Alternative 4A would allow for certain types of recreation in and adjacent to valley/foothill riparian natural community. The activities could include wildlife and plant viewing and hiking. *Conservation Measure 11 Natural Communities Enhancement and Management* (on which Environmental Commitment 11 is based) describes this program and identifies applicable restrictions on recreation that might adversely affect riparian habitat (see Section 3.4.11, *Conservation Measure 11 Natural Communities Enhancement and Management*, of the Draft BDCP and Section 4.1.2.3, *Environmental Commitments*, of this RDEIR/SDEIS). The project also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Priority would be given to use of existing trails and roads, with some potential for new trails. Limited tree removal and limb trimming could also be involved.

The various operations and maintenance activities described above could alter acreage of valley/foothill riparian natural community in the study area through changes in flow patterns and resultant changes in water quality. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Recreation activities could encroach on riparian areas and require occasional tree removal. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration and protection activities planned as part of *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM18, and AMM37. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with riparian habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

NEPA Effects**:** Ongoing operation, maintenance and management activities associated with implementation of Alternative 4A would not result in a net permanent reduction in the valley/foothill riparian natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion**:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of valley/foothill riparian natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, and AMM18 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural*

Communities Enhancement and Management, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Restoration and protection activities associated with *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the valley/foothill riparian natural community.

Nontidal Perennial Aquatic

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the nontidal perennial aquatic natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-4). Channel margin habitat enhancement associated with Environmental Commitment 6 could also remove small areas of this natural community.

As explained below, with the restoration and enhancement of nontidal wetland habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-4. Changes in Nontidal Perennial Aquatic Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	59	9
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	59	9

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-12: Changes in Nontidal Perennial Aquatic Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities would permanently eliminate an estimated 59 acres and temporarily remove 9 acres of nontidal perennial aquatic natural community in the study area. These modifications represent approximately 1.2% of the 5,567 acres of the community that is mapped in the study area. Natural communities restoration would add 832 acres (Environmental Commitment 10) and protect 119 acres (Environmental Commitment 3) of nontidal marsh during the same period which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. The nontidal marsh would be restored in the vicinity of giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998).

The individual effects of each relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 59 acres and temporarily remove 9 acres of nontidal perennial aquatic community. Most of the permanent loss would occur at the linear manmade ponds located north and south of Twin Cities Road just west of I-5 and an RTM storage site on Bouldin Island (see Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). Most of the temporary loss would occur where transmission line construction would cross Mandeville Island. These wetlands are linear ponds or small, isolated areas surrounded by agricultural land. These losses would take place during the Alternative 4A construction period.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal perennial aquatic habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would be undertaken within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Environmental Commitment 10 would entail restoration of 832 acres of nontidal marsh in CZs 2, 4, and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. This marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the Alternative 4A construction period, activities would affect the nontidal perennial aquatic community through water conveyance facilities construction losses (59 acres permanent and 9 acres temporary). Additional small losses could also occur during this time frame as channel margin habitat enhancement is implemented.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with Alternative 4A. Loss of nontidal perennial aquatic natural community would be considered both a loss in acreage of a sensitive natural community and a loss of waters of the United States as defined by Section 404 of the CWA. However, creating 832 acres of nontidal marsh as part of Environmental Commitment 10 during the Alternative 4A construction period would offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 68 acres of restoration and 68 acres of protection would be needed to offset (i.e., mitigate) the 68 acres of loss. The project also includes protection of 119 acres of nontidal marsh habitat (Environmental Commitment 3). The protection acreage exceeds the typical 1:1 protection requirement and fully compensates for the construction losses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils,* *Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Implementation of Alternative 4A would result in relatively minor (6%) losses of nontidal perennial aquatic community in the study area. These losses (59 acres of permanent and 9 acres of temporary loss) would be largely associated with construction of the water conveyance facilities. By the end of project construction, a total of 832 acres of nontidal marsh would be restored. The restoration would occur over a wide region of the study area, including within the Cosumnes/Mokelumne, Yolo Bypass, South Delta and East Delta ROAs (see Figure 12-1 in the Draft EIR/EIS).

***NEPA Effects*:** During the Alternative 4A construction period, creating 832 acres of nontidal marsh as part of Environmental Commitment 10 would offset the construction-related losses of 68 acres of nontidal perennial aquatic natural community. The effect would not be adverse.

***CEQA Conclusion*:** Alternative 4A would result in the loss of approximately 68 acres of nontidal perennial aquatic natural community due to construction of the water conveyance facilities. The construction losses would occur primarily at reusable tunnel material storage sites near Twin Cities Road and on Bouldin Island, and along the transmission corridor where it crosses Mandeville Island. The losses would be spread across the Alternative 4A construction period (14 years). These losses would be offset by planned restoration of 832 acres and protection of 119 acres of nontidal marsh during the same time period (Environmental Commitment 10 and Environmental Commitment 3). Also, AMM1, AMM2, AMM6, AMM7, and AMM10 would be implemented to minimize impacts. Because of these offsetting restoration activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 68 acres of restoration and 68 acres of protection would be needed to offset (i.e., mitigate) the 68 acres of loss. The project includes tidal marsh restoration (832 acres) and protection (119 acres) which is well in excess of the typical 1:1 restoration and protection acreages, and therefore compensates for all project-related losses. The restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Therefore, the impact would be less than significant. No mitigation is required.

Impact BIO-13: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Perennial Aquatic Natural Community

Alternative 4A would not result in periodic effects on the nontidal perennial aquatic natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-14: Modification of Nontidal Perennial Aquatic Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect nontidal perennial aquatic natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions would be associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would affect nontidal perennial aquatic natural community, in the form of the reservoir pools. The Alternative 4A operations scheme would alter the surface elevations of these reservoir pools as described in Section 4.3.2, *Surface Water*, of the RDEIR/SDEIS. These fluctuations would occur within historic ranges and would not adversely affect the natural community. Changes in releases that would influence downstream river flows are discussed below.
- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversion from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal perennial aquatic natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of nontidal perennial aquatic community would be reduced on a permanent basis. Some minor increases and some decreases would be expected to occur along the major rivers during some seasons and in some water-year types, but there would be no permanent loss. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal perennial aquatic community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal perennial aquatic habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal perennial aquatic habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management)*. Vegetation management is also the principal activity associated with *Environmental Commitment 13 Invasive Aquatic Vegetation Control.* Use of herbicides to

control nuisance vegetation could pose a long-term hazard to nontidal perennial aquatic natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial aquatic areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For nontidal perennial aquatic natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal perennial aquatic natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal perennial aquatic habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities would not result in a net permanent reduction in the nontidal perennial aquatic natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of nontidal perennial aquatic natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal perennial aquatic natural community.

Nontidal Freshwater Perennial Emergent Wetland

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the nontidal freshwater perennial emergent wetland natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-5). Small losses of this community could also occur with planned channel margin enhancement activities (Environmental Commitment 6).

As explained below, with the restoration and enhancement of nontidal marsh habitat, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-5. Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	2	6
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	2	6

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-15: Changes in Nontidal Freshwater Perennial Emergent Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities would permanently eliminate an estimated 2 acres and temporarily remove 6 acres of nontidal freshwater perennial emergent wetland natural community in the study area. These modifications represent approximately 0.5% of the 1,509 acres of the community that is mapped in the study area. Nontidal marsh restoration (Environmental Commitment 10) would add 832 acres of nontidal marsh and natural communities protection (Environmental Commitment 3) would protect 119 acres of nontidal marsh. These actions would be taken over the course of Alternative 4A marsh restoration activities, which would expand the area of that habitat and offset the losses. The nontidal marsh restoration would include a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland natural communities. The nontidal marsh protection would be designed to support tricolored blackbird and western pond turtle populations in the study area. The restoration would occur in blocks that are contiguous with or near giant garter snake subpopulations identified in the recovery plan for this species (U.S. Fish and Wildlife Service 1998), and in areas suitable for greater sandhill crane permanent roosting and foraging.

The individual effects of each relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would permanently remove 2 acres and temporarily remove 6 acres of tidal freshwater perennial emergent wetland community. The permanent losses would occur at the Clifton Court Forebay construction site and the RTM site on Bouldin Island (see Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). The temporary loss would occur in a temporary work area and where temporary powerlines would be constructed across Mandeville Island. These wetlands are extremely small and remote water bodies, surrounded by agricultural operations. These losses would take place during the project's construction period.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of nontidal freshwater perennial emergent wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Nontidal marsh adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Environmental Commitment 10 would entail restoration of 832 acres of nontidal marsh in CZs 2, 4, and/or 5. The restoration would create a mosaic of nontidal perennial aquatic and nontidal freshwater perennial emergent natural communities. Some of this marsh restoration would occur in 25-acre or larger patches in or near giant garter snake occupied habitat and would be accompanied by adjacent grassland restoration or protection.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project's construction time frame, Alternative 4A would affect the nontidal freshwater perennial emergent wetland community through water conveyance facilities construction losses (2 acres permanent and 6 acres temporary). Small additional losses could result where channel margin habitat enhancement occurs along major Delta waterways (Environmental Commitment 6).

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with the project. Loss of nontidal freshwater perennial emergent wetland natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the combination of creating 832 acres and protecting 119 acres of nontidal perennial marsh as part of Environmental Commitment 3 and Environmental Commitment 10 during the construction of Alternative 4A would offset this loss, avoiding any adverse effect. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate 8 acres of restoration and 8 acres of protection would be needed to offset (i.e., mitigate) the 8 acres of loss. The project includes well in excess of the typical 1:1 restoration and protection acreages for this natural community.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Implementation of Alternative 4A would result in small (0.5%) losses of nontidal freshwater perennial emergent wetland community in the study area. These losses (2 acres of permanent and 6 acres of temporary loss) would be associated with construction of the water conveyance facilities. By the end of water conveyance facilities construction, a total of 832 acres of nontidal marsh would be restored and 119 acres would be protected. The restoration would occur near giant garter snake occupied habitat and greater sandhill crane roosting and foraging areas in the eastern Delta. Approximately half of the 119 acres of protection would occur in CZ 1, 2, 8, or 11 to provide nesting habitat for tri-colored blackbird (see Figure 12-1 in the Draft EIR/EIS).

NEPA Effects: The combination of creating 832 acres and protecting 119 acres of nontidal perennial marsh as part of Environmental Commitment 3 and Environmental Commitment 10 would offset the losses associated with construction of water conveyance facilities, avoiding any adverse effect. With 832 acres of nontidal marsh restoration and 119 acres of protection, Alternative 4A would not result in a net long-term reduction in the acreage of a sensitive natural community; the effect would not be adverse.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 8 acres of nontidal freshwater perennial emergent wetland natural community due to construction of the water conveyance facilities. The construction losses would occur near Clifton Court Forebay and along transmission line construction areas on Mandeville Island. The losses would occur during the project construction timeframe. These losses would be offset by planned restoration of 832 acres and protection of 119 acres of nontidal marsh (Environmental Commitment 10 and Environmental Commitment 3). AMM1, AMM2, AMM6, AMM7, and AMM10 would also be implemented to minimize impacts. Typical project-level mitigation ratios (1:1 for restoration and 1:1 for protection) would indicate that 8 acres of restoration and 8 acres of protection would be needed to offset (i.e., mitigate) the 8 acres of loss. The project includes well in excess of the typical 1:1 restoration and protection acreages and therefore compensates for the construction-related losses. The restoration and protection would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species, and would result in a net gain in acreage of this sensitive natural community. Because of these offsetting restoration and protection activities and AMMs, impacts would be less than significant.

Impact BIO-16: Increased Frequency, Magnitude and Duration of Periodic Inundation of Nontidal Freshwater Perennial Emergent Wetland Natural Community

Alternative 4A would not result in periodic effects on the nontidal freshwater perennial emergent wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-17: Modification of Nontidal Freshwater Perennial Emergent Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect nontidal freshwater perennial emergent wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified releases and water levels in upstream reservoirs.* Modified releases and water levels at Shasta Lake, Lake Oroville, Whiskeytown Lake, Lewiston Lake, and Folsom Lake would not affect the nontidal freshwater perennial emergent wetland natural community. These reservoirs do not support significant stands of freshwater emergent wetlands. Changes in releases that would influence downstream river flows are discussed below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of the nontidal freshwater perennial emergent wetland natural community in the study area. The majority of this wetland type exists outside of the levees of the larger rivers and would not be affected by flow changes in river or Delta channels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in nontidal freshwater perennial emergent wetland community downstream of these diversions. Nontidal wetlands below the diversions are not directly connected to the rivers, as this reach of the river is tidally influenced. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the project's actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in nontidal freshwater perennial emergent wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering nontidal freshwater perennial habitats. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within aquatic habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management).* Use of herbicides to control nuisance vegetation could pose a long-term hazard to nontidal freshwater perennial emergent wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to nontidal perennial wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For nontidal freshwater perennial emergent wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of nontidal freshwater perennial emergent wetland natural community in the study area through changes in flow patterns and facilities maintenance activities. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration*. The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with nontidal freshwater perennial emergent wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the nontidal freshwater perennial emergent wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of nontidal freshwater perennial emergent wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, and AMM5 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would expand this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the nontidal freshwater perennial emergent wetland natural community.

Alkali Seasonal Wetland Complex

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the alkali seasonal wetland complex natural community. Initial development and construction of water conveyance facilities would result in a small permanent removal of this community (see Table 12-4A-6). Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the alkali seasonal wetland natural community.

- Restore vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acreage (Resource Restoration and Performance Principle VP/AW2).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the protection, restoration, and enhancement of the amounts of habitat proposed for Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-6. Changes in Alkali Seasonal Wetland Complex Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	2	0
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	2	0

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-18: Changes in Alkali Seasonal Wetland Complex Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities under Alternative 4A would permanently eliminate an estimated 2 acres of alkali seasonal wetland complex natural community in the study area. There would be no temporary impacts to alkali seasonal wetlands. These modifications represent approximately 0.05% of the 3,723 acres of the community that is mapped in the study area. The combined vernal pool/alkali seasonal wetland complex protection (150 acres) and restoration (34 acres) would be initiated during project construction; these actions would offset the losses.

The effects associated with construction of water conveyance facilities are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the individual environmental commitment discussion.

- *Water Facilities and Operation*: Construction of the Alternative 4A transmission lines immediately west of Clifton Court Forebay would permanently affect 2 acres of alkali seasonal wetland complex natural community (see the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). The alkali seasonal wetland complex at this location is scattered and significantly degraded by past agricultural and water development-related activities. It is surrounded by or adjacent to vernal pool complex natural community.

  The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in alkali seasonal wetland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive alkali seasonal wetland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, in the Draft BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the alkali seasonal wetland complex in the construction area because the construction would occur primarily downwind of the natural community and the construction would contribute a negligible amount of nitrogen to regional projected emissions. No adverse effect is expected.

- *Environmental Commitment 3 Natural Communities Protection and Restoration:* Environmental Commitment 3 proposes to protect at least 150 acres of vernal pool/alkali seasonal wetland complex in the study area. The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of alkali seasonal wetland plants relative to nonnative species.

- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Environmental Commitment 9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The intent of the environmental commitment is to match the acreage of restoration with the actual acreage lost to other project measures (primarily water conveyance facilities). The current estimate for vernal pool/alkali seasonal wetland complex restoration is 34 acres. The goal is for no net loss of this natural community, consistent with the project's Resource Restoration and Performance Principles.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During project construction, Alternative 4A would affect the alkali seasonal wetland complex natural community through water conveyance facilities construction losses (2 acres permanent). These losses would occur on land immediately west of Clifton Court Forebay.

The construction losses of this special-status natural community would represent an adverse effect if they were not offset by avoidance and minimization measures and restoration actions associated with the project's environmental commitments. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 150 acres of combined vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3, the restoration of 34 acres of these communities as part of Environmental Commitment 9, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* would offset this loss, avoiding any adverse effect. AMM30 would require that transmission line construction avoid any losses of alkali seasonal wetland complex natural community (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for a full description of AMM30). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 4 acres of protection and 2 acres of restoration would be needed to offset (i.e., mitigate) the 2 acres of loss.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Implementation of Alternative 4A would result in very minor (0.05%) losses of alkali seasonal wetland natural community in the study area. These losses (2 acres) would be associated with construction of the project's water conveyance facility.

NEPA Effects: During the 14-year construction period for Alternative 4A, 150 acres of vernal pool/alkali seasonal wetland complex would be protected as part of Environmental Commitment 3 and 34 acres of these communities would be restored as part of Environmental Commitment 9, which would be guided by Resource Restoration and Performance Principles VP/AW2-VP/AW4. These environmental commitments would offset the loss of this community associated with water conveyance facilities, avoiding any adverse effect. The protection and restoration would occur primarily in the Clifton Court Forebay area. Therefore, Alternative 4A would not have an adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion: Alternative 4A would result in the permanent loss of approximately 2 acres of alkali seasonal wetland complex natural community due to water conveyance facility construction. The construction losses would occur primarily in the area adjacent to Clifton Court Forebay. The losses would occur during project construction.

The construction losses of this special-status natural community would represent a significant impact if they were not offset by avoidance and minimization measures and other actions associated with the project's environmental commitments. Loss of alkali seasonal wetland complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. However, the protection of 150 acres of combined vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3, the restoration of 34 acres of these communities as part of Environmental Commitment 9, Resource Restoration and Performance Principles VP/AW2-VP/AW4, and the implementation of *AMM30 Transmission Line Design and Alignment Guidelines* during construction of Alternative 4A would offset this loss, avoiding any significant impact. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 4 acres of protection and 2 acres or restoration would be needed to offset (i.e., mitigate) the 2 acres of loss. AMM1, AMM2, AMM3, AMM4, and AMM10 would also be implemented to minimize impacts. Because of the offsetting protection and restoration activities and AMMs, impacts would be less than significant.

Impact BIO-19: Increased Frequency, Magnitude and Duration of Periodic Inundation of Alkali Seasonal Wetland Natural Community

Alternative 4A would not result in periodic effects on the alkali seasonal wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-20: Modification of Alkali Seasonal Wetland Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A were constructed and the stream flow regime associated with changed water management was in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect alkali seasonal wetland complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation in and adjacent to Plan reserves. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect alkali seasonal wetland natural community. This natural community does not exist within or adjacent to the active Sacramento River system channels and Delta waterways that would be affected by modified flow levels.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in or adjacent to alkali seasonal wetland complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within alkali seasonal wetland complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to alkali seasonal wetland complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to alkali seasonal wetland complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the alkali seasonal wetland complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* The project would allow for certain types of recreation in and adjacent to alkali seasonal wetland natural community in the reserve system. The activities could include wildlife and plant viewing and hiking. *Conservation Measure 11 Natural Communities Enhancement and Management* (on which Environmental Commitment 11 is based) describes this program and identifies applicable restrictions on recreation that might adversely affect alkali seasonal wetland habitat (see Section 3.4.11, *Conservation Measure 11 Natural Communities Enhancement and Management*, of the Draft BDCP). The project also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Most recreation would be docent-led wildlife and botanical tours, using existing trails and roads in the vicinity of the reserves. No new trails would be constructed.

The various operations and maintenance activities described above could alter acreage of alkali seasonal wetland complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and restoration activities planned as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, and AMM37. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with alkali seasonal wetland complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the alkali seasonal wetland complex natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of alkali seasonal wetland complex natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the alkali seasonal wetland complex natural community.

Vernal Pool Complex

Construction, operation, maintenance and management associated with the environmental commitments of Alternative 4A would have no long-term adverse effects on the habitats associated with the vernal pool complex natural community. Initial development and construction of water conveyance facilities would result in permanent removal of 28 acres of this community (see Table 12-4A-7). Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the vernal pool complex natural community.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Restore vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acreage (Resource Restoration and Performance Principle VP/AW2).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the protection, restoration and enhancement of the amounts of habitat proposed for Alternative 4A, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-7. Changes in Vernal Pool Complex Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	28	3
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	28	3

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-21: Changes in Vernal Pool Complex Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities could permanently eliminate an estimated 28 acres and temporarily remove 3 acres of vernal pool complex natural community in the study area. These acreages are based on the proposed location of the water conveyance facilities construction footprint. The loss of this combined 31 acres would represent approximately 0.3% of the 12,133 acres of the community that is mapped in the study area. Vernal pool/alkali seasonal wetland complex protection (150 acres) and restoration (34 acres) would be initiated during the Alternative 4A construction period to counteract the loss of habitat. Because of the high sensitivity of this natural community and its shrinking presence in the study area, avoidance and minimization measures have been built into the project to eliminate the majority of this potential loss.

The individual effects of water conveyance facilities are addressed below. A summary statement of the impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation:* Construction of the Alternative 4A water conveyance facilities would directly affect 31 acres of vernal pool complex natural community, including 28 acres permanently affected and 3 acres temporarily affected. The permanent loss would occur along the southern edge of Clifton Court Forebay, where the forebay would be expanded to provide greater storage capacity and from the construction of permanent transmission lines. The temporary losses would occur in a temporary work area immediately adjacent to Clifton Court Forebay (see Figure 12-1 in the Draft EIR/EIS and the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS).

- Because of the close proximity of construction activity to adjacent vernal pool complex near Clifton Court Forebay, there is also the potential for indirect loss or damage to vernal pools from changes in pool hydrology or deposition of construction-related sediment. These potential indirect effects are discussed in detail in the vernal pool crustaceans impact analysis in Section 4.3.8.2, *Wildlife Species*, of this RDEIR/SDEIS.

- The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in vernal pool complex habitats in the vicinity of Clifton Court Forebay and Stone Lakes National Wildlife Refuge. A significant number of cars, trucks, and land grading equipment involved in construction would emit small amounts of atmospheric nitrogen from fuel combustion; this material could be deposited in sensitive vernal pool areas that are located west of the major construction areas at Clifton Court Forebay and east of the construction areas adjacent to Stone Lakes NWR. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the Draft BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the vernal pool complex in the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. At Stone Lakes National Wildlife Refuge, the USFWS refuge management undertakes active invasive species control, including use of grazing. No adverse effect is expected.

- *Environmental Commitment 3 Natural Communities Protection and Restoration:* Environmental Commitment 3 proposes to protect at least 150 acres of vernal pool complex, primarily in the Clifton Court Forebay area. The protection would occur in areas containing a mosaic of grassland and vernal pool complex in unfragmented natural landscapes supporting a diversity of native plant and wildlife species. These areas would be both protected and enhanced to increase the cover of vernal pool complex plants relative to nonnative species.

- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration:* Environmental Commitment 9 includes both vernal pool complex and alkali seasonal wetland complex restoration goals. The current estimate for vernal pool/alkali seasonal wetland complex restoration is 34 acres. This restoration environmental commitment includes a “no net loss” policy normally applied to this natural community.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project construction period (14 years), Alternative 4A could directly affect 28 acres of vernal pool complex natural community through construction-related losses in habitat from water conveyance facilities. This loss would occur in the vicinity of Clifton Court Forebay (see the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS).

The construction loss of this special-status natural community would represent an adverse effect if it were not offset by avoidance and minimization measures and restoration actions associated with the project's environmental commitments. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 150 acres of vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3 and the restoration of up to 34 acres of these communities (including a commitment to have restoration keep pace with losses) as part of Environmental Commitment 9 during construction of Alternative 4A facilities would offset this loss. The project focuses this protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). The core areas exist in CZ 1, CZ 8, and CZ 11 (see Figure 12-1 in the Draft EIR/EIS). Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 62 acres of protection and 31 acres of restoration would be needed to offset (i.e., mitigate) the 31 acres of loss.

To further avoid adverse effect, the project includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans,* and *AMM30 Transmission Line Design and Alignment Guidelines.* All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and an updated version of AMM2 is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. With these AMMs in place, Alternative 4A would not adversely affect vernal pool complex natural community.

***NEPA Effects*:** The environmental commitments associated with Alternative 4A include protection of 150 acres (Environmental Commitment 3) and restoration of an estimated 34 acres (Environmental Commitment 9) of vernal pool/alkali seasonal wetland complex in the near-term time frame, which would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4. The project focuses the protection in the core vernal pool areas identified in the USFWS vernal pool recovery plan (U.S. Fish and Wildlife Service 2005). A core area exists in CZ 1 (see Figure 12-1 in the Draft EIR/EIS). With these environmental commitments and other AMMs in place, Alternative 4A would not adversely affect vernal pool complex natural community. With these environmental commitments and AMMs in effect through the entire project period, Alternative 4A would not have an adverse effect on the vernal pool complex natural community.

***CEQA Conclusion*:** During the 14-year construction period, Alternative 4A could result in the direct loss of approximately 31 acres of vernal pool complex natural community due to construction of the water conveyance facility. The losses would occur immediately adjacent to Clifton Court Forebay.

The construction-related loss of this special-status natural community would represent a significant impact if it were not offset by avoidance and minimization measures and other actions associated with Alternative 4A environmental commitments. Loss of vernal pool complex natural community would be considered both a loss in acreage of a sensitive natural community and a loss of wetland as defined by Section 404 of the CWA. The protection of 150 acres of vernal pool/alkali seasonal wetland complex as part of Environmental Commitment 3 and the restoration of an estimated 34 acres of this community (including a commitment to have restoration keep pace with losses) as part of Environmental Commitment 9 during the construction of Alternative 4A facilities would offset this near-term loss, Resource Restoration and Performance Principles VP/AW1-VP/AW4. Typical project-level mitigation ratios (2:1 for protection and 1:1 for restoration) would indicate 62 acres of protection and 34 acres of restoration would be needed to offset (i.e., mitigate) the 31 acres of loss. Alternative 4A also includes AMM1, AMM2, AMM3, AMM4, AMM10, AMM12, and AMM30 to minimize impacts. Because of the offsetting protection and restoration activities and implementation of AMMs, impacts would be less than significant.

Impact BIO-22: Increased Frequency, Magnitude and Duration of Periodic Inundation of Vernal Pool Complex Natural Community

Alternative 4A would not result in periodic effects on the vernal pool complex natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-23: Modification of Vernal Pool Complex Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect vernal pool complex natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreation activities in project preserves. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect vernal pool complex natural community. This natural community does not exist within or adjacent to the major Sacramento River system and Delta waterways.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the Alternative 4A actions have the potential to require removal of adjacent vegetation and could entail earth and rock work adjacent to vernal pool complex habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to vernal pool complex habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as part of *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to vernal pool complex natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to vernal pool complex areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the vernal pool complex natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

- *Recreation.* Alternative 4A would allow for certain types of recreation in and adjacent to vernal pool complexes in the reserve system. The activities could include wildlife and plant viewing and hiking. *Conservation Measure 11 Natural Communities Enhancement and Management* (on which Environmental Commitment 11 is based) describes this program and identifies applicable restrictions on recreation that might adversely affect vernal pool habitat (see Section 3.4.11, *Conservation Measure 11 Natural Communities Enhancement and Management*, of the Draft BDCP). Alternative 4A also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect vernal pools. Recreational trails would be limited to existing trails and roads. New trail construction would be prohibited within the vernal pool complex reserves. It is expected that most activities would be docent-led tours of reserves, minimizing adverse effects.

The various operations and maintenance activities described above could alter acreage of vernal pool complex natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities*

Enhancement and Management, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be greatly offset by restoration activities planned as part of *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, AMM10, AMM12, AMM37, and AMM30. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with vernal pool complex habitats by eliminating competitive, invasive species of plants.

NEPA Effects: Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in the vernal pool complex natural community within the study area. Therefore, there would be no adverse effect on this natural community.

CEQA Conclusion: The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of vernal pool complex natural community in the study area, and could create temporary increases in sedimentation or damage from recreational activity. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, AMM10, AMM12, AMM37, and AMM30 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the acreage of this natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the vernal pool complex natural community.

Managed Wetland

The construction of water conveyance facilities for Alternative 4A would reduce the acreage of managed wetland currently found in the study area. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-8).

Creation of similar habitat values by restoring nontidal marsh as part of Environmental Commitment 10 would offset the losses of managed wetland. The net effect would be a decrease in the amount of managed wetland, but an increase in similar habitat value for special-status and common species as cultivated land is converted to nontidal marsh. Impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes. Refer to Impacts BIO-178 through BIO-183 in the *Shorebirds and Waterfowl* discussion in Section 4.3.8.4, *General Terrestrial Biology*, of this RDEIR/SDEIS for further consideration of the effects of removing managed wetland natural community.

Table 12-4A-8. Changes in Managed Wetland Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	22	29
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	22	29

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-24: Changes in Managed Wetland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities would permanently eliminate an estimated 22 acres and temporarily affect 29 acres of managed wetland in the study area. This modification represents approximately 0.07% of the 70,798 acres of managed wetland that is mapped in the study area. This loss would occur over the course of Alternative 4A construction (14 year period). Alternative 4A does not include protection or restoration actions directed specifically at managed wetland, but protection and restoration of nontidal wetland (119 acres and 832 acres, respectively) would replace the habitat values lost for special-status wildlife and plant species.

The individual effects of the relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 22 acres and temporarily remove 29 acres of managed wetland community. The permanent losses would occur near the northeast corner of Clifton Court Forebay for the construction of a permanent shaft location and a permanent access road on Bouldin Island. Temporary impacts would occur in association with temporary work areas for a concrete batch plant on Mandeville Island and a tunnel muck conveyor facility near Clifton Court Forebay (see the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). Smaller losses would occur from construction of the temporary transmission lines that parallel the tunnel alignment northwest of the intermediate forebay and across the length of Mandeville Island.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in filling of small amounts of managed wetland habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur on the edges of tidal perennial aquatic habitat, including levees and channel banks. Managed wetland adjacent to these tidal areas could be affected. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During construction of the water conveyance facility, Alternative 4A would permanently remove 22 acres and temporarily remove 29 acres of managed wetland. These losses would occur in various locations, but the majority would occur in the vicinity of Clifton Court Forebay.

The construction loss of this special-status natural community would represent an adverse effect if it were not offset by the environmental commitments described in Section 4.1.2.3 *Environmental Commitments* of this RDEIR/SDEIS. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. Many managed wetland areas are interspersed with small natural wetlands that would be regulated under Section 404. The restoration of 832 acres of nontidal wetland (Environmental Commitment 10) and protection and enhancement of 119 acres (Environmental Commitment 3) of nontidal wetland during the Alternative 4A construction period would offset the loss of the habitat values associated with managed wetland associated with water conveyance facilities managed wetland loss. Typical project-level mitigation ratios (1:1 for protection) would indicate 51 acres of protection would be needed to offset the 51 acres of loss associated with water conveyance facilities. The protection and restoration of nontidal marsh associated with Alternative 4A would fully compensate for the loss in habitat value associated with the managed wetland loss.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and an updated versions of AMM2 is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

In spite of the managed wetland protection, restoration and avoidance measures contained in Alternative 4A, there would be a net reduction in the acreage of this special-status natural community. This would be an adverse effect when judged by the significance criteria used for analysis of terrestrial biological resources (see Section 12.3.1.2, *Significance Criteria for Terrestrial Biological Resources*, of the Draft EIR/EIS). However, the creation of nontidal marsh habitats (832 acres) that support similar ecological functions would offset this adverse effect. Also, there are other environmental commitments contained in the project (Environmental Commitment 3 and Environmental Commitment 11) that would improve management and enhance existing habitat values, further offsetting the effects of managed wetland loss on special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be no adverse effect.

NEPA Effects: Alternative 4A would result in a loss of 51 acres of managed wetland within the study area; however, it would also protect and enhance 119 acres and restore 832 acres of habitat (nontidal wetland) with similar wildlife values. Therefore, there would be no adverse effect on managed wetland natural community.

CEQA Conclusion: During the project's construction time frame (14 years), Alternative 4A would permanently remove 22 acres and temporarily remove 29 acres of managed wetland through construction-related losses in habitat from water conveyance facilities activities. The majority of the loss would be in the vicinity of Clifton Court Forebay.

The construction loss of this special-status natural community would represent a significant impact if it were not offset by other the environmental commitments described in Section 4.1.2.3, *Environmental Commitments,* of this RDEIR/SDEIS. Loss of managed wetland natural community would be considered both a loss in acreage of a sensitive natural community and potentially a loss of wetland as defined by Section 404 of the CWA. The restoration of 832 acres and protection and enhancement of 119 acres of nontidal marsh as part of Environmental Commitment 3 and Environmental Commitment 10 during construction of Alternative 4A would fully offset the losses in habitat value associated with water conveyance facilities. Typical project-level mitigation ratios (1:1 for protection) would indicate 51 acres of protection would be needed to offset the 51 acres of loss associated with water conveyance facilities. The combined protection and restoration proposed for nontidal marsh would offset the loss of wildlife habitat value. This acreage would significantly exceed the number of acres of managed wetland lost.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and an updated version of AMM2 is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

In spite of the nontidal marsh protection and restoration contained in Alternative 4A, there would be a net reduction in the acreage of managed wetland special-status natural community. This would be a significant impact when judged by the significance criteria listed in Section 12.3.1.2, *Significance Criteria for Terrestrial Biological Resources*, of the Draft EIR/EIS. However, there are other environmental commitments contained in the project (Environmental Commitment 3, Environmental Commitment 10 and Environmental Commitment 11) that would improve management and enhance existing habitat values and expand habitat with similar values, further offsetting the impacts of managed wetland loss on special-status terrestrial species and on common species that rely on this natural community for some life phase. As a result, there would be a less-than-significant impact.

Impact BIO-25: Increased Frequency, Magnitude and Duration of Periodic Inundation of Managed Wetland Natural Community

Alternative 4A would not result in periodic effects on the managed wetland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-26: Modification of Managed Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect managed wetland natural community in the study area. The ongoing actions include changes in operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, reduced diversions from south Delta channels, and recreational use of reserve areas. These actions are associated with water conveyance facilities and Environmental Commitment 11. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the reduction in acreage of the managed wetland natural community in the study area. Flow levels in the upstream rivers would not change to the degree that water levels in adjacent managed wetlands would be altered. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in the managed wetland community downstream of these diversions. The majority of the managed wetlands below the diversions is not directly connected to the rivers. Reduced diversions from the south Delta channels would not create a reduction in this natural community.
- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with Alternative 4 actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in managed wetland habitats. This activity could lead to increased soil erosion, turbidity and runoff entering managed wetlands. These activities would be subject to normal erosion, turbidity and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within managed wetland habitats would require use of sediment and turbidity barriers, soil stabilization and revegetation of disturbed surfaces. Proper implementation of these measures would avoid permanent adverse effects on this community.
- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to managed wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the community, or direct discharge of herbicides to managed wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in aquatic and terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the managed wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.
- *Recreation.* The project would allow hunting, fishing and hiking in managed wetland reserve areas. *Conservation Measure 11 Natural Communities Enhancement and Management* (on which Environmental Commitment 11 is based) describes this program and identifies applicable restrictions on recreation that might adversely affect managed wetland habitat (see Section 3.4.11, *Conservation Measure 11 Natural Communities Enhancement and Management*, of the Draft BDCP). The project also includes an avoidance and minimization measure (AMM37) that further dictates limits on recreation activities that might affect this natural community. Hunting would be the dominant activity in fall and winter months, while fishing and hiking would be allowed in non-hunting months.

The various operations and maintenance activities described above could alter acreage of managed wetland natural community in the study area through facilities maintenance, vegetation management, and recreation. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by restoration activities planned as part of *Environmental Commitment 10 Nontidal Marsh Restoration* and protection and restoration actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration*. Recreation activity effects would be minimized by AMM37 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The management actions associated with levee repair and control of invasive plant species would also result in a long-term benefit to the species associated with managed wetland habitats by improving water movement.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in acreage of managed wetland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of managed wetland natural community in the study area, and could create temporary increases in turbidity and sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Hunting could intermittently reduce the availability of this community to special-status and common wildlife species. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM37 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural*

Communities Enhancement and Management, would create positive effects, including improved water movement in and adjacent to these habitats. Long-term restoration activities associated with *Environmental Commitment 10 Nontidal Marsh Restoration* and protection and restoration actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would greatly expand the ecological functions of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this sensitive natural community within the study area. Therefore, there would be a less-than-significant impact on the managed wetland natural community.

Other Natural Seasonal Wetland

The other natural seasonal wetlands natural community encompasses all the remaining natural (not managed) seasonal wetland communities other than vernal pools and alkali seasonal wetlands. These areas mapped by CDFW (Hickson and Keeler-Wolf 2007) and ICF biologists (the western area of additional analysis; see Figure 12-1 in the Draft EIR/EIS) consist of seasonally ponded, flooded, or saturated soils dominated by grasses, sedges, or rushes. The largest segments of this community in the study area are located along the Cosumnes River northeast of Thornton, and in the western extension of the study area northwest of Rio Vista. Most of the smaller mapped areas are located in the Suisun Marsh ROA on the western edge of the Montezuma Hills and in the interior of the Potrero Hills. There are also other natural seasonal wetlands mapped along Old River and Middle River in CZ 7. The only project conservation activity that would potentially affect this natural community is the channel margin enhancement measure (Environmental Commitment 6) (see Table 12-4A-9).

Table 12-4A-9. Changes in Other Natural Seasonal Wetland Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	0	0
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	UNK	UNK
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	0	0

UNK = unknown
[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-27: Modification of Other Natural Seasonal Wetland Natural Community as a Result of Implementing Alternative 4A

Because specific locations for implementing Alternative 4A's *Environmental Commitment 6 Channel Margin Enhancement* have not been identified, it is not known whether the creation of channel margin habitats along study area streams would remove other natural seasonal wetland community habitats. Several small patches of other natural seasonal wetland natural community are mapped along study area waterways. Because the areas of this community are small, and because their habitat values are also provided by other seasonal wetlands in the study area, the small potential that other natural seasonal wetland would be removed by channel margin enhancement is not expected to create an adverse effect on the special-status species that use this habitat.

***NEPA Effects*:** Alternative 4A environmental commitments would not adversely affect other natural seasonal wetland natural community because of the small potential for this community to be displaced.

***CEQA Conclusion*:** This community would not be significantly impacted because of the small potential for channel margin enhancement to displace other natural seasonal wetland acreage. There would be no substantial impact on the community. The impact would be less than significant.

Impact BIO-28: Modification of Other Natural Seasonal Wetland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the project facilities and conservation lands that could affect other natural seasonal wetland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not affect other natural seasonal wetland natural community. The small areas mapped in the study area are not in or adjacent to streams that would experience changes in water levels as a result of these operations.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with the project actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in other natural seasonal wetland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within other natural seasonal wetland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces as required by *AMM10 Restoration of Temporarily Affected Natural Communities*. Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Communities Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to the other natural seasonal wetland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to wetland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of the project to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial or aquatic environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Habitat enhancement.* The project includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the other natural seasonal wetland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of other natural seasonal wetland natural community in the study area. Activities could introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the project, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be minor when compared to the restoration activities planned as part of *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The vernal pool/alkali seasonal wetland complex environmental commitment (Environmental Commitment 9) includes restoration of 34 acres of seasonal wetlands with similar ecological values as the other natural seasonal wetland community. The management actions associated with control of invasive plant species would also result in a long-term benefit to the species associated with other natural seasonal wetland habitats by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be no adverse effect on the other natural seasonal wetland natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of other natural seasonal wetland natural community in the study area, and could create temporary increases in sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and*

Management, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Long-term restoration activities associated with *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration* and protection actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would ensure that the ecological values provided by this small natural community would not decrease in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the other natural seasonal wetland natural community.

Grassland

Construction, operation, maintenance and management associated with Alternative 4A would have no long-term adverse effects on the habitats associated with the grassland natural community. Initial development and construction of water conveyance facilities would result in both permanent and temporary removal of this community (see Table 12-4A-10). Implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles over the term of the project to benefit the grassland natural community.

- Restore grasslands to connect fragmented patches of protected grassland and to provide upland habitat (Resource Restoration and Performance Principle G1).
- Restore and sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical sites (Resource Restoration and Performance Principle G3).
- Increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (Resource Restoration and Performance Principle G4).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).
- Protect grassland on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Resource Restoration and Performance Principle G8).
- Create or protect high-value upland giant garter snake habitat adjacent to the nontidal perennial aquatic habitat being restored and created (Resource Restoration and Performance Principle G9).
- Protect 647 acres of grassland in the Byron Hills area (Resource Restoration and Performance Principle G10).

As explained below, with the protection, restoration and enhancement of the amounts of habitat included in the project, in addition to implementation of AMMs, impacts on this natural community would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-10. Changes in Grassland Natural Community Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Water Conveyance Facilities	506	151
Environmental Commitment 4[a]	0	0
Environmental Commitment 7[a]	0	0
Environmental Commitment 10[a]	0	0
TOTAL IMPACTS	506	151

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-29: Changes in Grassland Natural Community as a Result of Implementing Alternative 4A

Construction and land grading activities that would accompany the implementation of water conveyance facilities would permanently eliminate an estimated 506 acres and temporarily remove 151 acres of grassland natural community in the study area. These modifications represent approximately 0.8% of the 78,047 acres of the community that is mapped in the study area.

The individual effects of each relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of the Alternative 4A water conveyance facilities would permanently remove 506 acres and temporarily remove 151 acres of grassland natural community. The permanent losses would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland; the rerouting of SR 160; construction of the intermediate forebay; a reusable tunnel material storage site on Bouldin Island; at a permanent pipeline shaft access road on the east side of Bacon Island; and at various permanent facility sites around Clifton Court Forebay, including a reusable tunnel material storage site, new canal connections from Clifton Court Forebay to the two aqueducts, and in the forebay expansion area on the south side of the existing forebay. Most of the permanent losses would be of ruderal and herbaceous grassland areas that exist in very narrow bands adjacent to waterways, levees and roads (see the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). Some of the grassland lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland. The temporary losses would be associated with construction of the temporary access roads along the Sacramento River; at work areas and barge offloading facility construction sites at the south end of Bouldin Island, at the north end of Bacon Island, and the south end of Venice Island and at the northwest corner of Victoria Island; at temporary access road sites on the northern and southern ends of Bacon Island and the northwest corner of Victoria Island; at temporary work areas on Mandeville and Bacon Islands; at the operable barrier construction site at the head of Old River, and various locations around Clifton Court Forebay. These losses would take place during the Alternative 4A construction period.
- The construction activity associated with water conveyance facilities also has the potential to lead to increased nitrogen deposition in grassland habitats in the vicinity of Clifton Court Forebay. A significant number of cars, trucks, and land grading equipment involved in construction in and around the forebay would emit small amounts of atmospheric nitrogen from

fuel combustion; this material could be deposited in sensitive grassland areas that are located west of the major construction areas at Clifton Court Forebay. Nitrogen deposition can pose a risk of adding a fertilizer to nitrogen-limited soils and their associated plants. Nonnative invasive species can be encouraged by the added nitrogen available. Appendix 5.J, Attachment 5J.A, *Construction-Related Nitrogen Deposition on BDCP Natural Communities*, of the Draft BDCP addresses this issue in detail. It has been concluded that this potential deposition would pose a low risk of changing the grassland in and adjacent to the construction areas because the construction would contribute a negligible amount of nitrogen to regional projected emissions and the existing grassland is dominated by nonnative invasive species of plants. Also, the construction at Clifton Court Forebay would occur primarily downwind of the natural community. No adverse effect is expected.

- *Environmental Commitment 3 Natural Community Protection and Restoration*: Approximately 1,060 acres of grassland natural community would be protected to restore and enhance aquatic and upland habitat for a number of amphibian, reptile and mammal special-status species.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin habitat enhancement could result in removal of small amounts of grassland natural community along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where grassland habitat stringers exist, including along levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.
- *Environmental Commitment 8 Grassland Natural Community Restoration:* Up to 1,070 acres of grassland natural community would be restored primarily on the fringes of the Delta, where upland areas merge with Delta wetland and agricultural lands. Restoration would focus on CZ 1, CZ 8, and CZ 11, as proposed by the Draft BDCP.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Natural communities enhancement and management would include a wide range of activities designed to improve habitat conditions in restored and protected lands associated with the project. This measure also promotes sound use of pesticides, vector control activities, invasive species control and fire management in preserve areas. To improve the public’s ability to participate in recreational activities in and adjacent to restored and protected habitats, a system of trails is proposed. The location and extent of this system are not yet known; however, it is assumed that the trail system would be located entirely in grassland habitats.

The following paragraphs summarize the combined effects discussed above and describe other project environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

During the project’s construction timeframe, Alternative 4A would affect the grassland natural community through water conveyance facilities construction losses (506 acres permanent and 151 acres temporary). These losses would occur along the eastern bank of the Sacramento River at intake sites, adjacent to Clifton Court Forebay associated with forebay expansion, and at various permanent and temporary construction sites for barge unloading facilities and tunnel shaft sites through the central Delta.

The construction losses of this natural community would not represent an adverse effect based on the significance criteria used for this section because grassland is not considered a special-status or sensitive natural community. Most Central Valley grasslands are dominated by nonnative annual grasses and herbs. However, the importance of grassland as a habitat that supports life stages of numerous special-status plants and wildlife is well documented (see Chapter 3, *Conservation Strategy*, of the Draft BDCP). The significance of losses in grassland habitat is, therefore, discussed in more detail in species analyses in Section 4.3.8.2, *Wildlife Species*, of the RDEIR/SDEIS. The combination of restoring 1,070 acres grassland (Environmental Commitment 8), protecting and enhancing 1,060 acres (Environmental Commitment 3) of grassland natural community during the construction phase of the project (14 years), and the commitment to restore temporarily affected grassland (151 acres) to its pre-project condition within one year of completing construction as required by *AMM10 Restoration of Temporarily Affected Natural Communities*, would offset this construction loss, avoiding any loss in the value of this habitat for special-status species. The protected and restored habitat would be managed and enhanced to benefit special-status and common wildlife species (Environmental Commitment 3 and Environmental Commitment 11). Typical project-level mitigation ratios (2:1 for protection) would indicate that 1,314 acres of protection would be needed to offset (i.e., mitigate) the 657 acres of combined permanent and temporary loss. The combination of protection, along with the enhancement and management associated with Environmental Commitment 3 and Environmental Commitment 11 contained in the project, is designed to avoid a temporal lag in the value of grassland habitat available to sensitive species.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats at work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Implementation of Alternative 4A would result in the loss of 0.8% of the grassland natural community in the study area. These losses (506 acres of permanent and 151 acres of temporary loss) would be associated with construction of the water conveyance facilities.

NEPA Effects: By the end of the project's construction time frame, a total of 1,060 acres of grassland would be protected (Environmental Commitment 3) and 1,070 acres of grassland would be restored (Environmental Commitment 8), which would be guided by Resource Restoration and Performance Principles G1, G3, G4, and G7–G10. The protection would occur primarily in the west Delta and Clifton Court Forebay areas. Temporarily affected grassland would also be restored following construction activity as described in AMM10. There would be a permanent loss of 506 acres of grassland in the study area. However, the combination of restoration, protection and enhancement of grassland associated with Alternative 4A would replace the habitat lost and improve the habitat value of this community in the study area; there would not be an adverse effect on the grassland natural community.

CEQA Conclusion: Alternative 4A would result in the loss of approximately 657 acres of grassland natural community due to construction of the water conveyance facilities. The construction losses would occur along the eastern bank of the Sacramento River at intake sites, adjacent to Clifton Court Forebay associated with forebay expansion, and at various permanent and temporary construction sites for barge unloading facilities and tunnel shaft sites through the central Delta.

The construction losses of this natural community would not represent a significant impact based on the significance criteria used for this section because grassland is not considered a special-status or sensitive natural community. Nonetheless, these losses would be offset by planned restoration of 151 acres of temporarily affected grassland, the restoration of 1,070 acres of grassland, and protection of 1,060 acres of grassland natural community scheduled for the 14-year construction period of Alternative 4A, which would be guided by Resource Restoration and Performance Principles G1, G3, G4, and G7–G10. Also, AMM1, AMM2, AMM6, and AMM7 would be implemented to minimize impacts. Because of these offsetting restoration and protection activities and AMMs, impacts would be less than significant. Typical project-level mitigation ratios (2:1 for protection) would indicate that 1,314 acres of protection would be needed to offset (i.e., mitigate) the 657 acres of loss. The combined protection (1,060 acres) and restoration (1,070 acres) of 2,130 acres of grassland would more than offset the losses from the project. The combination of two approaches (protection and restoration) contained in the project environmental commitments and avoidance and minimization measures is designed to avoid a temporal lag in the value of grassland habitat available to special-status species. The protection and restoration would be initiated at the beginning of Alternative 4A implementation to minimize any time lag in the availability of this habitat to special-status species. Therefore, there would be a less-than-significant impact on the grassland natural community.

Impact BIO-30: Increased Frequency, Magnitude and Duration of Periodic Inundation of Grassland Natural Community

Alternative 4A would not result in periodic effects on grassland natural community type.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact BIO-31: Modification of Grassland Natural Community from Ongoing Operation, Maintenance and Management Activities

Once the physical facilities associated with Alternative 4A are constructed and the stream flow regime associated with changed water management is in effect, there would be new ongoing and periodic actions associated with operation, maintenance and management of the Alternative 4A facilities and conservation lands that could affect grassland natural community in the study area. The ongoing actions include modified operation of upstream reservoirs, the diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels. These actions are associated with water conveyance facilities. The periodic actions would involve access road and conveyance facility repair, vegetation management at the various water conveyance facilities and habitat restoration sites (Environmental Commitment 11), levee repair and replacement of levee armoring, channel dredging, and habitat enhancement in accordance with natural community management plans. The potential effects of these actions are described below.

- *Modified river flows upstream of and within the study area and reduced diversions from south Delta channels.* Changes in releases from reservoirs upstream of the study area, increased diversion of Sacramento River flows in the north Delta, and reduced diversions from south Delta channels (associated with Operational Scenario H) would not result in the permanent reduction in acreage of grassland natural community in the study area. Flow levels in the upstream rivers would not change such that the acreage of this community would be reduced on a permanent basis. The grassland along rivers upstream of planned north Delta diversions is primarily ruderal vegetation on levee banks and is dependent on winter and spring rains for germination and growth rather on than river levels. Similarly, increased diversions of Sacramento River flows in the north Delta would not result in a permanent reduction in grassland natural community downstream of these diversions. The reductions in flows below the intakes would occur primarily in the wet months when the existing nonnative annual grasslands along river levees are dormant, and like upstream grassland, this community is dependent on winter and spring rains for germination and growth in the winter and spring months, not on river stage. Anticipated small changes in river salinity in the west Delta and Suisun Marsh would not create a substantial change in grassland acreage in these areas. Reduced diversions from south Delta channels would not create a reduction in this natural community.

- *Access road, water conveyance facility and levee repair.* Periodic repair of access roads, water conveyance facilities and levees associated with project actions have the potential to require removal of adjacent vegetation and could entail earth and rock work in grassland habitats. This activity could lead to increased soil erosion and runoff entering these habitats. These activities would be subject to normal erosion and runoff control management practices, including those developed as part of *AMM2 Construction Best Management Practices and Monitoring* and *AMM4 Erosion and Sediment Control Plan.* Any vegetation removal or earthwork adjacent to or within grassland habitats would require use of sediment barriers, soil stabilization and revegetation of disturbed surfaces (*AMM10 Restoration of Temporarily Affected Natural Communities*). Proper implementation of these measures would avoid permanent adverse effects on this community.

- *Vegetation management.* Vegetation management, in the form of physical removal and chemical treatment, would be a periodic activity associated with the long-term maintenance of water conveyance facilities and restoration sites (*Environmental Commitment 11 Natural Community Enhancement and Management*). Use of herbicides to control nuisance vegetation could pose a long-term hazard to grassland natural community at or adjacent to treated areas. The hazard could be created by uncontrolled drift of herbicides, uncontrolled runoff of contaminated stormwater onto the natural community, or direct discharge of herbicides to grassland areas being treated for invasive species removal. Environmental commitments and *AMM5 Spill Prevention, Containment, and Countermeasure Plan* have been made part of Alternative 4A to reduce hazards to humans and the environment from use of various chemicals during maintenance activities, including the use of herbicides. These commitments, including the commitment to prepare and implement spill prevention, containment, and countermeasure plans and stormwater pollution prevention plans, are described in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS. Best management practices, including control of drift and runoff from treated areas, and use of herbicides approved for use in terrestrial environments would also reduce the risk of affecting natural communities adjacent to water conveyance features and levees associated with restoration activities.

- *Channel dredging.* Long-term operation of the Alternative 4A intakes on the Sacramento River would include periodic dredging of sediments that might accumulate in front of intake screens. The dredging could occur adjacent to grassland natural community. This activity should not permanently reduce the acreage of grassland natural community because it is periodic in nature; the grassland in the vicinity of the proposed intakes is ruderal grasses and herbs with low habitat value.

- *Habitat enhancement.* The Alternative 4A includes a long-term management element for the natural communities within the study area (Environmental Commitment 11). For the grassland natural community, a management plan would be prepared that specifies actions to improve the value of the habitats for covered species. Actions would include control of invasive nonnative plant and animal species, fire management, restrictions on vector control and application of herbicides, and maintenance of infrastructure that would allow for movement through the community. The enhancement efforts would improve the long-term value of this community for both special-status and common species.

The various operations and maintenance activities described above could alter acreage of grassland natural community in the study area through changes in flow patterns and changes in periodic inundation of this community. Activities could also introduce sediment and herbicides that would reduce the value of this community to common and sensitive plant and wildlife species. Other periodic activities associated with the Plan, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would be undertaken to enhance the value of the community. While some of these activities could result in small changes in acreage, these changes would be offset by protection and enhancement activities planned as part of *Environmental Commitment 3 Natural Communities Protection and Restoration*, or minimized by implementation of AMM2, AMM4, AMM5, and AMM10. The management actions associated with levee repair, periodic dredging and control of invasive plant species would also result in a long-term benefit to the species associated with grassland habitats by improving water movement in adjacent waterways and by eliminating competitive, invasive species of plants.

***NEPA Effects*:** Ongoing operation, maintenance and management activities associated with Alternative 4A would not result in a net permanent reduction in grassland natural community within the study area. Therefore, there would be no adverse effect on this natural community.

***CEQA Conclusion*:** The operation and maintenance activities associated with Alternative 4A would have the potential to create minor changes in total acreage of grassland natural community in the study area, and could create temporary increases sedimentation. The activities could also introduce herbicides periodically to control nonnative, invasive plants. Implementation of environmental commitments and AMM2, AMM4, AMM5, and AMM10 would minimize these impacts, and other operations and maintenance activities, including management, protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* and *Environmental Commitment 11 Natural Communities Enhancement and Management*, would create positive effects, including reduced competition from invasive, nonnative plants in these habitats. Protection and enhancement actions associated with *Environmental Commitment 3 Natural Communities Protection and Restoration* would increase the value of this natural community in the study area. Ongoing operation, maintenance and management activities would not result in a net permanent reduction in this natural community within the study area. Therefore, there would be a less-than-significant impact on the grassland natural community.

Inland Dune Scrub

The inland dune scrub natural community is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. In the study area, the inland dune scrub community consists of remnants of low-lying ancient stabilized dunes related to the Antioch Dunes formation located near the town of Antioch (CZ 10; see Figure 12-1 in the Draft EIR/EIS). While inland dune scrub is within the study area, none of the Alternative 4A actions is expected to affect this community.

Cultivated Lands

Cultivated lands is the major land cover type in the study area (487,106 acres, see Table 12-1 in the Draft EIR/EIS). The Delta, the Yolo Bypass and the Cache Slough drainage are dominated by various types of agricultural activities, with crop production the dominant element (see Figure 12-1 in the Draft EIR/EIS). Major crops and cover types in agricultural production include grain and hay crops (wheat, oats and barley), field crops (corn, beans and safflower), truck crops (tomatoes, asparagus and melons), pasture (alfalfa, native and nonnative pasture), rice, orchards, and vineyards. Tables 12-2 and 12-3 in the Draft EIR/EIS list special-status wildlife species supported by cultivated lands.

The effects of Alternative 4A on cultivated lands are discussed from various perspectives in this document. Section 4.3.10, *Agricultural Resources*, of the RDEIR/SDEIS includes a detailed analysis of cropland conversion as it relates to agricultural productivity. Many of the discussions of individual terrestrial plant and wildlife species in this section also focus on the relevance of cultivated land loss. Because cultivated lands is not a natural community and because the effects of its loss are captured in the individual species analyses, there is no separate analysis of this land cover type presented here. For Alternative 4A, the total loss (permanent and temporary) is estimated to be 7,314 acres. The majority of the permanent loss would be associated with tidal marsh restoration (Environmental Commitment 4; 54 acres), riparian natural community restoration (Environmental Commitment 7; 251 acres), nontidal marsh restoration (Environmental Commitment 10; 832 acres), and construction of the modified tunnel and associated water conveyance facilities (permanent removal of 3,768 acres and temporary removal 1,339 acres of cultivated lands). Of the 7,314 acres, 7,091 would be made up of croplands and the other 223 acres would be non-cropland agricultural areas.

Developed Lands

Additional lands in the study area that were not designated with a natural community type have been characterized as developed lands (90,660 acres). Developed lands include lands with residential, industrial, and urban land uses, as well as landscaped areas, riprap, road surfaces and other transportation facilities (see Figure 12-1 in the Draft EIR/EIS and the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS). Developed lands support some common plant and wildlife species, whose abundance and species richness vary with the intensity of development. One special-status species, the giant garter snake, is closely associated with a small element of developed lands; specifically, embankments and levees near water that are covered with riprap provide giant garter snake habitat.

As with cultivated lands, no effort has been made to analyze the effects of Alternative 4A activities on this land cover type because it is not a natural community. The effects of its conversion are discussed in Section 4.3.9, *Land Use*, of the RDEIR/SDEIS. Where the loss of developed lands may affect individual special-status species or common species, the impact analysis is contained in that species discussion.

Wildlife Species

Vernal Pool Crustaceans

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on vernal pool crustaceans (California linderiella, Conservancy fairy shrimp, longhorn fairy shrimp, midvalley fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp). The habitat model used to assess effects for the vernal pool crustaceans consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value for vernal pool crustaceans and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were included in the model as high-value habitat for vernal pool crustaceans. Also included as low-value habitat for vernal pool crustaceans are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but which do not include topographic depressions that are characteristic of vernal pool crustacean habitat.

Alternative 4A would result in permanent losses (see Table 12-4A-11) and indirect conversions of vernal pool crustacean modeled habitat. Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit vernal pool crustaceans.

- Restore vernal pool complex and alkali seasonal wetland suitable for vernal pool crustaceans to achieve no net loss of wetted acreage (Environmental Commitment 9, Resource Restoration and Performance Principle VP/AW2).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Protect 150 acres of existing vernal pool complex (Environmental Commitment 3) in the greater Byron Hills area, primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on vernal pool crustaceans would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-11. Changes in Vernal Pool Crustacean Modeled Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary	Indirect
Water Conveyance Facilities	High-value	24	1	41
	Low-value	7	2	0
Total Impacts Water Conveyance Facilities		**31**	**3**	**41**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	0	0	0
	Low-value	0	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**	**0**
TOTAL IMPACTS		**31**	**3**	**41**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-32: Loss or Conversion of Habitat for and Direct Mortality of Vernal Pool Crustaceans

Alternative 4A would result in the direct permanent and temporary loss combined of 34 acres of modeled vernal pool crustacean habitat from conveyance facilities construction. In addition, water conveyance facilities construction that causes hydrologic changes could result in the indirect conversion of an additional 41 acres of high-value vernal pool crustacean habitat. Construction of the water conveyance facilities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place. Habitat enhancement and management activities (Environmental Commitment 11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

Alternative 4A would also result in impacts on critical habitat for vernal pool fairy shrimp (195 acres). These impacts would be from water conveyance facilities construction west of Clifton Court Forebay. Of the 195 acres of vernal pool fairy shrimp critical habitat, only 8 acres consist of modeled habitat for vernal pool crustaceans, with the remainder consisting of cultivated lands.

As specified in *AMM12 Vernal Pool Crustaceans* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, restoration projects are designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that temporary transmission lines avoid removal of wetted acres of vernal pools and alkali seasonal wetlands wetted acres of aquatic habitats to the maximum extent practicable. The term wetted acres refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involve an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 34 acres of vernal pool crustacean habitat, composed of 25 acres of high-value and 9 acres of low-value habitat (Table 12-4A-11). The construction of the conveyance facilities would result in the permanent loss of habitat associated with a vernal pool fairy shrimp CNDDB occurrence as a result of the expansion of Clifton Court Forebay. In addition, conveyance facility construction could result in the indirect conversion of 41 acres of high-value vernal pool crustacean habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, from the storage of RTM, and permanent access roads. There are records of vernal pool fairy shrimp and midvalley fairy shrimp in the vicinity of these areas (California Department of Fish and Game 2013). Alternative 4A would also result in the permanent loss of 195 acres of critical habitat for vernal pool fairy shrimp. The permanent impacts on critical habitat are associated with the RTM disposal areas and an associated access road west of Clifton Court Forebay (177 acres), a new transmission line (15 acres), and upgrades to a permanent access road just south of this area (3 acres). However, as discussed above, only 8 acres of this critical habitat consists of modeled habitat for vernal pool crustaceans and the remaining critical habitat consist of cultivated lands that are not suitable for the species. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that transmission lines are designed to avoid removal of aquatic habitats to the maximum extent feasible.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* The project's restoration/creation of vernal pools to achieve no net loss and the protection of 150 acres of vernal pool complex would benefit vernal pool crustaceans. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily affect vernal pool crustacean habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool crustacean habitat and are expected to result in overall improvements to and maintenance of vernal pool crustacean habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The proposed conservation efforts have been evaluated to determine whether they would provide sufficient habitat protection and restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4A-11 lists the impacts on modeled vernal pool crustacean habitat that is based on the natural community mapping done within the study area. Table 12-4A-12 was prepared to further analyze the project's effects on vernal pool crustaceans using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of habitat. Wetted acres were estimated by using the Draft BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the project area it is likely that the actual densities within the project area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4A-12. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 4A (acres)

	Direct Loss	Indirect Conversion
AMM12 Impact Limit	10	20
Water Conveyance Facilities[a]	5.1	6.2
Environmental Commitments 4, 6–7, 9–11	0	0
Total	**5.1**	**6.2**

[a] These acreages were generated by assuming that the modeled habitat identified in Table 12-4A-12 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by Alternative 4A would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 5.1 wetted acres of vernal pool crustacean habitat (or 34 acres of vernal pool complex) should be restored and 22.6 wetted acres (or 150 acres of vernal pool complex) protected to mitigate Alternative 4A's direct and indirect effects on vernal pool crustacean habitat. With the implementation of AMM30 the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay.

Project proponents would commit to protecting 150 acres of vernal pool complex by protecting at least 2 wetted acres of vernal pools for each wetted acre directly or indirectly affected. Alternative 4A has also committed to restoring/creating vernal pools and alkali seasonal wetlands such that there is no net loss of vernal pool acreage. The final amount of restoration would be determined during implementation based on the following criteria.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools and/or alkali seasonal wetlands suitable for the species would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria, prior to impacts occurring), then 1.5 wetted acres of vernal pools and/or alkali seasonal wetlands suitable for the species would be restored for each wetted acre directly affected (1.5:1 ratio).

The protection and restoration efforts would include the following the Resource Restoration and Performance Principles.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principle VP/AW1).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW2).

- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM12 Vernal Pool Crustaceans, AMM30 Transmission Line Design and Alignment Guidelines,* and *AMM37 Recreation*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of vernal pool crustacean habitat under Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management and enhancement would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the period of construction and operations. Considering these commitments, losses and conversion of vernal pool crustacean habitat under Alternative 4A would not be an adverse effect.

CEQA Conclusion: Alternative 4A would have significant impact on vernal pool crustacean habitat as a result of habitat modification of a special-status species and potential for direct mortality in the absence of the protection and restoration of habitat. However, the project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 9, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4 and effects would be avoided and minimized by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the period of construction and operations. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of vernal pool crustaceans. Therefore, Alternative 4A would have a less-than-significant impact on vernal pool crustaceans under CEQA.

Impact BIO-33: Indirect Effects of Alternative 4A on Vernal Pool Crustaceans

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction and restoration areas, and maintenance activities. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. Vernal pool crustaceans and their habitat could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into vernal pool crustacean habitat that occurs along the southern and western boundaries of the forebays.

NEPA Effects: Water conveyance facilities construction and restoration activities could indirectly affect vernal pool crustaceans and their habitat in the vicinity of construction areas. These potential effects would be avoided and minimized through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the period of construction and operations. The indirect effects of Alternative 4A on vernal pool crustaceans and their habitat would not be adverse under NEPA.

***CEQA Conclusion*:** Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact vernal pool crustaceans and their habitat in the vicinity of these work areas. These potential impacts would be minimized or avoided through AMM1–AMM6, AMM10, and AMM12, which would be in effect throughout the period of construction and operations. The indirect impacts of Alternative 4A on vernal pool crustaceans would be less than significant under CEQA.

Impact BIO-34: Periodic Effects of Inundation of Vernal Pool Crustacean Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on vernal pool crustacean habitat.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Valley Elderberry Longhorn Beetle

The habitat model used to assess the effects for valley elderberry longhorn beetle is based on riparian habitat and nonriparian habitat (vernal pool complexes and grasslands within 200 feet of channels). Alternative 4A would result in both temporary and permanent losses of valley elderberry longhorn beetle modeled habitat as indicated in Table 12-4A-13. The majority of the losses would take place over an extended period of time as the restoration environmental commitments are being implemented. In addition, an estimated 5 elderberry shrubs that were previously mapped by DWR in the DHCCP Conveyance Planning Area could be impacted by the Alternative 4A water conveyance alignment. Full implementation of Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit valley elderberry longhorn beetle.

- Mitigate impacts on elderberry shrubs consistent with USFWS (1999) conservation guidelines for the species and planting shrubs in high-density cluster (Resource Restoration and Performance Principle VELB1).
- Site elderberry longhorn beetle habitat restoration with drainage immediately adjacent to or in the vicinity of occupied habitat (Resource Restoration and Performance Principle VELB2).
- Restore 251 acres of valley/foothill riparian (Environmental Commitment 7).
- Protect 103 acres of valley/foothill riparian (Environmental Commitment 3).

As explained below, with the restoration and protection of these amounts of habitat, impacts on valley elderberry longhorn beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-13. Changes in Valley Elderberry Longhorn Beetle Modeled Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Riparian	42	31
	Nonriparian	211	86
Total Impacts Water Conveyance Facilities		**253**	**117**
Environmental Commitments 4, 6–7, 9–11[a]	Riparian	5	0
	Nonriparian	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11a		**5**	**0**
TOTAL IMPACTS		**258**	**117**

[a] See discussion below for a description of applicable Environmental Commitments.

Impact BIO-35: Loss of Valley Elderberry Longhorn Beetle Habitat

Alternative 4A would result in the permanent and temporary loss combined of up to 375 acres of modeled valley elderberry longhorn beetle habitat (78 acres of riparian habitat and 297 acres of nonriparian habitat), and an estimated 10 elderberry shrubs from water conveyance facilities, which represent potential habitat for the species (Table 12-4A-13). Due to the limitation of the habitat suitability model, all of these effects are assumed to be a large overestimate of the true effect on potential valley elderberry longhorn beetle habitat. Environmental commitments that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other project physical facilities could degrade or eliminate valley elderberry longhorn beetle habitat. Implementation of the habitat protection and restoration contained in Alternative 4A and implementation of AMMs committed to would result in no adverse effects under NEPA and less-than-significant impacts under CEQA. Each of these activities is described below.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 370 acres of modeled valley elderberry longhorn beetle habitat, composed of 73 acres of riparian habitat and 297 acres of nonriparian habitat (Table 12-4A-13). In addition, an estimated 5 shrubs could be removed as a result of conveyance facilities construction. As noted in Section 12.3.2.3, *Methods Used to Assess Species Effects*, in the Draft EIR/EIS, elderberry shrubs were mapped in the DHCCP Conveyance Planning Area where accessible and thus the entire footprint of water conveyance facilities was not surveyed. In many cases, the data collected did not always specify the number of shrubs observed but rather the size class and a range of stem numbers. The exact number of shrubs to be impacted would be determined during pre-construction surveys of the footprints of the conveyance facility and associated work areas as part of the implementation of *AMM15 Valley Elderberry Longhorn Beetle*. Most of these impacts are associated with the intake and forebay construction in the north delta. There are no records of valley elderberry longhorn beetle within these impact areas. The portion of the above impacts that result from temporary habitat loss includes 117 acres of modeled valley elderberry longhorn beetle habitat (31 acres riparian and 86 acres nonriparian habitat). Elderberry shrubs could be affected from ground-disturbing activities associated with conveyance construction footprints, reusable tunnel material storage areas, geotechnical boring areas, temporary access roads, and staging areas.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the permanent loss of approximately 5 acres of riparian habitat. Elderberry shrubs could be affected from ground-disturbing activities associated with the re-contouring of surface topography, excavation or modification of channels, type conversion from riparian and grasslands to tidal habitat, levee removal and modification, and removal of riprap and other protections from channel banks.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Activities associated with natural communities enhancement and management, such as grazing practices and ground disturbance or herbicide use in the control of nonnative vegetation, intended to maintain and improve habitat functions of protected habitats for species could result in loss of elderberry shrubs and the potential for injury or mortality to beetles. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.
- Operations and maintenance: Post-construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect valley elderberry beetle. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas could affect elderberry shrubs occupied by the species. These effects, however, would be reduced by AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe the environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Based on modeled habitat, the study area supports approximately 34,456 acres of modeled habitat (17,786 acres of riparian and 16,670 acres of nonriparian) for valley elderberry longhorn beetle. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 375 acres of modeled valley elderberry longhorn beetle habitat (78 acres of riparian habitat and 297 acres of nonriparian habitat) (1% of the modeled habitat in the study area). These losses would not fragment any known populations of valley elderberry longhorn beetle.

Typical NEPA and CEQA project-level mitigation ratios for riparian habitat affected by the project would be 1:1 for restoration and 1:1 for protection of riparian habitat. Using these typical ratios would indicate that 78 acres of the riparian habitat should be restored/created and 78 acres of existing riparian should be protected to mitigate project losses of valley elderberry longhorn beetle habitat.

Alternative 4A includes a commitment to restore/create 251 acres of riparian habitat and protect 103 acres of riparian habitat and in the project area. The Resource Restoration and Performance Principles identified under Alternative 4A for valley elderberry longhorn beetle conservation include implementing the USFWS (1999) conservation guidelines for the species (transplanting elderberry shrubs and planting elderberry seedlings and associated natives) (Resource Restoration and Performance Principle VELB1) and siting elderberry restoration within drainages immediately adjacent to or in the vicinity of sites confirmed to be occupied by valley elderberry longhorn beetle(Resource Restoration and Performance Principle VELB2). These Resource Restoration and Performance Principles would be met through the implementation of Environmental Commitment 7

Riparian Natural Community Restoration. *Environmental Commitment 7 Riparian Natural Community Restoration* specifically calls for the planting of elderberry shrubs in large, contiguous clusters with a mosaic of associated natives as part of riparian restoration consistent with USFWS (1999) conservation guidelines. The acres of riparian protection and restoration proposed would satisfy the typical mitigation requirements described in the previous paragraph. Though there are no restoration and preservation goals for the nonriparian habitat affected, the commitment to transplant shrubs and plant additional elderberry seedlings and associated natives would, together with the proposed restoration and protection of riparian (a higher quality habitat), would be more than adequate to compensate for the projects effects on the nonriparian habitat component of the modeled habitat for the species.

The project also includes commitments to implement AMM1 W*orker Awareness Training*, AMM2 C*onstruction Best Management Practices and Monitoring*, AMM3 *Stormwater Pollution Prevention Plan*, AMM4 *Erosion and Sediment Control Plan*, AMM5 *Spill Prevention, Containment, and Countermeasure Plan*, AMM6 *Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and AMM15 *Valley Elderberry Longhorn Beetle*. AMM15 requires surveys for elderberry shrubs within 100 feet of any ground disturbing activities, the implementation of avoidance and minimize measures for any shrubs that are identified within this 100-foot buffer, and transplanting shrubs that can't be avoided. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites.

Other factors relevant to effects on valley elderberry longhorn beetle include:

- Habitat loss is widely dispersed throughout the study area and would not be concentrated in any one location.
- There would be a temporal loss of riparian habitat, which is expected to result in a minimal effect on valley elderberry longhorn beetle because much of the riparian habitat in the project area is not known to be currently occupied by the species, because all elderberry shrubs that are suitable for transplantation would be moved to conservation areas in the project area, and because most of the affected community is composed of small patches of riparian scrub and herbaceous vegetation that are fragmented and distributed across the agricultural landscape of the project area and thus are likely to provide no or low-value habitat for the beetle.
- Temporarily disturbed areas would be restored within 1 year following completion of construction and management activities. Under AMM10, a restoration and monitoring plan would be developed prior to initiating any construction-related activities associated with the environmental commitments or other covered activities that would result in temporary effects on natural communities.

NEPA Effects: In the absence of actions to compensate and avoid and minimize effects, the losses of valley elderberry longhorn beetle habitat and potential for direct mortality of a special-status species associated with Alternative 4A would represent an adverse effect. However, with habitat protection and restoration associated with Environmental Commitment 7, Resource Restoration and Performance Principles VELB1 and VELB2, and by AMM1–AMM6, AMM10, and AMM15, the effects of Alternative 4A as a whole on valley elderberry longhorn beetle would not be adverse under NEPA.

CEQA Conclusion: Considering the protection and restoration provisions, which would provide acreages of new or enhanced habitat in amounts greater than necessary to compensate for habitats lost to construction and restoration activities, together with Resource Restoration and Performance Principles VELB1 and VELB2, implementation of Alternative 4A as a whole would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the alternative would have a less-than-significant impact on valley elderberry longhorn beetle under CEQA.

Impact BIO-36: Indirect Effects on Valley Elderberry Longhorn Beetle and its Habitat

Construction activities associated with water conveyance facilities, habitat restoration, and habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic post-construction disturbances with localized impacts on valley elderberry longhorn beetle. Construction related effects could result from ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in dust and the inadvertent release of hazardous substances in areas where elderberry shrubs occur. A GIS analysis estimates that approximately 10 shrubs could be indirectly affected by conveyance facilities construction (see Section 12.3.2.3, *Methods Used to Assess Species Effects*, of the Draft EIR/EIS for a discussion of the methods used to make this estimate). Restoration activities could result in excavation or modification of channels, and type conversion from riparian and grasslands to other habitats, that occur within 100 feet of an elderberry shrubs. These potential effects would be minimized or avoided through AMM1–AMM6, AMM10, and AMM15.

***NEPA Effects*:** With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 4A construction, operations, and maintenance, substantial adverse indirect effects on valley elderberry longhorn beetle would be avoided and minimized. The indirect effects on valley elderberry longhorn beetle as a result of implementing Alternative 4A environmental commitments would not have an adverse effect on valley elderberry longhorn beetle under NEPA.

CEQA Conclusion: With the implementation of AMM1–AMM6, AMM10, and AMM15 as part of Alternative 4A construction, operation, and maintenance, substantial adverse indirect effects on valley elderberry longhorn beetle would be avoided and minimized. Furthermore, the impacts from project would not result in a substantial reduction in numbers or a restriction in the range of valley elderberry longhorn beetle. Therefore, the indirect effects under this alternative would have a less-than-significant impact on valley elderberry longhorn beetle under CEQA.

Impact BIO-37: Periodic Effects of Inundation of Valley Elderberry Longhorn Beetle Habitat as a Result of Implementation of Alternative 4A

Alternative 4A would not result in periodic effects on valley elderberry longhorn beetle.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Nonlisted Vernal Pool Invertebrates

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on nonlisted vernal pool invertebrates that are not covered by the Plan (Blennosperma vernal pool andrenid bee, hairy water flea, Ricksecker's water scavenger beetle, curved-foot hygrotus beetle, molestan blister beetle). Little is known about the range of these species so it is assumed that they have potential to occur in the same areas described by the vernal pool crustacean modeled habitat. That habitat model consists of: vernal pool complex, which consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly affected by agricultural or development practices; alkali seasonal wetlands in CZ 8; and degraded vernal pool complex, which consists of low-value ephemeral habitat ranging from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, disking, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. For the purpose of the effects analysis, vernal pool complex is categorized as high-value and degraded vernal pool complex is categorized as low-value for these species. Alkali seasonal wetlands in CZ 8 were also included as high-value habitat for vernal pool crustaceans in the model. Also included as low-value for vernal pool habitat are areas along the eastern boundary of CZ 11 that are mapped as vernal pool complex because they flood seasonally and support typical vernal pool plants, but do not include topographic depressions that are characteristic of vernal pools.

Alternative 4A would result in permanent losses of habitat for nonlisted vernal pool invertebrates as indicated in Table 12-4A-14 and indirect conversions of vernal pool habitat. Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles that would benefit nonlisted vernal pool invertebrates.

- Protect 150 acres of existing vernal pool complex (Environmental Commitment 3) in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principles VP/AW1)
- Restore vernal pool complex and alkali seasonal wetland suitable for vernal pool invertebrates to achieve no net loss of wetted acreage (Environmental Commitment 9, Resource Restoration and Performance Principles VP/AW2).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principles VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principles VP/AW4).

As explained below, with the restoration and protection of these amounts of habitat, impacts on nonlisted vernal pool invertebrates would not be adverse for NEPA purposes and would be less-than significant for CEQA purposes.

Table 12-4A-14. Changes in Nonlisted Vernal Pool Invertebrate Habitat Associated with Alternative 4A (acres)[a]

Project Component	Habitat Type	Permanent	Temporary	Indirect
Water Conveyance Facilities	High-value (vernal pool complex)	24	1	41
	Low-value (degraded vernal pool complex)	7	2	0
Total Impacts Water Conveyance Facilities		**31**	**3**	**41**
Environmental Commitments 4, 6–7, 9–11[a]	High-value (vernal pool complex)	0	0	0
	Low-value (degraded vernal pool complex)	0	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**	**0**
TOTAL IMPACTS		**31**	**3**	**41**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-38: Loss or Conversion of Habitat for and Direct Mortality of Nonlisted Vernal Pool Invertebrates

Alternative 4A would result in the direct, permanent and temporary loss combined of 34 acres of vernal pool habitat from conveyance facilities construction. In addition, conveyance construction could result in the indirect conversion due to hydrologic alteration of an additional 41 acres of vernal pool complex. Construction of the water conveyance facilities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool habitat. USFWS typically considers construction within 250 feet of vernal pools to constitute an indirect effect unless more detailed information is provided to further refine the limits of any such effects. For the purposes of this analysis, the 250-foot buffer was applied to the water conveyance facilities work areas where surface and subsurface disturbance activities would take place. Habitat enhancement and management activities (Environmental Commitment 11), which include disturbance or removal of nonnative vegetation, could result in local adverse habitat effects.

As specified in *AMM12 Vernal Pool Crustaceans* and *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, restoration projects would be designed such that no more than a total of 10 wetted acres of vernal pool crustacean habitat are permanently lost. AMM12 would also ensure that no more than 20 wetted acres of vernal pool crustacean habitat are indirectly affected by alterations to hydrology resulting from adjacent BDCP covered activities, in particular tidal restoration. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that temporary transmission lines avoid removal of wetted acres of vernal pools and alkali seasonal wetlands wetted acres of aquatic habitats to the maximum extent practicable. The term wetted acres refers to an area that would be defined by the three parameter wetland delineation method used by the U.S. Army Corps of Engineers to determine the limits of a wetland, which involve an evaluation of wetland soil, vegetation, and hydrology characteristics. This acreage differs from vernal pool complex acreages in that a vernal pool complex is composed of individual wetlands (vernal pools) and those upland areas that are in between and surrounding them, which provide the supporting hydrology (surface runoff and groundwater input), organic and nutrient inputs, and refuge for the terrestrial phase of some vernal pool species.

A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent and temporary combined loss of approximately 34 acres of vernal pool habitat, composed of 25 acres of high-value and 9 acres of low-value habitat (Table 12-4A-14). In addition, the conveyance facilities could result in the indirect conversion of 41 acres of vernal pool habitat in the vicinity of Clifton Court Forebay. The indirect effects would result from the construction of permanent transmission lines, from the storage of reusable tunnel material, and permanent access roads. *AMM30 Transmission Line Design and Alignment Guidelines* would ensure that temporary transmission lines are designed to avoid removal wetted acres of aquatic habitats to the maximum extent practicable. There are no records of these nonlisted vernal pool invertebrates at this location (California Department of Fish and Game 2013).
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Alternative 4A's restoration/creation of vernal pools to achieve no net loss and the protection of 150 acres of vernal pool complex would benefit vernal pool invertebrates. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance

wildlife values in protected habitats may result in localized ground disturbances that could temporarily affect vernal pool invertebrate habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on vernal pool invertebrate habitat and are expected to result in overall improvements to and maintenance of vernal pool habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The proposed conservation efforts have been evaluated to determine whether they would provide sufficient habitat protection and restoration in an appropriate timeframe to ensure that the effects of construction would not be adverse under NEPA and would be less than significant under CEQA. Table 12-4A-14 above lists the impacts on nonlisted vernal pool invertebrate habitat that are based on the natural community mapping done within the study area. Table 12-4A-15 was prepared to further analyze the project's effects on vernal pool invertebrates using wetted acres of habitat in order to compare the effects of this alternative with the effect limits established in *AMM12 Vernal Pool Crustaceans*, which are measured in wetted acres of habitat. Wetted acres were estimated by using the Draft BDCP's assumption that restored vernal pool complexes would have a 15% density of vernal pools (i.e., of 100 acres of vernal pool complex 15 acres would constitute vernal pools and the remaining 85 acres supporting uplands). Based on an informal evaluation of aerial photographs of the project area, it is likely that the actual densities within the project area are approximately 10%, but the 15% density value was chosen as a conservative estimate for determining effects.

Table 12-4A-15. Estimated Effects on Wetted Vernal Pool Crustacean Habitat under Alternative 4A (acres)

	Direct Loss	Indirect Conversion
AMM12 Impact Limit	10	20
Water Conveyance Facilities[a]	5.1	6.2
Environmental Commitments 4, 6–7, 9–11	0	0
Total	**5.1**	**6.2**

[a] These acreages were generated by assuming that the modeled habitat identified in Table 12-4A-14 has densities of wetted habitat at 15%. The direct effects numbers include permanent and temporary impacts.

Typical NEPA and CEQA project-level mitigation ratios for loss of vernal pools affected by Alternative 4A would be 1:1 for restoration and 2:1 for protection. Typically, indirect conversion impacts are mitigated by protecting vernal pools at a 2:1 ratio. Using these typical ratios would indicate that 5.1 wetted acres of vernal pool habitat (34 acres of vernal pool complex) should be restored and 22.6 wetted acres of vernal pool habitat (150 acres of vernal pool complex) protected to mitigate Alternative 4A's direct and indirect effects on nonlisted vernal pool species habitat. With the implementation of AMM30 the effects on aquatic habitat would be avoided to the maximum extent feasible during the designing of the transmission line west of Clifton Court Forebay.

Project proponents would commit to protecting 150 acres of vernal pool complex by protecting at least 2 wetted acres of vernal pools protected for each wetted acre directly or indirectly affected. The Plan also includes a commitment to restore or create vernal pools such that the Plan results in no net loss of vernal pool acreage. The amount of restoration would be determined during implementation based on the following criteria, which would satisfy Resource Restoration and Performance Principle VP/AW2.

- If restoration is completed (i.e., restored natural community meets all success criteria) prior to impacts, then 1.0 wetted acre of vernal pools would be restored for each wetted acre directly affected (1:1 ratio).
- If restoration takes place concurrent with impacts (i.e., restoration construction is completed, but restored habitat has not met all success criteria prior to impacts occurring), then 1.5 wetted acres of vernal pools would be restored for each wetted acre directly affected (1.5:1 ratio).

The protection and restoration would be achieved by implementation of the following the Resource Restoration and Performance Principles.

- Protect existing vernal pool complex in the greater Byron Hills area primarily in core vernal pool recovery areas identified in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005) (Resource Restoration and Performance Principles VP/AW1).
- Increase size and connectivity of protected vernal pool complexes and alkali seasonal wetlands in the greater Byron Hill area (Resource Restoration and Performance Principles VP/AW3).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principles VP/AW4).

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM30 Transmission Line Design and Alignment Guidelines*, and *AMM37 Recreation*. *AMM12 Vernal Pool Crustaceans*, though developed for vernal pool crustaceans, includes measures to avoid and minimize direct and indirect effects on vernal pools and would thus be applicable to nonlisted vernal pool invertebrates as well. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

***NEPA Effects*:** The loss of vernal pool habitat under Alternative 4A would not be adverse under NEPA because project proponents would commit to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the time period of construction and operations. Considering these commitments, losses and conversions of nonlisted vernal pool invertebrates habitat under Alternative 4A would not be adverse.

CEQA Conclusion**:** The effects on nonlisted vernal pool invertebrate habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of actions to compensate, avoid, and minimize impacts. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 9, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VP/AW1-VP/AW4, and by AMM1–AMM6, AMM10, AMM12, AMM30, and AMM37, which would be in place throughout the period of construction and operations. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of nonlisted vernal pool invertebrates. Therefore, Alternative 4A would have a less-than-significant impact on nonlisted vernal pool invertebrates under CEQA.

Impact BIO-39: Indirect Effects of Alternative 4A on Nonlisted Vernal Pool Invertebrates

Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. Ground-disturbing activities, stockpiling of soils, and maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into this habitat. Vernal pools could be periodically indirectly affected by maintenance activities at water conveyance facilities. Embankment maintenance activities around Clifton Court Forebay could result in the inadvertent discharge of sediments and hazardous materials into nonlisted vernal pool invertebrate habitat that occurs along the southern and western boundaries of the forebays.

NEPA Effects**:** Water conveyance facilities construction and restoration activities could indirectly affect nonlisted vernal pool invertebrates and their habitat in the vicinity of construction areas. These potential effects would be avoided and minimized through AMM1–AMM6, and AMM10 which would be in effect throughout the period of construction and operations. The indirect effects of Alternative 4A on nonlisted vernal pool invertebrates would not be adverse under NEPA.

CEQA Conclusion: Construction and maintenance activities associated with water conveyance facilities, and restoration actions could indirectly impact nonlisted vernal pool invertebrates and their habitat in the vicinity of construction and restoration areas, and maintenance activities. These potential impacts would be minimized or avoided through AMM1–AMM6, and AMM10, which would be in effect throughout period of construction and operations. The indirect impacts of Alternative 4A on nonlisted vernal pool invertebrates would be less than significant under CEQA.

Impact BIO-40: Periodic Effects of Inundation of Nonlisted Vernal Pool Invertebrates' Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on nonlisted vernal pool invertebrates.

NEPA Effects**:** No effect.

CEQA Conclusion: No impact.

Sacramento and Antioch Dunes Anthicid Beetles

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on Sacramento and Antioch Dunes anthicid beetles. Potential habitat in the study area includes the inland dune scrub at Antioch Dunes NWR, sand bars along the Sacramento and San Joaquin Rivers, and sandy dredge spoil piles (California Department of Fish and Game 2006c and 2006d).

The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not likely affect Sacramento and Antioch Dunes anthicid beetles. The construction of the water conveyance structure and associated infrastructure would generally avoid affects to channel margins where sand bars are likely to form. Conveyance construction would not affect inland dune scrub habitat at Antioch Dunes NWR. No dredge spoil areas that could be occupied by Sacramento anthicid beetle were identified within conveyance facilities footprints during a review of Google Earth imagery. Also, a review of the locations of the Alternative 4A water intake facilities on aerial imagery did not reveal any sandbars along the channel margins. These portions of the Sacramento River have steep, riprap lined channel banks that are likely not conducive to the formation of sandbars.

Implementation of Alternative 4A restoration measures could affect habitat for Sacramento and Antioch Dunes anthicid beetles. Both species are known to utilize interior sand dunes and sandbar habitat. The only interior sand dune habitat within the project area is at Antioch Dunes, which would not be impacted by the Alternative 4A environmental commitments. Both species are known to occur along the Sacramento River and San Joaquin Rivers. The implementation of Alternative 4A restoration actions could affect habitat for Sacramento and Antioch Dunes anthicid beetles along channels throughout the project area; however the extent of these habitats in the project area is unknown because these areas were not identified at the scale of mapping done within the study area. Because of current and historic channel modifications (channel straightening and dredging) and levee construction throughout the Delta, sandbar habitat is likely very limited and restricted to channel margins. The implementation of *Environmental Commitment 4 Tidal Natural Communities Restoration* and *Environmental Commitment 6 Channel Margin Enhancement* could impact sandbar habitat along the river channels and possibly sandy, dredge piles on Delta islands.

Alternative 4A would likely result in beneficial effects on Sacramento and Antioch Dunes anthicid beetles. The following Alternative 4A environmental commitments would generally increase opportunities for the formation of sandbars in the project area.

- As stated in Environmental Commitment 6, 4.6 miles of channel margin habitat would be enhanced.
- Restore 251 acres of riparian habitat (Environmental Commitment 7).
- Protect 103 acres of riparian habitat (Environmental Commitment 3).

These measures would improve shoreline conditions by creating benches along levees, shallow habitat along margins, and increasing shoreline vegetation, all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create opportunities for sand to be deposited and for sandbars to subsequently form. As explained below, potential impacts on Sacramento and Antioch Dunes anthicid beetle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-16. Changes in Sacramento and Antioch Dunes Anthicid Beetles' Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	unknown	unknown
TOTAL IMPACTS	**unknown**	**unknown**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-41: Loss or Conversion of Habitat for and Direct Mortality of Sacramento and Antioch Dunes Anthicid Beetles

Implementation of Alternative 4A environmental commitments could affect Sacramento and Antioch Dunes anthicid beetles and their habitat. As mentioned above, the full extent of this habitat in the study area is unknown but it is assumed that sand bars likely occur to some degree along the Sacramento and San Joaquin Rivers and that some islands in the Delta may contain sandy dredge spoil piles. A review of Google Earth imagery in the north Delta did identify three general areas that appear to have accumulations of sandy soils (with some vegetation), possibly from dredge disposal, are Decker Island, the western portion of Bradford Island, and the southwestern tip of Grand Island. A review of Google Earth imagery in the south Delta did identify sandbar habitat along the San Joaquin River from the southern end of the project area downstream to an area just west of Lathrop. An additional area along Paradise Cut was identified just north of I-5. Environmental commitments that could result in impacts on Sacramento and Antioch Dunes anthicid beetles are tidal habitat restoration (Environmental Commitment 4) and channel margin enhancement (Environmental Commitment 6). In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate habitat for Sacramento and Antioch Dunes anthicid beetles. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration could impact the areas of sandy soils identified from aerial photographs on Decker Island, the western portion of Bradford Island, and on the southwestern tip of Grand Island because these areas fall within the West Delta Restoration Opportunity Area (ROA). The methods and techniques for tidal restoration may include the recontouring of lands so that elevations are suitable for the establishment of marsh plains and the eventual breaching of levees. There are three CNDDB records of Sacramento anthicid beetle (just north of Rio Vista, one just south of Rio Vista along the west shore of the Sacramento River, and one on Grand Island) and one CNDDB record of Antioch Dunes anthicid beetle (just north of Rio Vista) that fall within the West Delta ROA (California Department of Fish and Wildlife 2013). Tidal restoration actions in the West Delta ROA may eliminate potential habitat and impact occupied habitat of both Sacramento and Antioch Dunes anthicid beetles.
- *Environmental Commitment 6 Channel Margin Enhancement*: Channel margin enhancement could result in impacts on 4.6 miles of channel margin that could contain sandbars.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

Alternative 4A could result in substantial effects on Sacramento and Antioch Dunes anthicid beetles because all of the habitat identifiable from aerial photo review falls within either the West Delta ROA, which may be considered for tidal restoration (Environmental Commitment 4). Furthermore, three of the records for Sacramento anthicid beetle within the study area fall within areas being considered for tidal restoration (Environmental Commitment 4), which represents approximately one quarter of the extant records for this species range wide (3 of 13). The only extant record for Antioch Dunes anthicid beetle, which represents one of five extant records range wide, falls within the West Delta ROA that is just north of Rio Vista. These occurrences could be affected if tidal restoration occurs in these areas. However, considering all of the environmental commitments under Alternative 4A, Sacramento and Antioch Dunes anthicid beetles would likely benefit from the project. Under Alternative 4A, Environmental Commitment 6, and Environmental Commitment 7, would generally contribute to the formation of sandbar habitat in the project area. These measures would improve shoreline conditions by creating benches along levees (Environmental Commitment 6) and increasing shoreline vegetation (Environmental Commitment 7), all of which would likely contribute to the formation of sandbars along Delta river channels where these measures would be implemented. Increasing the structural diversity of Delta river channel margins would create areas of slow water that would allow for sand to be deposited and for sandbars to subsequently form.

***NEPA Effects*:** The potential impacts on Sacramento and Antioch Dunes anthicid beetles associated with Alternative 4A as a whole would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other means to compensate for, avoid, and/or minimize impacts. However, considering the implementation of restoration associated with Environmental Commitment 6 and Environmental Commitment 7 the effects of Alternative 4A as a whole on Sacramento and Antioch Dunes anthicid beetles would not be adverse under NEPA.

***CEQA Conclusion*:** Alternative 4A would potentially impact Sacramento and Antioch Dunes anthicid beetles' habitat and could impact three occurrences of Sacramento anthicid beetle and one occurrence of Antioch Dunes anthicid beetle. However, the implementation of the environmental commitments would likely benefit Sacramento and Antioch Dunes anthicid beetles. Environmental Commitment 6 and Environmental Commitment 7 would generally contribute to the formation of sandbar habitat in the project area. Alternative 4A as a whole would not result in a substantial adverse effect though habitat modification and would not substantially reduce the number or restrict the range of these species. Therefore, the alternative would have a less-than-significant impact on Sacramento and Antioch Dunes anthicid beetles under CEQA.

Delta Green Ground Beetle

Suitable habitat in the study area would be vernal pool complexes and annual grasslands in the general Jepson Prairie area. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not affect delta green ground beetle because the facilities and construction area are outside the known range of the species. Implementation of Alternative 4A could affect delta green ground beetle through the potential protection of grasslands (Environmental Commitment 3) in the vicinity of Jepson Prairie and the subsequent implementation of habitat enhancement and management actions (Environmental Commitment 11) in these areas. In addition, tidal natural communities restoration (Environmental Commitment 4) could result in potential impacts on delta green ground beetle and its habitat. Alternative 4A could result in beneficial effects on delta green ground beetle through the protection of grasslands it occurs in CZ 1.

These areas could contain currently occupied habitat for delta green ground beetle and/or create conditions suitable for eventual range expansion. As explained below, potential impacts on delta green ground beetle would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-42 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4A-17. Changes in Delta Green Ground Beetle Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	unknown	unknown
TOTAL IMPACTS	**unknown**	**unknown**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-42: Loss or Conversion of Habitat for and Direct Mortality of Delta Green Ground Beetle

Alternative 4A environmental commitments could result in the conversion of habitat and/or direct mortality to delta green ground beetle. Environmental commitments that could affect delta green ground beetle include tidal natural communities habitat restoration (Environmental Commitment 4) and habitat enhancement and management activities (Environmental Commitment 11) in CZ 1. CZ 1 is the only portion of the project area that contains occupied and potential habitat for delta green ground beetle. The range of the delta green ground beetle is currently believed to be generally bound by Travis Air Force Base to the west, Highway 113 to the east, Hay Road to the north, and Creed Road to the south (Arnold and Kavanaugh 2007; USFWS 2009). Further discussion of this potential effect is provided below, and NEPA and CEQA conclusions follow.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal restoration in the Cache Slough ROA could result in the loss of delta green ground beetle habitat if restoration is planned in areas known to be or potentially occupied by the species. The tidal restoration methods and techniques identified in Environmental Commitment 4 include excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. These disturbances could affect delta green ground beetle through habitat modification, either directly or indirectly through hydrologic modifications, and/or result in direct mortality to the species.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Grasslands would potentially be protected in CZ 1. Potential effects from Environmental Commitment 11 could include direct mortality to larvae and adults from the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur or in critical habitat for vernal pool species. The creation of new recreation trails as part of Environmental Commitment 11 would result in impacts on grasslands within CZ 1, which could affect delta green ground beetle if present.

NEPA Effects: The potential protection of grassland in CZ 1 (Environmental Commitment 3) could benefit delta green ground beetle if these areas occur within the range of the species. The management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and Management* and the potential construction of recreational trails in CZ 1 has a potential to affect this species. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Direct mortality and/or the affects to delta green ground beetle habitat would be an adverse effect under NEPA. Implementation of mitigation measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce this effect.

CEQA Conclusion: The implementation of grassland protection (Environmental Commitment 3), tidal natural communities restoration (Environmental Commitment 4), and recreational trail construction and subsequent enhancement and management actions (Environmental Commitment 11) could impact delta green ground beetle. Tidal restoration projects around Calhoun Cut and possible Lindsey Slough could affect habitat and result in direct mortality to the species from excavating channels; modifying ditches, cuts, and levees to encourage tidal circulation; and scalping higher elevation areas to create marsh plains. Potential impacts from Environmental Commitment 11 could include direct mortality to larvae and adults resulting from the implementation of recreation trail construction in grassland in CZ 1 and from grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. AMM37 would ensure that new trails in vernal pool complexes be sited at least 250 feet from wetland features, or closer if site-specific information indicates that local watershed surrounding a vernal pools is not adversely affected. Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control, though some of these methods would be restricted in areas where rare plants occur and in critical habitat for vernal pool species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range, and therefore result in significant impacts on delta green ground beetle. Implementation of Mitigation Measure BIO-42, *Avoid Impacts on Delta Green Ground Beetle and its Habitat*, would reduce these potential impacts to a less-than-significant level.

Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat

As part of the design of recreational trails in CZ 1, the development of tidal restoration plans, and site-specific management plans on protected grasslands in the area of Jepson Prairie, the project proponents will implement the following measures to avoid effects on delta green ground beetle.

- If recreational trail construction and/or habitat restoration or protection is planned for the lands adjacent to Calhoun Cut and noncultivated lands on the western side of Lindsey Slough, these area will be evaluated by a USFWS approved biologist for potential delta green ground beetle habitat (large playa pools, or other similar aquatic features, with low growing vegetation or bare soils around the perimeter). The biologist will have previous experience with identifying suitable habitat requirements for delta green ground beetle.
- Any suitable habitat identified by the biologist (with previous experience with delta green ground beetle) within the species current range will be considered potentially occupied and

all ground disturbing activities in these areas will be avoided, which for the project area is generally the area west of State Route 113.

- Any other areas identified as suitable habitat outside of the current range of the species will be surveyed by a biologist with previous experience in surveying for and identifying delta green ground beetle. No ground disturbing activities will be implemented in areas identified as occupied by delta green ground beetle.
- Based on the results of the habitat evaluations and surveys, recreational trail construction plans, and site-specific restoration and management plans will be developed so that they don't conflict with the recovery goals for delta green ground beetle in the USFWS's 2005 *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (U.S. Fish and Wildlife Service 2005). Plans will include measures to protect and manage for delta green ground beetle so that they continue to support existing populations or allow for future colonization.

Callippe Silverspot Butterfly

This section describes the effects of Alternative 4A on callippe silverspot butterfly. Suitable habitats are typically in areas influenced by coastal fog with hilltops that support the specie's host-plant, Johnny jump-ups. Preferred nectar flowers used by adults include thistles, blessed milk thistle, and coyote wild mint. Other native nectar sources include hairy false goldenaster, coast buckwheat, mourning bride, and California buckeye. Suitable habitat in the study area is located in CZ 11 in the Cordelia Hills west of I-680 and in the Potrero Hills on the northern edge of Suisun Marsh. The construction, and operations and maintenance of the water conveyance facilities under Alternative 4A would not result in impacts on callippe silverspot butterfly or its habitat. If Cordelia Hills and Potrero Hills are identified for grassland protection opportunities as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* and the subsequent implementation of *Environmental Commitment 11 Natural Communities Enhancement and Management,* could affect callippe silverspot butterfly. Callippe silverspot butterfly has been documented in the western most portion of the project area (CZ 11) in the Cordelia Hills (Solano County Water Agency 2009). Potential habitat for the species (grassy hills with *Viola pedunculata*) is present in the Potrero Hills, but it has not been observed there (EDAW 2005, California Department of Fish and Wildlife 2013). Alternative 4A would protect up to 1,060 acres of grassland, some of which may occur in areas in CZ 11 that contain habitat for callippe silverspot butterfly. As explained below, potential impacts on callippe silverspot would be adverse for NEPA purposes and would be significant for CEQA purposes. Mitigation Measure BIO-43 would reduce the effects under NEPA and reduce the impacts to a less-than-significant level under CEQA.

Table 12-4A-18. Changes in Callippe Silverspot Butterfly Habitat Associated with Alternative 4A (acres)[a]

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	unknown	unknown
TOTAL IMPACTS	**unknown**	**unknown**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-43: Loss or Conversion of Habitat for and Direct Mortality of Callippe Silverspot Butterfly

Alternative 4A environmental commitments could result in the conversion of habitat and/or direct mortality to callippe silverspot butterfly. Only one environmental commitment was identified as potentially affecting Callippe silverspot butterfly, *Environmental Commitment 11 Natural Communities Enhancement and Management*, which could result in the disturbance of callippe silverspot butterfly habitat if such areas are acquired as part of grassland protection under *Environmental Commitment 3 Natural Communities Protection and Restoration*. Further discussion of this potential effect is provided below and NEPA and CEQA conclusions follow.

Up to 1,060 acres of grasslands would be protected in the project area, some of which may occur in CZ 11. If areas chosen for protection include Cordelia Hills or Potrero Hills, where there is known and potential habitat, respectively, then grassland enhancement and management actions could affect the callippe silverspot butterfly. Potential effects from Environmental Commitment 11 could include the loss of larval host and nectar sources and direct mortality to larvae and adults from the installation of artificial nesting burrows and structures and the implementation of grassland management techniques, which may include livestock grazing, prescribed burning, and mowing. In addition to these grassland management actions, Environmental Commitment 11 also includes guidelines and techniques for invasive plant control, which may include manual control (hand-pulling and digging), mechanical control (large equipment), and chemical control. Several of the preferred nectar sources are thistles, some of which have been identified by the California Invasive Plant Council as having limited to moderate ecological impacts (California Invasive Plant Council 2006).

***NEPA Effects*:** The protection of 1,060 acres of grassland some of which may occur within CZ 11 could benefit callippe silverspot butterfly if these protected areas include occupied and potential habitat on the hill tops in Cordelia Hills and Potrero Hills. However, the management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and Management* also has a potential to adversely affect this species. Direct mortality and/or the removal of larval host plants and nectar sources for adults would be an adverse effect under NEPA. Implementation of Mitigation Measure BIO-43, *Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat*, would ensure the effect is not adverse under NEPA.

CEQA Conclusion: If grasslands within the Cordelia Hills and Potrero Hills are protected as part of *Environmental Commitment 3 Natural Communities Protection and Restoration* then the subsequent management of these grasslands according to *Environmental Commitment 11 Natural Communities Enhancement and Management* has a potential to affect this species. These actions could result in adverse effects through habitat modification and a possible reduction in the number of the species or restrict its range and would therefore result in significant impact on the species under CEQA. However, callippe silverspot butterfly could benefit from the protection of occupied and potential habitat for the species with the implementation of Mitigation Measure BIO-43, which would avoid and minimize effects from management actions and thus reduce the potential impact to a less-than-significant level under CEQA.

Mitigation Measures BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat

As part of the development of site-specific management plans on protected grasslands in the Cordelia Hills and/or Potrero Hills, project proponents will implement the following measures to avoid and minimize the loss of callippe silverspot habitat.

- Hilltops in Cordelia Hills and Potrero Hills will be surveyed for callippe silverspot larval host plants (Johnny jump-ups) by a biologist familiar with identifying this plant species. These surveys should occur during the plant's blooming period (typically early January through April)
- If larval host plants are present, then presence/absence surveys for callippe silverspot butterfly larvae will be conducted according to the most recent USFWS approved survey methods by a biologist with previous experience in surveying for and identifying callippe larvae and/or signs of larval presence. These surveys should be conducted prior to the adult flight season, which usually starts in mid-May.
- If larvae are detected then no further surveys are necessary. If larvae are not detected then surveys for adults will be conducted by a biologist familiar with surveying for and identifying callippe silverspot. Surveys typically start in mid-May and continue weekly for 8 to 10 weeks.
- If callippe silverspot butterflies are detected, then the site-specific management plans will be written to include measures to protect and manage for larval host plants and nectar sources so that they continue to support existing populations and/or allow for future colonization. Mapping of both larval host plants and nectar sources will be incorporated into the management plans.

California Red-Legged Frog

Modeled California red-legged frog habitat in the study area is restricted to freshwater aquatic and grassland habitat, and immediately adjacent cultivated lands along the study area's southwestern edge in CZ 7, CZ 8, CZ 9, and CZ 11. Pools in perennial and seasonal streams and stock ponds provide potential aquatic habitat for this species. While stock ponds are underrepresented as a modeled habitat, none is expected to be affected by project actions.

Alternative 4A would result in both temporary and permanent losses of California red-legged frog modeled habitat as indicated in Table 12-4A-19. Factors considered in assessing the value of affected habitat for the California red-legged frog, to the extent that information is available, are presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. The study area represents the extreme eastern edge of the species' coastal range, and species' occurrences are reported only from CZ 8 and CZ 11.

Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the California red-legged frog.

- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).

- Protect 647 acres of grassland in the Byron Hills area (Environmental Commitment 3, Resource Restoration and Performance Principle G10).
- Protect 150 acres and restore 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitment 3, Environmental Commitment 9, and Resource Restoration and Performance Principle VP/AW1) with the grassland portions expected to benefit California red-legged frog.
- Increase burrow availability for burrow-dependent species in grasslands surrounding all suitable aquatic habitat including stock ponds and vernal pool/alkali seasonal wetland complexes (Resource Restoration and Performance Principles G5, VP/AW6).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in protected grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs to reduce potential effects, impacts on California red-legged frog would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-19. Changes in California Red-Legged Frog Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic	1	0
	Upland	36	32
Total Impacts Water Conveyance Facilities		**37**	**32**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic	0	0
	Upland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**37**	**32**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-44: Loss or Conversion of Habitat for and Direct Mortality of California Red-Legged Frog

Alternative 4A water conveyance facilities construction and environmental commitments would result in the permanent and temporary loss combined of up to 1 acre of modeled aquatic habitat and 68 acres of modeled upland habitat for California red-legged frog (Table 12-4A-19). Construction activities associated with the water conveyance facilities, including operation of construction equipment, could result in permanent and temporary effects on, as well as injury and mortality of, California red-legged frogs. In addition, natural enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could degrade or eliminate California red-legged frog habitat including injury and mortality of California red-legged frogs. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A would result in the permanent loss of up to 1 acre of aquatic habitat and 36 acres of upland habitat for California red-legged frog in CZ 8 (Table 12-4A-19). Permanent effects would be associated with RTM, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California red-legged frog (Table 12-4A-19). Although there are no California red-legged frog occurrences that overlap with the water conveyance facilities construction footprint there are a number of occurrences approximately 0.5 mile to the west of Clifton Court Forebay.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of 647 acres of grassland, protection of 150 acres and restoration of 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands, and protection and restoration of 6 acres of aquatic habitat would benefit California red-legged frog. Activities associated with natural communities enhancement and management in protected California red-legged frog habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects on, and injury or mortality of, California red-legged frogs. These effects would be avoided and minimized with implementation of the AMMs discussed below. Herbicides would only be used in California red-legged frog habitat in accordance with the written recommendation of a licensed, registered pest control advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California red-legged frog. *AMM14 California Red-Legged Frog* would be implemented to ensure that California red-legged frog upland and aquatic habitats are avoided, as described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

- An unknown number of acres of upland cover and dispersal habitat for the California red-legged frog could be removed as a result of constructing trails and associated recreational facilities. Passive recreation in the reserve system could result in trampling and disturbance of egg masses in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, AMM37 Recreation requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California red-legged frog are expected to be minimal.

- Critical habitat: Several environmental commitments would be implemented in California red-legged frog habitat and designated critical habitat in CZ 8 and CZ 11. Approximately 2,460 acres of designated critical habitat for the California red-legged frog overlaps with the study area along the western edge of CZ 11 in critical habitat unit SOL-1. An additional 862 acres of designated critical habitat is also present along the western edge of CZ 8 in critical habitat unit ALA-2. Environmental commitments to protect and enhance grassland habitat for covered species, including California red-legged frog in CZ 8 could include acquisition and enhancement of designated critical habitat for the California red-legged frog and California tiger salamander. Any habitat enhancement actions for these species in designated critical habitat are expected to enhance the value of any affected designated critical habitat for conservation of California red-legged frog. These actions would result in an overall benefit to California red-legged frog within the study area through protection and management of grasslands with associated intermittent stream habitat and through restoration of vernal pool complex habitat and its associated grassland habitat.

- Operations and maintenance: Ongoing water conveyance facilities operation and maintenance is expected to have little if any adverse effect on the California red-legged frog. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic postconstruction disturbances that could affect California red-legged frog use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California red-legged frogs if present in work sites. Implementation environmental commitments and AMM1–AMM6, AMM10, AMM14, and AMM37, would reduce these effects.
- Injury and direct mortality: Construction activities associated with the water conveyance facilities, stock pond and vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California red-legged frogs. Breeding, foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California red-legged frog. Frogs occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating frogs outside of the construction area as described in AMM1–AMM6, AMM10, AMM14, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are approximately 159 acres of modeled aquatic habitat and 7,766 acres of modeled upland habitat for California red-legged frog in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 1 acre of aquatic habitat and 68 acres of upland habitat for California red-legged frog (less than 1% of the total aquatic habitat and total upland habitat in the study area).

These effects would result from construction of the water conveyance facilities. The 1 acre of aquatic habitat that would be permanently lost is not known to be used for breeding. Most of the California red-legged frog upland habitat that would be removed consists of naturalized grassland or cultivated land in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay. The removed upland cover and dispersal habitat is within 0.5 mile of a cluster of known California red-legged frog occurrences to the west. However, this habitat consists mostly of cultivated lands and small patches of grasslands, and past and current surveys in this area have not found any evidence that this habitat is being used (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS).

With full implementation of Alternative 4A at least 647 acres of grassland would be protected, 150 acres of vernal pool/alkali seasonal wetland complexes with associated grasslands would be protected and 34 acres would be restored, and up to 6 acres of aquatic habitat would be protected and restored in the greater Byron Hills in CZ 8. Protection of grassland in CZ 8 west of Byron Highway would benefit the California red-legged frog by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas. Six acres of ponds in the grasslands would also be protected to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California red-legged frogs. Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in Environmental Commitment 11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California red-legged frogs. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This would ensure that California red-legged frog upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of nontidal wetlands and 2:1 for protection of grassland habitats. Using these ratios would indicate that 1 acre of aquatic habitat should be restored, 1 acre of aquatic habitat should be protected, and 136 acres of grassland should be protected for California red-legged frog.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM10 Restoration of Temporarily Affected Natural Communities, AMM14 California Red-Legged Frog, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6, and AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on California red-legged frog habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, AMM14, and AMM37, which would be in place throughout the construction period, the effects of Alternative 4A as a whole on California red-legged frog would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on California red-legged frog habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and

Performance Principles L2, L3, VP/AW1, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, AMM14, and AMM37, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on California red-legged frog would be less than significant.

Impact BIO-45: Indirect Effects of Alternative 4A on California Red-Legged Frog

Noise and visual disturbance outside the project footprint but within 500 feet of construction activities are indirect effects that could temporarily affect the use of California red-legged frog habitat, all of which is upland cover and dispersal habitat. The areas to be affected are near Clifton Court Forebay, and no California red-legged frogs were detected during recent surveys conducted by DWR in this area (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS).

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California red-legged frog habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids also could result in the subsequent loss of California red-legged frog if these materials enter the aquatic system. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California red-legged frog.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM14, and AMM37 as part of implementing Alternative 4A would avoid the potential for adverse effects on California red-legged frogs, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California red-legged frogs, or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on California red-legged frog.

CEQA Conclusion: Indirect effects from environmental commitment operations and maintenance, as well as construction-related noise and visual disturbances, could impact California red-legged frog in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California red-legged frog or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California red-legged frog habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM14, and AMM37, Alternative 4A construction, operation, and maintenance would avoid the potential for substantial adverse effects on California red-legged frog, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California red-legged frogs. The indirect effects of Alternative 4A would have a less-than-significant impact on California red-legged frogs.

California Tiger Salamander

Modeled California tiger salamander habitat in the study area contains two habitat types: terrestrial cover and aestivation habitat, and aquatic breeding habitat and is restricted to CZ 1, CZ 2, CZ 4, CZ 5, CZ 7, CZ 8, and CZ 11 (Figure 12-14). Modeled terrestrial cover and aestivation habitat contains all grassland types and alkali seasonal wetland with a minimum patch size of 100 acres and within a geographic area defined by species records and areas most likely to support the species. Patches of grassland that were below the 100-acre minimum patch size but were contiguous with grasslands outside of the study area boundary were included. Modeled aquatic breeding habitat for the California tiger salamander includes vernal pools and seasonal and perennial ponds.

California tiger salamander occurs within the study area in CZ 8 west of Clifton Court Forebay and in CZ 11 in the Potrero Hills (Figure 12-14). Potential habitat exists in vernal pool habitats in Yolo and Solano Counties (CZs 1, 2, and 3) west of Liberty Island and in the vicinity of Stone Lakes and the Cosumnes River Preserve in Sacramento County (CZ 4). DWR found California tiger salamander west of Clifton Court Forebay in the same vicinity as several of the CNNDB (California Department of Fish and Wildlife 2013) records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS). There is also a small, isolated population near Manteca, south of Highway 120 in CZ 7.

Construction and restoration associated with Alternative 4A would result in temporary and permanent losses of upland habitat that California tiger salamander uses for cover and dispersal (Table 12-4A-20). Potential aquatic habitat for this species would not be affected. Factors considered in assessing the value of affected habitat for California tiger salamander, to the extent that information is available, include presence of limiting habitat (aquatic breeding habitat), known occurrences and clusters of occurrences, proximity of the affected habitat to existing protected lands, and the overall degraded or fragmented nature of the habitat. While environmental commitments implemented in other CZs could have potential effects on California tiger salamander, those activities in CZ 8 and CZ 11 are considered to have a proportionately larger effect due to their closer proximity to known occurrences of the species.

Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the California tiger salamander (see Chapter 3, *Conservation Strategy*, of the Draft EIR/EIS).

- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect 647 acres of grassland in the Byron Hills area in CZ 8 (Environmental Commitment 3, Resource Restoration and Performance Principle G10).
- Protect 150 acres and restore 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitment 3, Environmental Commitment 9, and Resource Restoration and Performance Principle VP/AW1).
- Increase burrow availability for burrow-dependent species in grasslands surrounding all suitable aquatic habitat including stock ponds and vernal pool/alkali seasonal wetland complexes (Resource Restoration and Performance Principles G5, VP/AW6).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in protected grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for

covered amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).

- Increase the size and connectivity of protected vernal pool complex within the project area and increase connectivity with protected vernal pool complex adjacent to the project area (Resource Restoration and Performance Principle VP/AW3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on California tiger salamander would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-20. Changes in California Tiger Salamander Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic	0	0
	Upland	29	32
Total Impacts Water Conveyance Facilities		**29**	**32**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic	0	0
	Upland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**29**	**32**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-46: Loss or Conversion of Habitat for and Direct Mortality of California Tiger Salamander

Alternative 4A would result in the permanent and temporary loss combined of up to 61 acres of modeled upland habitat for California tiger salamander (Table 12-4A-20). There would be no effects on aquatic habitat. Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM. In addition, natural enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could degrade or eliminate California tiger salamander habitat including injury and mortality of California tiger salamanders. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities, including transmission lines, would result in the permanent loss of 29 acres of upland habitat for California tiger salamander habitat, primarily in CZ 8 (Table 12-4A-20). Permanent effects would be associated with RTM, grading, paving, excavating, extension and installation of cross culverts, installation of structural hardscape, and installation and relocation of utilities. Construction-related effects would temporarily disturb 32 acres of upland habitat for the California tiger salamander (Table 12-4A-20). There is one California tiger salamander occurrence just south of the City of Byron that overlaps with the area of temporary effects. The area that would be affected by conveyance facilities construction is south of Clifton Court

Forebay, where modeled California tiger salamander habitat is of relatively low value in that it consists of fragmented patches of primarily terrestrial habitat surrounded by actively cultivated lands. The highest concentration of California tiger salamander occurrences are in CZ 8 and west of the conveyance facilities alignment, while lands to the east consist primarily of actively cultivated lands that are not suitable for the species. Habitat loss in this area is not expected to contribute to habitat fragmentation or impede important California tiger salamander dispersal.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of 647 acres of grassland, protection of 150 acres and restoration of 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands, and protection and restoration of up to 6 acres of aquatic habitat would benefit California tiger salamander. Habitat enhancement- and management-related activities in protected California tiger salamander habitats would result in overall improvements to and maintenance of California tiger salamander habitat values. Activities associated with natural communities enhancement and management in protected California tiger salamander habitat, such as ground disturbance or herbicide use to control nonnative vegetation, could result in local adverse habitat effects and injury or mortality of California tiger salamander and disturbance effects if individuals are present in work sites. Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 would reduce these effects. Herbicides would only be used in California tiger salamander habitat in accordance with the written recommendation of a licensed, registered Pest Control Advisor and in conformance with label precautions and federal, state, and local regulations in a manner that avoids or minimizes harm to the California tiger salamander.

- An unknown number of acres of terrestrial cover and aestivation habitat for the California tiger salamander could be affected as a result of constructing trails and associated recreational facilities in CZ 8. Passive recreation in the reserve system could result in trampling and disturbance of eggs and larvae in water bodies, degradation of water quality through erosion and sedimentation, and trampling of sites adjacent to upland habitat used for cover and movement. However, *AMM37 Recreation* requires protection of water bodies from recreational activities and requires trail setbacks from wetlands. With these restrictions, recreation related effects on California tiger salamander are expected to be minimal.

- Critical habitat: Approximately 1,781 acres of designated Critical Habitat Unit 2, Jepson Prairie Unit, for California tiger salamander overlap the study area in CZ 1. While this area is located within the Cache Slough Complex, it is not expected to be affected by project restoration actions.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on the California tiger salamander. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect California tiger salamander use of the surrounding habitat. Operation of maintenance equipment, including vehicle use along transmission corridors in CZ 8, could also result in injury or mortality of California tiger salamanders if present in work sites. These effects, however, would be minimized with implementation of the California tiger salamander measures described in AMM1–AMM6, AMM10, AMM13, and AMM37.

- Injury and direct mortality: Construction activities associated with the water conveyance facilities, stock pond and vernal pool complex restoration, and habitat and management enhancement-related activities, including operation of construction equipment, could result in injury or mortality of California tiger salamanders. Foraging, dispersal, and overwintering behavior may be altered during construction activities, resulting in injury or mortality of California tiger salamander if the species is present. Salamanders occupying burrows could be trapped and crushed during ground-disturbing activities. Degradation and loss of estivation habitat is also anticipated to result from the removal of vegetative cover and collapsing of burrows. Injury or mortality would be avoided and minimized through implementation of seasonal constraints and preconstruction surveys in suitable habitat, collapsing unoccupied burrows, and relocating salamanders outside of the construction area as described in AMM1–AMM6, AMM10, AMM13, and AMM37.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

There are approximately 8,273 acres of aquatic and 29,459 acres of upland modeled habitat for California tiger salamander in the study area. Alternative 4A as a whole would result in the permanent loss of, and temporary effects combined on 61 acres of upland habitat for California tiger salamander for the term of the plan (less than 1% of the total upland habitat in the study area). These effects would result from construction of the water conveyance facilities. There would be no effects on aquatic habitat.

With full implementation of Alternative 4A at least 647 acres of grassland would be protected, 150 acres of vernal pool/alkali seasonal wetland complexes with associated grasslands would be protected and 34 would be restored, and up to 6 acres of aquatic habitat would be protected and restored in the greater Byron Hills in CZ 8. Protection of grassland in CZ 8 west of Byron Highway would benefit the California tiger salamander by providing habitat in the portion of the study area with the highest long-term conservation value for the species based on known species occurrences and large, contiguous habitat areas. Six acres of ponds in the grasslands would also be protected or restored to provide aquatic habitat for this species, and the surrounding grassland would provide dispersal and aestivation habitat. Aquatic features in the protected grasslands in CZ 8 would be maintained and enhanced to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding California tiger salamanders. Additionally, livestock exclusion from streams and ponds and other measures would be implemented as described in Environmental Commitment 11 to promote growth of aquatic vegetation with appropriate cover characteristics favorable to California tiger salamanders. Lands protected in CZ 8 would connect with lands protected under the *East Contra Costa County HCP/NCCP* and the extensive Los Vaqueros Watershed lands, including grassland areas supporting this species. This would ensure that California tiger salamander upland and associated aquatic habitats would be protected and enhanced in the largest possible patch sizes adjacent to occupied habitat within and adjacent to the study area.

Typical NEPA and CEQA project-level mitigation ratios of 2:1 for protected grassland habitats would indicate that 122 acres of grassland should be protected for California tiger salamander to mitigate the project losses.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged*

Material, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM13 California Tiger Salamander, and AMM37 Recreation*. These AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6, and AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on California tiger salamander habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW3, VP/AW6, G2, G7, and G10, and guided by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on California tiger salamander would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on California tiger salamander habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, L3, VP/AW1, VP/AW3, VP/AW6, G2, G7, and G10, and by AMM1–AMM6, AMM10, AMM13, and AMM37, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on California tiger salamander would be less than significant.

Impact BIO-47: Indirect Effects of Alternative 4A on California Tiger Salamander

Indirect effects could occur outside of the construction footprint but within 500 feet of California tiger salamander habitat. Activities associated with conveyance construction, restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances with localized effects on California tiger salamander and its habitat, and temporary noise and visual disturbances. Most of the areas indirectly affected are associated with the construction of Byron Forebay in CZ 8.

Maintenance and refueling of heavy equipment could result in the inadvertent release of sediment and hazardous substances into species habitat. Increased sedimentation could reduce the suitability of California tiger salamander habitat downstream of the construction area by filling in pools and smothering eggs. Accidental spills of toxic fluids into the aquatic system could result in the subsequent loss of California tiger salamander habitat. Hydrocarbon and heavy metal pollutants associated with roadside runoff also have the potential to enter the aquatic system, affecting water quality and California tiger salamander.

NEPA Effects: Implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 under Alternative 4A would avoid or minimize the potential for adverse effects on California tiger salamanders, either indirectly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of California tiger salamanders or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on California tiger salamander.

CEQA Conclusion: Indirect effects resulting from project operations and maintenance as well as construction-related noise and visual disturbances could impact California tiger salamander in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact California tiger salamander or its prey. The inadvertent discharge of sediment or excessive dust adjacent to California tiger salamander habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM6, AMM10, AMM13, and AMM37 as part of Alternative 4A, the project would avoid the potential for substantial adverse effects on California tiger salamander, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of California tiger salamanders. The indirect effects of Alternative 4A would have a less-than-significant impact on California tiger salamander.

Impact BIO-48: Periodic Effects of Inundation of California Tiger Salamander Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on California tiger salamander.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Giant Garter Snake

The habitat model used to assess effects for the giant garter snake is based on aquatic habitat and upland habitat. Modeled aquatic habitat is composed of tidal perennial aquatic, tidal freshwater perennial emergent wetland, nontidal freshwater emergent wetland, and nontidal perennial aquatic natural communities; rice fields; and artificial canals and ditches. Modeled upland habitat is composed of all nonwetland and nonaquatic natural communities (primarily grassland and cropland) within 200 feet of modeled aquatic habitat features. The modeled upland habitat is ranked as high-, moderate-, or low-value based on giant garter snake associations between vegetation and cover types (U.S. Fish and Wildlife Service 2012) and historical and recent occurrence records (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS), and presence of features necessary to fulfill the species' life cycle requirements. Modeled habitat is expressed in acres for aquatic and upland habitats, and in miles for linear movement corridors in aquatic habitat. Other factors considered in assessing the value of affected habitat for the giant garter snake, to the extent that information is available, are proximity to conserved lands and recorded occurrences of the species, proximity to giant garter snake subpopulations (Yolo Basin/Willow Slough and Coldani Marsh/White Slough) in the study area that are identified in the draft recovery plan for this species (U.S. Fish and Wildlife Service 1999b), and contribution to connectivity between giant garter snake subpopulations.

Construction and restoration associated with Alternative 4A would result in both temporary and permanent losses of giant garter snake modeled habitat as indicated in Table 12-4A-21. Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the giant garter snake.

- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).

- Protect 1,060 acres and restore 1,070 acres of grassland (Environmental Commitment 3 and Environmental Commitment 8).
- Protect 843 acres of high-value upland giant garter snake habitat adjacent to suitable aquatic habitat (Environmental Commitment 3, Resource Restoration and Performance Principle GGS4).
- Restore 255 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, with suitable habitat characteristics for giant garter snake and western pond turtle in CZ 4 and CZ 5 (Environmental Commitment 10).
- Protect 11,870 acres of cultivated lands that provide suitable habitat for covered and other native wildlife species, of which 255 acres of rice land or equivalent-value habitat would be protected for giant garter snake and connected to the restored 255 acres of aquatic habitat in nontidal marsh for giant garter snake in CZ 4 or CZ 5 (Environmental Commitment 3, Resource Restoration and Performance Principles GGS1 and GGS3).
- Protect and improve habitat linkages that allow terrestrial species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2)
- Target cultivated land conservation to provide connectivity between other conservation lands (Resource Restoration and Performance Principle CL2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).
- Protect giant garter snakes on restored and protected nontidal marsh and adjacent uplands from incidental injury or mortality by establishing 200-foot buffers between protected giant garter snake habitat and roads (other than those roads primarily used to support adjacent cultivated lands and levees). Establish giant garter snake reserves at least 2,500 feet from urban areas or areas zoned for urban development (Resource Restoration and Performance Principle GGS2).
- Create connections from the Coldani Marsh/White Slough subpopulation to other areas in the giant garter snake's historical range in the Stone Lakes vicinity by protecting 255 acres of rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in CZ 4 and/or CZ 5. Any portion of the 255 acres may consist of muted tidal freshwater emergent wetland and may overlap with the 160 acres of tidally restored freshwater emergent wetland if it meets specific giant garter snake habitat criteria (Resource Restoration and Performance Principle GGS5).

As explained below, with the restoration or protection of these amounts of habitat, in addition to the implementation of AMMs, impacts on giant garter snake would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-21. Changes in Giant Garter Snake Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type [b]	Permanent	Temporary
Water Conveyance Facilities	Aquatic (acres)	217	120
	Upland (acres)	455	193
	Aquatic (miles)	13	7
Total Impacts Water Conveyance Facilities (acres)		**672**	**313**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic (acres)	0	0
	Upland (acres)	0	0
	Aquatic (miles)	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a] (acres)		0	0
TOTAL IMPACTS (acres)		**672**	**313**

[a] See discussion below for a description of applicable environmental commitments.
[b] Aquatic acres represent tidal and nontidal habitat combined, and upland acres represent low-, moderate-, and high-value acreages combined.

Impact BIO-49: Loss or Conversion of Habitat for and Direct Mortality of Giant Garter Snake

Alternative 4A would result in the permanent and temporary loss combined of up to 337 acres of modeled aquatic habitat (tidal and nontidal combined), up to 648 acres of modeled upland habitat, and up to 20 miles of channels providing aquatic movement habitat for the giant garter snake (Table 12-4A-21). Project measures that would result in these losses are water conveyance facilities and transmission line construction, geotechnical investigation, and establishment and use of RTM. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities would degrade or eliminate giant garter snake habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 672 acres of modeled giant garter snake habitat, composed of 217 acres of aquatic habitat and 455 acres of upland habitat (Table 12-4A-21). The 455 acres of upland habitat that would be removed for the construction of the conveyance facilities consists of 130 acres of high-, 292 acres of moderate-, and 33 acres of low-value habitat. In addition, approximately 13 miles of channels providing giant garter snake movement habitat would be removed as a result of conveyance facilities construction. Development of the water conveyance facilities would also result in the temporary removal of up to 120 acres of giant garter snake aquatic habitat and up to 193 acres of adjacent upland habitat in areas near construction and geotechnical investigation in CZ 5 and CZ 6 (see Table 12-4A-21 and Terrestrial Biology Map Book). In addition, approximately 7 miles of channels providing giant garter snake movement habitat would be temporarily removed as a result of conveyance facilities construction. There are three giant garter snake occurrences in the vicinity of the water conveyance facilities construction footprint in Snodgrass Slough and Middle River.

Most of the habitat to be lost is in CZ 6 on Mandeville Island. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 4A construction locations. Water facilities construction and operation is expected to have low to moderate potential for adverse effects on giant garter snake aquatic habitat on Mandeville Island because it is not located near or between populations identified in the draft recovery plan. An estimated 301 of the 672 acres would be lost as storage areas for reusable tunnel material, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored: while this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. Furthermore, the amount of storage area needed for reusable tunnel material is flexible and the footprint used in the effects analysis is based on a worst case scenario: the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of giant garter snake habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available giant garter snake habitat and are expected to result in overall improvements to and maintenance of giant garter snake habitat values. These effects cannot be quantified, but are expected to be minimal because vegetation removal would occur around existing infrastructure and roads where giant garter snake are not as likely to be present. Any of these minor impacts would be avoided and minimized by the AMMs listed below.

  Passive recreation in the reserve system could result in human disturbance of giant garter snakes basking in upland areas and compaction of upland burrow sites used for brumation. However, AMM37, described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, requires setbacks for trails in giant garter snake habitat. With this measure in place, recreation-related effects on giant garter snake are expected to be minimal.

- Operations and maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect giant garter snake use of the surrounding habitat in the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 3, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be reduced by AMMs and environmental commitments as described below.

- Injury and direct mortality: Construction vehicle activity may cause injury or mortality of the giant garter snake. If snakes reside where activities take place (most likely in the vicinity of the Coldani Marsh/White Slough subpopulation [CZ 4]), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of giant garter snakes. This risk is highest from late fall through early spring, when the snakes are dormant. Increased vehicular traffic associated construction and restoration could contribute to a higher incidence of road kill. However, preconstruction surveys would be implemented after the project planning phase and prior to any ground-disturbing activity. Any disturbance to suitable aquatic and upland sites in or near the project footprint would be avoided to the extent feasible, and the loss of aquatic habitat and grassland vegetation would be minimized through adjustments to project design, as practicable. Construction monitoring and other measures would be implemented to avoid and minimize injury or mortality of this species during construction as described in *AMM16 Giant Garter Snake*.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A environmental commitments that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are approximately 31,281 acres of aquatic and 53,285 acres of upland modeled habitat for giant garter snake in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 337 acres of aquatic habitat and 648 acres of upland habitat for giant garter snake during the term of the plan (1% of the total aquatic and upland modeled habitat in the study area).

With full implementation of Alternative 4A there would be protection of 1,060 acres and restoration of 1,070 acres of grassland, protection of 11,870 acres of cultivated lands, 119 acres of nontidal wetlands, and restoration of 832 acres of nontidal wetlands in the study area. Lands to be protected and restored specifically for the giant garter snake total 1,353 acres (255 acres nontidal marsh, 843 acres of grassland, 255 acres of cultivated lands (rice or habitat of equivalent value in CZ 4, and CZ 5). In addition to the 1,353 acres of high-value habitat targeted specifically for giant garter snake, the protection and restoration of other natural communities is expected to provide additional restoration and protection of garter snake habitat. An unknown number of irrigation and drainage ditches located in cultivated lands and suitable for giant garter snake movement would be maintained and protected within the reserve system, which would include isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands.

Protection and management of cultivated lands (Environmental Commitment 11) would also benefit the giant garter snake by providing connectivity and maintaining irrigation and drainage channels that provide aquatic habitat for the snake. Giant garter snake habitat would be restored and protected specifically to conserve and expand the Coldani Marsh/White Slough subpopulation of the giant garter snake. Protecting and expanding existing giant garter snake subpopulations, and providing connectivity between protected areas, is considered the most effective approach to giant garter snake conservation in the study area. The Coldani Marsh/White Slough and Yolo Basin/Willow Slough subpopulations are the only known subpopulations of giant garter snakes in the study area and are identified as important for the recovery of the species in the draft recovery plan for the species (U.S. Fish and Wildlife Service 1999b). Implementation actions that target giant garter snake habitat would focus on these two important subpopulations.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 337 acres of aquatic habitat should be restored, 337 acres of aquatic habitat should be protected, and 1,296 acres of upland habitat should be protected for giant garter snake.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural*

Communities, AMM16 Giant Garter Snake, and AMM37 Recreation. All of these AMMs include elements that avoid or minimize the risk of activities affecting habitats and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6, and AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on giant garter snake would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on giant garter snake habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles GGS1-GGS5, L2, L3, CL1, and CL2, and guided by AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on giant garter snake would not result in a substantial reduction in numbers or a restriction in the range of giant garter snakes. Therefore, the effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50: Indirect Effects of Alternative 4A on Giant Garter Snake

Construction activities outside the project footprint but within 200 feet of construction associated with water conveyance facilities, habitat restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized effects on giant garter snake habitat, and temporary noise and visual disturbances. These potential effects would be minimized or avoided through AMM1–AMM7, AMM10, AMM16, and AMM37, which would be in effect during all project activities.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect giant garter snake or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative effect on the species or its prey. AMM1–AMM6 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on giant garter snake or its prey.

Covered activities have the potential to exacerbate bioaccumulation of mercury in covered species that feed on aquatic species, including giant garter snake. The operational impacts of new flows under water conveyance facilities were analyzed to assess potential effects on mercury concentration and bioavailability. Results indicated that changes in total mercury levels in water and fish tissues due to future operational conditions were insignificant (see Draft BDCP Appendix 5.D, *Contaminants*).

Marsh (tidal and nontidal) restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes. Thus, restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect giant garter snake, which feeds on small fishes, tadpoles, and small frogs, especially introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Along with minimization and mitigation measures and adaptive management and monitoring, *Environmental Commitment 12 Methylmercury Management* is expected to reduce the amount of methylmercury resulting from the restoration of natural communities.

Extant populations of giant garter snake within the study area are known only from the upper Yolo Basin and at the Coldani Marsh/White Slough area. Davis et al. (2007) found mercury concentrations in fish at White Slough (and the central Delta in general) to be relatively low compared to other areas of the Delta. No restoration activities involving flooding (and subsequent methylation of mercury) are planned within the known range of the Coldani Marsh/White Slough giant garter snake population. Yolo Basin is where some of the highest concentrations of mercury and methylmercury have been documented (Foe et al. 2008); however, there would be no construction or restoration in this area. Effects from exposure to methylmercury may include decreased predator avoidance, reduced success in prey capture, difficulty in shedding, and reduced ability to move between shelter and foraging or thermoregulation areas (Wylie et al. 2009). The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Measures described in *Environmental Commitment 12 Methylmercury Management* include provisions for project-specific Mercury Management Plans. Along with avoidance and minimization measures and adaptive management and monitoring, Environmental Commitment 12 is expected to reduce the effects of methylmercury resulting from natural communities and floodplain restoration on giant garter snake.

NEPA Effects: Implementation of the AMMs listed above and *Environmental Commitment 12 Methylmercury Management* as part of implementing Alternative 4A would avoid the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. These AMMs and Environmental Commitment would also avoid and minimize effects that could substantially reduce the number of giant garter snakes or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on giant garter snake.

CEQA Conclusion: Indirect effects from project operations and maintenance as well as construction-related noise and visual disturbances could impact giant garter snake in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could impact giant garter snake or its prey. The inadvertent discharge of sediment or excessive dust adjacent to giant garter snake habitat could also have a negative impact on the species or its prey. With implementation of AMM1–AMM7, AMM10, AMM16, and AMM37 and *Environmental Commitment 12 Methylmercury Management* as part of Alternative 4A construction, operation and maintenance, the project would avoid or minimize the potential for substantial adverse effects on giant garter snakes, either indirectly or through habitat modifications. Therefore, the indirect effects of Alternative 4A would have a less-than-significant impact on giant garter snakes.

Impact BIO-50a: Loss of Connectivity among Giant Garter Snakes in the Coldani Marsh/White Slough Subpopulation, Stone Lakes National Wildlife Refuge, and the Delta

Implementation of Alternative 4A would not introduce a substantial barrier to the movement among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***NEPA Effects*:** Alternative 4A would not adversely affect connectivity among giant garter snakes in the Coldani Marsh/White Slough subpopulation, Stone Lakes National Wildlife Refuge, and the Delta in the study area.

***CEQA Conclusion*:** Alternative 4A would have a less-than-significant impact on connectivity among giant garter snakes in the study area and therefore no mitigation is required.

Impact BIO-51: Periodic Effects of Inundation of Giant Garter Snake Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on giant garter snake.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Pond Turtle

The habitat model used to assess effects on the western pond turtle is based on aquatic and upland nesting and overwintering habitat. Further details regarding the habitat model, including assumptions on which the model is based, are provided in Draft BDCP Appendix 2.A, *Species Accounts*, Section 2A.29, *Western Pond Turtle.* The model quantified two types of upland nesting and overwintering habitat, including upland habitat in natural communities as well as upland in agricultural areas adjacent to aquatic habitats. Both of these upland habitat types are combined for this analysis. Factors considered in assessing the value of affected aquatic habitat are natural community type and availability of adjacent nesting and overwintering habitat. The highest value aquatic habitat types in the study area consist of nontidal freshwater perennial emergent wetlands and ponds adjacent to suitable nesting and overwintering habitat (Patterson pers. comm.). Less detail is provided on effects on dispersal habitat because, although dispersal habitat is important for maintaining and increasing distribution and genetic diversity, turtles have been known to travel over many different land cover types; therefore, this habitat type is not considered limiting. The value of dispersal habitat depends less on the habitat type itself than on the proximity of that habitat type to high-value aquatic and nesting and overwintering habitat.

Alternative 4A would result in both temporary and permanent losses of western pond turtle modeled habitat, as indicated in Table 12-4A-22. The majority of these losses would take place over an extended period of time as tidal marsh is restored in the study area.

Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles to benefit the western pond turtle.

- Protect 103 acres and restore 251 acres of valley/foothill riparian habitat (Environmental Commitments 3 and 7).
- Protect 119 acres and restore 832 acres of nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will

include suitable habitat characteristics for western pond turtle (Environmental Commitments 3 and 10, Resource Restoration and Performance Principle WPT1).

- Protect 1,060 acres and restore 1,070 acres of grassland (Environmental Commitments 3 and 8).
- Protect up to 6 acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

As explained below, with the restoration and protection of these amounts of habitat, in addition to implementation of AMMs, impacts on western pond turtle would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-22. Changes in Western Pond Turtle Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Aquatic (acres)	264	2,102
	Upland (acres)	286	77
	Aquatic (miles)	7	5
Total Impacts Water Conveyance Facilities (acres)		**550**	**2,179**
Environmental Commitments 4, 6–7, 9–11[a]	Aquatic (acres)	0	0
	Upland (acres)	5	0
	Aquatic (miles)	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a] (acres)		**5**	
TOTAL IMPACTS (acres)		**555**	**2,179**

[a] See discussion below for a description of applicable environmental commitments.

[b] Upland acres represent upland nesting and overwintering habitat acreages combined for both natural communities and agricultural lands adjacent to aquatic habitats.

Impact BIO-52: Loss or Conversion of Habitat for and Direct Mortality of Western Pond Turtle

Alternative 4A would result in the permanent and temporary loss of up to 2,366 acres of aquatic habitat and 368 acres of upland nesting and overwintering habitat (Table 12-4A-22). Activities that would result in the temporary and permanent loss of western pond turtle modeled habitat are conveyance facilities and transmission line construction, geotechnical investigations, and establishment and use of RTM, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western pond turtle habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 264 acres of aquatic habitat and 286 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (Table 12-4A-22). Development of the water conveyance facilities would also result in the temporary removal of up to 2,102 acres of aquatic habitat and 77 acres of upland nesting and overwintering habitat for the western pond turtle in the study area (see Table 12-4A-22). Approximately 7 miles of channels providing western pond turtle movement habitat would be removed and 5 miles would be temporarily disturbed. Permanent effects on an estimated 162 of the total 550 aquatic and upland acres combined and 4 of the 7 miles would be lost as storage areas for RTM, which would likely be moved to other sites for use in levee build-up and restoration. The affected area would likely be restored. Although this effect is categorized as permanent because there is no assurance that the material would eventually be moved, the effect would likely be temporary. Furthermore, the amount of storage area needed for RTM is flexible and the footprint used in the effects analysis is based on a worst case scenario. The actual area to be affected by RTM storage would likely be less than the estimated acreage.

  The majority of the permanent loss of aquatic habitat and upland nesting and overwintering habitat would be near Clifton Court Forebay in CZ 8. Refer to the Terrestrial Biology Map Book for a detailed view of Alternative 4A construction locations. The aquatic habitat in the Clifton Court Forebay area is considered to be of reasonably high-value because it consists of agricultural ditches in or near known species occurrences. The nesting and overwintering habitat that would be lost consists primarily of cultivated lands with some small portion of ruderal grassland habitat. Except for remnant, uncultivated patches, the cultivated lands are not suitable for nesting and overwintering unless left fallow. Construction of the water conveyance facilities would also affect dispersal habitat, which is primarily cultivated lands. Although there are western pond turtle occurrences scattered throughout CZ 3, CZ 4, CZ 5, and CZ 6, this effect is widely dispersed because of the long, linear nature of the pipeline footprint.

  There are four western pond turtle occurrences that overlap with the water conveyance facilities footprint in CZ 2, one occurrence that overlaps with an RTM area on the southern tip of Bouldin Island in CZ 5, and one occurrence that overlaps with an RTM area along Twin Cities Road in CZ 4.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the conversion of approximately 5 acres of upland nesting and overwintering habitat for western pond turtle to tidal marsh. Tidal habitat restoration is expected to change existing salinity and flow conditions rather than lead to complete loss of aquatic habitat. Restoration of tidal flow where habitat consists of the calm waters of managed freshwater ponds and wetlands could have an adverse effect on the western pond turtle. Tidal restoration is likely to create suitable, slow-moving freshwater slough and marsh habitat suitable for western pond turtle. The habitat affected would be in the interior Delta (West Delta and South Delta) which is of low value, consisting of levees and intensively farmed cultivated lands, while the Cache Slough and Cosumnes-Mokelumne ROAs are less intensively farmed and have higher-value habitat for the turtle. Because the estimates of the effect of tidal inundation are based on projections of where restoration may occur, actual effects are expected to be lower because sites would be selected to minimize effects on western pond turtle habitat (see AMM17 in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP).

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of western pond turtle habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available western pond turtle habitat and are expected to result in overall improvements to and maintenance of western pond turtle habitat values. In addition, effects would be avoided and minimized by the AMMs listed below.

- Passive recreation in the reserve system could result in human disturbance of western pond turtles basking in upland areas and compaction of upland burrow sites used for nesting. However, AMM37, described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS, requires setbacks for trails in western pond turtle habitat. With this measure in place, recreation-related effects on western pond turtle are expected to be minimal.
- Operations and maintenance: Ongoing maintenance of facilities is expected to have little if any adverse effect on the western pond turtle. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western pond turtle use where there is suitable habitat in the study area. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized by AMMs and environmental commitments described below.
- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of western pond turtles. If turtles reside where environmental commitments are implemented (most likely in the vicinity of aquatic habitats in the study area), the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or mortality of western pond turtles. However, to avoid injury or mortality, preconstruction surveys would be conducted in suitable aquatic or upland habitat for the western pond turtle, and turtles found would be relocated outside the construction areas, as required by the AMMs listed below.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Based on the habitat model, the study area supports approximately 81,666 acres of aquatic and 28,864 acres of upland habitat for western pond turtle. Alternative 4A as a whole would remove 2,366 acres of aquatic habitat and 368 acres of upland nesting and overwintering habitat for western pond turtle (3% of the total aquatic habitat and 1% of the total upland habitat in the study area).

These effects would result from water conveyance facilities construction (2,366 acres of aquatic and 363 acres of upland habitats), tidal habitat restoration (Environmental Commitment 4, 5 acres of upland habitat). Most of the impacts (2,102 acres) from water conveyance facilities would be temporary in the vicinity of Clifton Court Forebay and are expected to return to suitable aquatic habitat once construction is completed. Therefore the following analysis addresses the permanent loss of 264 acres of aquatic habitat.

Implementation of Alternative 4A as a whole would increase the extent and distribution of high-value aquatic and upland nesting and overwintering habitat for western pond turtle in the study area. The conservation strategy for western pond turtle involves restoration and protection of aquatic and adjacent upland habitat, and establishment of an interconnected reserve system that provides for western pond turtle dispersal. The project proponents have committed to protection and restoration of up to 957 acres of aquatic habitat including 951 acres of nontidal wetland and up to 6 acres of stock ponds. In addition, there would be 354 acres of valley/foothill riparian habitat and 2,130 acres of grasslands habitat. The most beneficial restoration would occur in the 832 acres of freshwater emergent wetland consisting of slow-moving slough and marsh adjacent to protected, undisturbed grassland of which 77 acres would be protected and 77 acres restored with suitable habitat characteristics for western pond turtle. Aquatic features (e.g., ditches and ponds) and adjacent uplands that are preserved and managed as part of the 11,870 acres of protected cultivated lands described above for giant garter snake are also expected to benefit the species and to help offset the loss of aquatic habitat. Additionally, basking platforms would be installed as needed in restored freshwater marsh to benefit the western pond turtle.

Riparian restoration would potentially increase the quantity and value of aquatic and nesting and overwintering habitat. Where riparian vegetation is restored adjacent to slower-moving channels, sloughs, and ponds, downed trees can provide important basking habitat and cover habitat for turtles. Riparian restoration in those more interior portions of Old and Middle Rivers that would be managed for riparian brush rabbit habitat have potential to benefit resident western pond turtles as riparian-adjacent grassland is an important habitat characteristic for the rabbit.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected for western pond would be 1:1 for restoration and 1:1 for protection of aquatic habitats and 2:1 for protection of upland habitats. Using these ratios would indicate that 246 acres of aquatic habitat should be restored, 246 acres of aquatic habitat should be protected, and 736 acres of upland habitat should be protected for western pond turtle. Alternative 4A also contains commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM10 Restoration of Temporarily Affected Natural Communities, and AMM17 Western Pond Turtle*. These AMMs include elements that would avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on western pond turtle would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles WPT1, G2, and CL1, and guided by AMM1–AMM6, AMM10, AMM17, and AMM37, the effects of Alternative 4A as a whole on western pond turtle would not be an adverse effect.

CEQA Conclusion: In the absence of actions to restore and protect habitat, the effects on western pond turtle habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles WPT1, G2, and CL1, and guided by AMM1–AMM6, AMM10, AMM17, and AMM37, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on western pond turtle would be less than significant.

Impact BIO-53: Indirect Effects of Alternative 4A on Western Pond Turtle

Indirect effects on western pond turtle within 200 feet of construction activities could temporarily affect the use of aquatic habitat and upland nesting and overwintering habitat for the western pond turtle. Construction activities outside the construction footprint but within 200 feet of water conveyance facilities, habitat restoration, and ongoing habitat enhancement, as well as operation and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances with localized impacts on western pond turtle habitat, and temporary noise and visual disturbances.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its aquatic prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle aquatic habitat could also have a negative effect on the species or its prey. AMM1–AMM6, and AMM10 would minimize the likelihood of such spills and would ensure measures are in place to prevent runoff from the construction area and potential effects of sediment or dust on western pond turtle or its prey.

***NEPA Effects*:** With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4A, the project would avoid the potential for substantial adverse effects on western pond turtles, either directly or through habitat modifications. These AMMs would also avoid and minimize effects that could substantially reduce the number of western pond turtles or restrict the species range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on western pond turtle.

***CEQA Conclusion*:** Indirect effects resulting from project operations and maintenance as well as construction-related noise and visual disturbances could impact western pond turtle in aquatic and upland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect western pond turtle or its prey. The inadvertent discharge of sediment or excessive dust adjacent to western pond turtle habitat could also have a negative effect on the species or its prey. With implementation of AMM1–AMM6, AMM10, and AMM17 as part of Alternative 4A construction, operation, and maintenance, the Alternative 4A would avoid the potential for substantial adverse effects on western pond turtles, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of western pond turtles. The indirect effects of Alternative 4A would have a less-than-significant impact on western pond turtles.

Impact BIO-54: Periodic Effects of Inundation of Western Pond Turtle Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects on western pond turtle.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Silvery Legless Lizard, San Joaquin Coachwhip, and Blainville's Horned Lizard

This section describes the effects of Alternative 4A on the silvery legless lizard, San Joaquin coachwhip and Blainville's horned lizard (special-status reptiles). The habitat types used to assess effects on silvery legless lizard are limited to inland sand dunes near Antioch (CZ 9 and CZ 10)

(Figure 12-17). There are isolated patches of sandy habitat in the vicinity of Oakley and along the railroad in the East Bay Regional Park Legless Lizard Preserve that are not shown in Figure 12-17 because project mapping was not available at this level of detail. Furthermore, none of these areas would be affected by construction or restoration activities and this species is not discussed any further.

The habitat types used to assess effects on the San Joaquin coachwhip are alkali seasonal wetland complex, grassland, and inland dune scrub west of Byron Highway (CZ 7)and west of Old River and West Canal (CZ 8). The habitat types used to assess effects on the Blainville's horned lizard are the same as those for the whipsnake in CZ 7 and CZ 8. There is also potential habitat for the horned lizard to occur in grassland habitat around Stone Lake (CZ 4). Although the expected range for San Joaquin coachwhip and Blainville's horned lizard extends into the study area, there are no records for either of these species within the study area (California Department of Fish and Wildlife 2013

Construction associated with Alternative 4A environmental commitments would result in both temporary and permanent removal of habitat that special-status reptiles use for cover and dispersal (Table 12-4A-23).

Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit special-status reptiles.

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Resource Restoration and Performance Principle L1).
- Increase native species diversity and relative cover of native plant species, and reduce the introduction and proliferation of nonnative species (Resource Restoration and Performance Principle L3).
- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect 150 acres and restore 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitment 3).
- Protect 1,060 acres and restore 1,070 acres of grassland (Environmental Commitments 3 and 8).

As explained below, with the restoration or protection of these amounts of habitat, in addition to implementation of AMMs, impacts on special-status reptiles would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-23. Changes in Special-Status Reptile Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type[b]	Permanent	Temporary
Water Conveyance Facilities	Grassland	291	89
Total Impacts Water Conveyance Facilities		**291**	**89**
Environmental Commitments 4, 6–7, 9–11[a]	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**291**	**89**

[a] See discussion below for a description of applicable environmental commitments.
[b] Grassland impacts include alkali seasonal wetland complex, grassland, and inland dune scrub natural communities.

Impact BIO-55: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Reptiles

Alternative 4A would result in the permanent and temporary loss of 380 acres of habitat for special-status reptiles (Table 12-4A-23). Water conveyance facilities and transmission line construction, including establishment and use of RTM and geotechnical investigations would cause the loss of special-status reptile habitat. In addition, habitat enhancement and management activities (Environmental Commitment 11), such as ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects for special-status reptiles. For purposes of this analysis, the acres of total effects are considered the same for both San Joaquin coachwhip and Blainville's horned lizard, even though there would be slightly more acres of permanent effect on the San Joaquin coachwhip resulting from water conveyance facilities activities in CZ 4.

In addition to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of special-status reptiles, including the potential crushing of individuals and disruption of essential behaviors. Construction of access roads could fragment suitable habitat, impede upland movements in some areas, and increase the risk of road mortality. Construction activities related to environmental commitments could have similar effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Development of the conveyance facilities would result in the permanent loss of approximately 291 acres of habitat for special-status reptiles in the vicinity of Clifton Court Forebay. Construction-related effects would temporarily disturb 89 acres of suitable habitat for special-status reptiles in the study area. There are no occurrences of either species within the construction footprint for water conveyance facilities.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *Environmental Commitment 11* that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of special-status reptile habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor adverse effects on available special-status reptile habitat and are expected to result in overall improvements to and maintenance of species

habitat values. These effects cannot be quantified, but are expected to be minimal and would be reduced through implementation of Mitigation Measure BIO-55 *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs.*

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status reptiles. Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect special-status reptiles' use of suitable habitat in the study area. These effects, however, would be minimized with implementation of Mitigation Measure BIO-55.
- Injury and direct mortality: Construction vehicles may cause injury to or mortality of special-status reptiles. The operation of equipment for land clearing, construction, operation and maintenance, and restoration, enhancement, and management activities could result in injury or mortality. This risk is highest from late fall through early spring, when special-status reptiles are not as active. Increased vehicular traffic associated with project actions could contribute to a higher incidence of road kill. However, conducting construction during the late-spring through early fall periods when feasible and implementation of Mitigation Measure BIO-55 would avoid and minimize injury or mortality of special-status reptiles during construction.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

Alternative 4A would remove 380 acres of grassland habitat for special-status reptiles as a result of water conveyance facilities.

Effects of water conveyance facilities construction on special-status reptiles would be offset through the project's protection of 1,060 acres and restoration of 1,070 acres of grassland, and grassland associated with protection and restoration of up to 184 acres of vernal pool/alkali seasonal wetland complex. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8. This area connects to more than 620 acres of existing habitat that is protected under the East Contra Costa County HCP/NCCP. The projects commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of vernal pool/alkali seasonal wetland complexes) in CZ 8 would sufficiently offset the adverse effects resulting from water conveyance facilities construction.

The typical NEPA and CEQA project-level mitigation ratio (2:1 for protection) for this natural community would indicate that 760 acres should be protected in the near-term to offset water conveyance facilities losses.

NEPA Effects: In the absence of actions to restore and protect habitat, the effects on special-status reptile habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L1-L3, and by Mitigation Measure BIO-55, which would be in place throughout the construction period and operations, the effects of Alternative 4A as a whole on special-status reptiles would not be an adverse effect.

CEQA Conclusion: In the absence of other actions to restore and protect habitat, the effects on special-status reptile habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L1–L3, and by Mitigation Measure BIO-55, which would be in place throughout the construction period and operations, the impact of Alternative 4A as a whole on special-status reptiles would be less than significant.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

DWR will retain a qualified biologist to conduct a habitat assessment in areas that are relatively undisturbed or have a moderate to high potential to support noncovered special-status reptiles (Blainville's horned lizard and San Joaquin coachwhip) in CZ 4, CZ 7, and CZ 8. The qualified biologist will survey for noncovered special-status reptiles in areas of suitable habitat concurrent with the preconstruction surveys for covered species in CZ 4, CZ 7, and CZ 8. If special-status reptiles are detected, the biologist will passively relocate the species out of the work area prior to construction if feasible.

In addition, *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM10 Restoration of Temporarily Affected Natural Communities*, will be implemented for all noncovered special-status reptiles adversely affected by the project to avoid, minimize, or compensate for impacts.

Impact BIO-56: Indirect Effects of Alternative 4A on Special-Status Reptile Species

Construction activities associated with water conveyance facilities, environmental commitments, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status reptiles and their habitat.

In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Construction vehicles and equipment can transport in their tires and various parts under the vehicles invasive weed seeds and vegetative parts from other regions to construction sites, resulting in habitat degradation. These potential effects would be reduced through implementation of AMM10. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status reptile habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* would avoid the potential for substantial adverse effects on these species, either indirectly or through habitat modifications. The mitigation measure would also avoid and minimize effects that could substantially reduce the number of special-status reptiles, or restrict either species' range. Therefore, with implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4A on special-status reptiles would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects from project operations and maintenance as well as construction-related noise and visual disturbances could impact special-status reptiles. In addition, construction activities could indirectly affect special-status reptiles if construction resulted in the introduction of invasive weeds that create vegetative cover that is too dense for the species to navigate. Water conveyance facilities operations and maintenance activities, such as vegetation and weed control, and road maintenance, are not expected to remove special-status reptile habitat, but operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual special-status reptiles, if present. These activities could result in a significant impact.

With implementation of Mitigation Measure BIO-55, *Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs* as part of Alternative 4A construction, operation, and maintenance, the project would avoid the potential for significant effects on special-status reptile species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. With implementation of Mitigation Measure BIO-55, the indirect effects of Alternative 4A would have a less-than-significant impact on special-status reptiles.

Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs

See description of Mitigation Measure BIO-55 under Impact BIO-55.a

California Black Rail

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on California black rail. The habitat model used to assess effects for the California black rail is based on primary breeding habitat and secondary habitat. Primary (breeding) habitat for this species within the Delta includes all *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre (essentially instream islands of the San Joaquin River and its tributaries and White Slough Wildlife Area). In Suisun Marsh, primary habitat includes all *Schoenoplectus* and *Typha*-dominated, and *Salicornia*-dominated patches greater than 0.55 acre, with the exception that all low marsh habitats dominated by *Schoenoplectus acutus* and *S. californicus* and all managed wetlands, in general, are considered secondary habitat with lesser ecological value. Upland transitional zones that provide refugia during high tides within 150 feet of the tidal wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and valuable foraging opportunities.

Alternative 4A would result in both temporary and permanent losses of California black rail modeled habitat as indicated in Table 12-4A-24. Full implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles that would benefit the California black rail.

- At the ecotone that would be created between restored tidal wetlands and transitional uplands (Environmental Commitment 4), provide for at least 22 acres of California black rail habitat (*Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta) consisting of shallowly inundated emergent vegetation at the upper edge of the marsh (within 50 meters of upland refugia habitat) with adjacent riparian or other shrubs that will provide upland refugia, and other moist soil perennial vegetation. If feasible, create the 22 acres of tidal habitat in a single patch in a location that is contiguous with occupied California black rail habitat (Resource Restoration and Performance Principle CBR1).
- Create topographic heterogeneity in restored tidal wetlands (Environmental Commitment 4, Resource Restoration and Performance Principle CBR2).

California black rail is a fully protected species and take of California black rail individuals is prohibited under section 3511 of the Fish and Game Code. With the implementation of *AMM38 California Black Rail*, construction activities would not result in take and effects on the species would be avoided. As explained below, with the restoration and protection of tidal wetland habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM38 California Black Rail*, and *AMM27 Selenium Management*, impacts on the California black rail would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-24. Changes in California Black Rail Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	1	21
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**1**	**21**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	0	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**1**	**21**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-57: Loss or Conversion of Habitat for and Direct Mortality of California Black Rail

Alternative 4A would result in the combined permanent and temporary loss of 22 acres of modeled primary habitat for California black rail (Table 12-4A-24). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM areas. Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other Alternative 4A physical facilities could degrade or eliminate California black rail habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of up to 1 acre and the temporary loss of up to 21 acres of modeled primary California black rail habitat (Table 12-4A-24). The construction of a temporary transmission line in the central Delta that extends from Bouldin Island to Victoria Island would impact modeled habitat on Mandeville Island, the north end of Bacon Island, and on in-channel islands along the transmission line alignment. Other temporary impacts on modeled habitat would result from a temporary barge unloading facility and a temporary access road along the north end of Bacon Island, and from a temporary work area on Mandeveille Island. Geotechnical exploration could also impact black rail habitat on an in-channel island east of Bacon Island. Up to 1 acre of habitat would be permanently lost from the construction of a permanent transmission line at the northeast corner of Clifton Court Forebay in CZ 8. The water conveyance facilities footprint intersects with one California black rail occurrence on Mandeville Island, from the footprint of the temporary transmission line.

  Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: California black rail modeled habitat would be not be affected by tidal marsh restoration. The restoration of 22 acres of tidal wetlands in the central Delta would benefit California black rail. The primary habitat for the species in the Delta consists of in-channel islands, which are in areas that are most vulnerable to the effects of sea level rise in the study area. Tidal restoration under Environmental Commitment 4 would ensure that land is protected adjacent to current habitat in the delta with the consideration of sea level rise. Tidal restoration for the California black rail would include an ecotone between wetlands and transitional uplands which would provide upland refugia for the species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions associated with natural communities enhancement, that are designed to enhance wildlife values in restored tidal wetland habitats may result in localized ground disturbances that could temporarily remove small amounts of California black rail habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities are expected to have minor adverse effects on available California black rail habitat and are expected to result in overall improvements and maintenance of California black rail habitat values. Noise and visual disturbances during implementation of habitat management actions could also result in temporary disturbances that affect California black rail use of the surrounding habitat. These effects cannot be quantified, but would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM38 California Black Rail* and an updated version of AMM6 *Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The implementation of *AMM38 California Black Rail* would avoid disturbance and take by requiring restrictions on construction activities during the breeding season and establishing nodisturbance buffers around California black rail territories. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited. Environmental Commitment 11 would also include the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation on California black rail if needed.

Water Facility Operations and Maintenance: Post construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California black rail use of the central Delta. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM38 California Black Rail* and an updated version of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).Injury and Direct Mortality: California black rail is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If rails are present adjacent to covered activities, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or take of California black rail. Increased vehicular traffic associated with construction and maintenance of water conveyance facilities could also contribute to a higher potential for take. The implementation of *AMM38 California Black Rail* would avoid disturbance and take of California black rail individuals by restricting construction activities during the breeding season and establishing 500-foot no-disturbance buffers around identified territorial calling centers. If the 500-foot buffer does not provide complete avoidance of take, a CDFW-approved biologist would monitor construction activities to ensure that black rail individuals are not harmed. If breeding territories cannot be accurately delimited construction would not occur in order to avoid impacts (*AMM38 California Black Rail* is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The following paragraphs summarize the combined effects discussed above and describe environmental commitments that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 7,467 acres of primary and 17,915 acres of secondary habitat for California black rail. Alternative 4A would result in the permanent loss of 1 acre and temporary effects on up to 21 acres of primary California black rail habitat (much less than 1% of the total primary habitat in the study area) as a result of water conveyance facilities construction. The typical NEPA and CEQA project-level mitigation ratio for the tidal wetlands that would be affected by the project would be 1:1 for restoration/creation of tidal wetlands. Using this ratio would indicate that 22 acres of tidal freshwater emergent wetland should be restored/created to mitigate the losses of California black rail habitat.

The project includes measures to improve habitat for California black rail to offset the habitat that is permanently and temporarily lost. Conservation commitments under Alternative 4A through *Environmental Commitment 4 Tidal Natural Communities Restoration* would restore or create 22 acres of tidal wetlands in the central Delta.

Upland refugia for California black rail would be created between the restored tidal wetlands and transitional uplands to provide cover from predators (*Environmental Commitment 4 Tidal Natural Communities Restoration*/Resource Restoration and Performance Principle CBR1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *Environmental Commitment 11 Natural Communities Enhancement and Management*. These wetlands would consist of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acre, which would provide primary habitat for the black rail. If feasible, the 22 acres of tidal restoration would occur in a single patch at a location adjacent to occupied California black rail habitat. Upland refugia for California black rail would be created between the restored tidal freshwater emergent wetlands and transitional uplands to provide cover from predators (Environmental Commitment 4/Resource Restoration and Performance Principle CBR1). In addition, nonnative predators would be controlled to reduce nest predation if necessary through *Environmental Commitment 11 Natural Communities Enhancement and Management*.

The project also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on California black rail: *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, and *AMM38 California Black Rail*. *AMM38 California Black Rail* requires surveys for California black rail and the implementation of avoidance and minimization measures including the establishment of a 500 foot no disturbance buffer around any identified calling stations. All of these AMMs include elements that avoid or minimize the risk of affecting habitat and avoid the risk of take of California black rail in or adjacent to work areas and RTM storage sites.

***NEPA Effects*:** In the absence of environmental commitments and AMMs, the losses of California black rail habitat and potential for take of a special-status species associated with Alternative 4A would represent an adverse effect. However, with habitat protection and restoration associated with Environmental Commitment 4, guided by Resource Restoration and Performance Principles CBR1 and CBR2, and AMM1–AMM7, and *AMM38 California Black Rail*, the effects of Alternative 4A as a whole on California black rail would not be adverse under NEPA.

***CEQA Conclusion*:** In the absence of other environmental commitments and AMMs, the losses of California black rail habitat and potential for take of a special-status species associated with Alternative 4A in the late long-term would represent a significant impact. Considering the restoration provisions, which would provide acreages of new tidal marsh habitat in amounts necessary to compensate for habitats lost to construction and restoration activities guided by Resource Restoration and Performance Principles CBR1 and CBR2, and the implementation of AMM1–AMM7 and *AMM38 California Black Rail*, implementation of Alternative 4A as a whole would not result in a substantial adverse effect through habitat modifications and would avoid take of California black rail individuals. Therefore, the alternative would have a less-than-significant impact on California black rail under CEQA.

Impact BIO-58: Effects on California Black Rail Associated with Electrical Transmission Facilities

A variety of rail species are known to suffer take from transmission line collision, likely associated with migration and flights between foraging areas (Eddleman et. al.1994). Due to their wing shape and body size, rails have low to moderate flight maneuverability (Bevanger 1998), increasing susceptibility to collision mortality. However, there are relatively few records of California black rail collisions with overhead wires.

California black rails exhibit daytime site fidelity and a lack of long-distance night migration, two factors which are associated with low collision risk in avian species (Eddleman et al. 1994). California black rail movements in the study area are likely short, seasonal, and at low altitudes, typically less than 16 feet (5 meters) (Eddleman et al, 1994). There are numerous occurrences within 1 mile of the proposed temporary transmission line which extends north-south between Bouldin Island and Clifton Court Forebay. However, although the species may have low to moderate flight maneuverability, the bird's behavior (e.g., sedentary, nonmigratory, ground-nesting and foraging, solitary, no flocking, secretive) reduces potential exposure to overheard wires and vulnerability to collision mortality (see Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*, of the Draft BDCP). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would substantially reduce any potential for take of California black rail individuals from powerline collisions.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on California black rail. Although there is potential for temporary transmission lines to increase perching opportunities for raptors and result in increased predation pressure on local black rails, little is currently known about the seasonal movements of black rails or the potential for increased predation on rails near power poles. Therefore, because of the limited area over which poles are installed relative to the amount of California black rail habitat in the Delta, it is assumed that the increase in predation risk on California black rail from an increase in raptor perching opportunities is negligible.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further eliminate or the risk of take from bird strike for California black rails from the project. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible because of the limited area over which poles are installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on California black rail.

***CEQA Conclusion*:** The construction and presence of new transmission lines would not result in "take" of California black rail per Section 86 of the California Fish and Game Code because the risk of bird strike is considered to be minimal based on the species' flight behaviors. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further eliminate risk of take from bird strike for California black rails from the project. The increase in predation risk on California black rail from an increase in raptor perching opportunities is considered negligible when considering the limited area over which poles would be installed relative to the amount of California black rail habitat in the Delta. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on California black rail.

Impact BIO-59: Indirect Effects of Alternative 4A on California Black Rail

Indirect construction-related effects: Both primary and secondary habitat for California black rail within the vicinity of proposed construction areas could be indirectly affected by construction activities. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there is no available data to determine the extent to which these noise levels could affect California black rail. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect California black rail in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to California black rail habitat could also affect the species.

If construction occurs during the nesting season, these indirect effects could result in the loss or abandonment of nests, and take of any eggs and/or nestlings. in the implementation of *AMM38 California Black Rail* (as described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would avoid disturbance and take of individuals by requiring preconstruction surveys of potential breeding habitat, establishment of a 500-foot no-disturbance buffer, and the presence of an onsite monitor during the breeding season. In addition, construction would be avoided altogether if breeding territories cannot be accurately delimited.

Salinity: Water operations ranging between Operational Scenarios H3 and H4 would have an effect on salinity gradients in Suisun Marsh. It is expected that the salinity of water in Suisun Marsh would generally increase as a result of water operations and operations of salinity-control gates to mimic a more natural water flow. This would likely encourage the establishment of tidal wetland plant communities tolerant of more brackish environments, which should be beneficial to California black rail because its historical natural Suisun Marsh habitat was brackish tidal marsh.

Methylmercury Exposure: The modeled primary habitat for California black rail includes tidal brackish emergent wetland and tidal freshwater emergent wetland in Suisun Marsh and the Delta west of Sherman Island, and instream islands and White Slough Wildlife Area in the central Delta. Black rails typically occur in the high marsh zone near the upper limit of tidal flooding in salt and brackish habitats. Low marsh, managed wetlands, and the upland fringe are considered secondary habitat. California black rails are a top predator in the benthic food chain; they nest and forage in dense vegetation and prey on isopods, insects and arthropods from the surface of mud and vegetation They also consume insects and seeds from bulrushes (*Schoenoplectus* spp.) and cattails (*Typha* spp.) (Eddleman et al. 1994).

Largemouth bass was used as a surrogate species for analysis (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species would overestimate the effects on black rail. Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Modeled effects of mercury concentrations from changes in operations of water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that black rail mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes (primary black rail habitat) that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have existing elevated mercury tissue levels, these low level increases could result in some level of effects. Environmental Commitment 12, described below, would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California black rail. Tidal and nontidal marsh restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, tidal marsh restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative.

There could be an effect on California black rail from increases in selenium associated with tidal restoration activities (Environmental Commitment 4); however, effects on the California black rail population would be expected to be minimal as the amount of tidal restoration would total up to 22 acres. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of project design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design.

***NEPA Effects*:** Noise and visual disturbances related to construction-related activities from environmental commitments could reduce California black rail use of modeled habitat adjacent to work sites. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by California black rail. Potential effects of noise and visual disturbances on California black rail individuals would be avoided with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on habitat for the species.

Implementation of operations ranging between Operational Scenarios H3 and H4, including operation of salinity-control gates are expected to increase water salinity in Suisun Marsh because they will create conditions more similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations would not be expected to result in increased mercury bioavailability to California black rail. Restoration actions that would create high and low tidal marsh, which is California black rail habitat, could provide biogeochemical conditions for methylation of mercury in the in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

With the above measures in place, the indirect effects of Alternative 4A implementation would not result in take of California black rail individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would not have adverse effect on California black rail.

***CEQA Conclusion*:** Noise and visual disturbances related to construction-related activities and other environmental commitments could reduce California black rail use of modeled habitat adjacent to work sites. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by California black rail. Potential effects of noise and visual disturbance on California black rail individuals would be avoided with *AMM38 California Black Rail*. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects on dust on habitat for the species.

Implementation of Operational Scenarios H3 and H4, including operation of salinity-control gates, are expected to increase water salinity in Suisun Marsh. These salinity gradient changes should have a beneficial impact on California black rail because they will create conditions more similar to historic conditions.

Tidal habitat restoration could result in increased exposure of California black rail to selenium; however, the amount of tidal restoration would total up to 22 acres, and potential exposure to selenium resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Any effects would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. With implementation of AMM27, potential for increased selenium exposure would result in no adverse effect on the species.

Changes in water operations would not be expected to result in increased mercury bioavailability to California black rail. Restoration actions that would create high and low tidal marsh, which is California black rail habitat, could provide biogeochemical conditions for methylation of mercury in the in the newly inundated soils. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the amount of tidal restoration would total up to 22 acres, and potential exposure to methylmercury resulting from these acres of restoration would not be expected to adversely affect the California black rail population. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for any effects of increased methylmercury exposure.

With these measures in place, indirect effects of Alternative 4A implementation would not result in take of California black rail individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on California black rail.

Impact BIO-60: Fragmentation of California Black Rail Habitat as a Result of Project Implementation

Restoration activities may temporarily fragment existing wetlands and could create temporary barriers to California black rail movements. Grading, filling, contouring and other initial ground-disturbing activities could remove habitat along movement corridors used by individuals and potentially temporarily reduce access to adjacent habitat areas. The temporary adverse effects of fragmentation of tidal freshwater emergent wetland habitat for California black rail or restoration activities resulting in barriers to movement would be minimized through sequencing of *Environmental Commitment 4 Tidal Natural Community Restoration* activities to allow for recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

NEPA Effects: The fragmentation of existing wetlands and creation of temporary barriers to movement would not represent an adverse effect on California black rail as a result of habitat modification of a special-status species because *Environmental Commitment 4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38 California Black Rail* would avoid and minimize effects on California black rail.

CEQA Conclusion: The fragmentation of existing wetlands and creation of temporary barriers to movement would represent a less-than-significant impact on California black rail as a result of habitat modification of a special-status species because *Environmental Commitment 4 Tidal Natural Communities Restoration* would be phased to allow for the recovery of some areas before restoration actions are initiated in other areas. In addition, *AMM38California Black Rail* would avoid and minimize impacts on California black rail.

Impact BIO-61: Periodic Effects of Inundation of California Black Rail Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects of inundation on California black rail.

NEPA Effects: There would be no periodic effects of inundation on California black rail.

CEQA Conclusion: There would be no periodic impacts of inundation on California black rail.

California Clapper Rail [1]

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on California clapper rail. California clapper rail modeled habitat includes primarily middle marsh habitat with select emergent wetland plant alliances. High marsh is also used if it is of high value, and low marsh provides foraging habitat for the species. California clapper rail secondary habitats generally provide only a few ecological functions such as foraging (low marsh) or high-tide refuge (upland

[1] Based on recent genetic studies by Maley and Brumfield (2013) and Chesser et al. (2014), the “California” (*Rallus longirostris obsoletus*), “Yuma” (*R. l. yumanensis*), and “light-footed” (*R. l. levipes*) subspecies of clapper rail are now recognized by the American Ornithologists’ Union (AOU) as a separate species: Ridgway’s rail (*Rallus obsoletus*). Consequently, the taxon formerly known as California clapper rail (*R. l. obsoletus*) is now California Ridgway’s rail (*R. o. obsoletus*). For the purposes of this document, the “California clapper rail” common name has been retained due to its use in previous BDCP documents.

transition zones), while primary habitats provide multiple functions including breeding, effective predator cover, and foraging opportunities.

Alternative 4A would occur outside of the current range of the species and would not result in effects on modeled California clapper rail habitat as indicated in Table 12-4A-25. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-25. Changes in California Clapper Rail Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	0	0
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	0	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-62: Loss or Conversion of Habitat for and Direct Mortality of California Clapper Rail

No habitat would be lost or converted and there would be no direct take of California clapper rail under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects**:** There would be no effects on California Clapper Rail habitat.

CEQA Conclusion: There would be no impacts on California Clapper Rail habitat.

Impact BIO-63: Indirect Effects of the Project on California Clapper Rail

No indirect effects on California clapper rail were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects**:** There would be no indirect effects on California Clapper Rail.

CEQA Conclusion**:** There would be no indirect impacts on California Clapper Rail.

Impact BIO-64: Effects on California Clapper Rail Associated with Electrical Transmission Facilities

Isolated patches of suitable California clapper rail habitat may occur in the study area as far east as (but not including) Sherman Island. Home range and territory of the California clapper rail is not known, but in locations outside of California, clapper rail territory ranges 0.3 acre to 8 acres (0.1 to

3.2 hectares) (Rush et al. 2012), indicating that known occurrences are not likely to intersect with the proposed lines (BDCP Attachment 5J.C*, Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The location of the current population and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on California clapper rail because the location of the current population and suitable habitat for the species would make collision with the proposed transmission lines highly unlikely.

Impact BIO-65: Fragmentation of California Clapper Rail Habitat as a Result of Project Implementation

No effects of fragmentation of California clapper rail were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

NEPA Effects: There would be no effects of fragmentation on California Clapper Rail habitat.

CEQA Conclusion: There would be no impacts of fragmentation on California Clapper Rail habitat.

California Least Tern

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on California least tern. California least tern modeled habitat identifies foraging habitat as all tidal perennial aquatic natural community in the study area. Breeding habitat is not included in the model because most of the natural shoreline in the study area that historically provided nesting sites has been modified or removed. Least terns currently nest on artificial fill adjacent to tidal perennial aquatic habitat in the vicinity of Suisun Marsh and west Delta, and additional nesting could occur at the edge of tidal perennial waters whenever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). The study area is outside of the primary range of California least tern, although there are two CNDDB occurrences, one in Suisun Marsh (CZ 11), and one in Pittsburg (CZ 10).

Alternative 4A would result in both temporary and permanent losses of California least tern modeled foraging habitat as indicated in Table 12-4A-26.

California least tern is a fully protected species and "take" of individuals, per Section 86 of the California Fish and Game Code, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane*, and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized,* construction activities would not result in take of the species, which would avoid take per Section 86 of the California Fish and Game Code[2]. As explained below, with the expansion of aquatic foraging habitat in Clifton Court Forebay, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, and mitigation to avoid impacts on terns should they nest in the study area, impacts on the California least tern would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-26. Changes in California Least Tern Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Foraging	207	2,098
Total Impacts Water Conveyance Facilities		**207**	**2,098**
Environmental Commitments 4, 6–7, 9–11[a]	Foraging	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**207**	**2,098**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-66: Loss or Conversion of Habitat for and Direct Mortality of California Least Tern

Alternative 4A would result in the combined permanent and temporary loss of up to 2,367 acres of modeled foraging habitat for California least tern (Table 12-4A-26). The project components that would result in these losses are construction of water conveyance facilities and operation. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate California least tern foraging habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,305 acres of modeled California least tern aquatic foraging habitat (Table 12-4A-26). Of these acres, 207 acres would be a permanent loss the majority of which would occur where new facilities are constructed at Clifton Court Forebay. A smaller portion of the permanent loss would occur where Intakes 2, 3, and 5 encroach on the Sacramento River's east bank between Clarksburg and Courtland. Permanent losses would also occur where new control structures would be built into the California Aqueduct and the Delta Mendota Canal adjacent to Clifton Court Forebay where Clifton Court Forebay levees are modified. The temporary effects on tidal perennial aquatic habitats would occur at numerous locations, with the largest affect occurring at Clifton Court Forebay, where the entire forebay would be dredged to provide additional storage capacity. Other temporary effects would occur in the Sacramento River at Intakes 2, 3, and 5, and at temporary barge unloading facilities established at three locations along the tunnel route. The water conveyance facilities footprint does not overlap with any California least tern occurrences. Refer to the

[2] Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The project proponents do not propose to hunt, pursue, catch, or capture California least tern. Killing would be avoided through AMM20.

Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Noise and visual disturbances during implementation of habitat management actions could result in temporary disturbances that affect California least tern use of the surrounding habitat. These effects cannot be quantified, but are expected to be minimal because few management activities would be implemented in aquatic habitat and because terns are not expected to nest on protected lands. Surveys would be conducted prior to ground disturbance in any areas that have suitable nesting substrate for California least tern (flat, unvegetated areas near aquatic foraging habitat) and take and other effects on nesting terns would be avoided and minimized by the AMMs and Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, described below.
- *Water Facilities Operations and Maintenance*: Post construction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic postconstruction disturbances, localized impacts on California least tern foraging habitat, and temporary noise and disturbances over the term of the project. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas which could be adjacent to California least tern foraging habitat. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: California least terns currently nest in the vicinity of potential restoration sites in the west Delta area (CZ 10). New nesting colonies could establish if suitable nesting habitat is created during restoration activities (e.g., placement of unvegetated fill to raise surface elevations prior to breaching levees during restoration efforts). If nesting occurs where covered activities are undertaken, the operation of equipment for land clearing, construction, conveyance facilities operation and maintenance, and habitat restoration, enhancement, and management could result in injury or take of California least tern. Risk of injury or disturbance would be greatest to eggs and nestlings susceptible to land-clearing activities, abandonment of nests and nesting colonies, or increased exposure to the elements or to predators. Injury to adults or fledged juveniles is less likely as these individuals would be expected to avoid contact with construction equipment. However, injury or take would be avoided through planning and preconstruction surveys to identify nesting colonies, the design of projects to avoid locations with least tern colonies, and the provision for 500-foot buffers as required by Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*.

The following paragraph summarizes the combined effects discussed above and describes environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

With Alternative 4A implementation, there would be a permanent loss of 207 acres of modeled foraging habitat for California least tern in the study area. The permanent loss would occur primarily from the expansion of the Clifton Court Forebay and, a lesser amount would be lost along the Sacramento River. In addition, 2,098 acres would be temporarily unavailable from the dredging of the Clifton Court Forebay. The temporary loss of habitat would not be expected to adversely affect California least tern as the impact area is outside of their primary range.

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected by water conveyance facilities would be 1:1 for restoration/creation of tidal perennial aquatic habitat. Using this ratio would indicate that 207 acres of the tidal perennial aquatic natural community should be restored/created to compensate for the permanent loss of potential California least tern habitat from the construction of the water conveyance facilities. Part of the project includes the permanent expansion of the Clifton Court Forebay, which would create approximately 450 acres of aquatic habitat, which would be available for the California least tern if they were to forage in the area. This habitat creation would occur within the same timeframe as the construction temporary and permanent losses, thereby avoiding adverse effects on California least tern from loss of foraging habitat. In addition, 37 acres of tidal wetlands would be restored in the north delta, which would provide foraging opportunities for the species.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM*2 *Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats at or adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Although nesting by California least tern is not expected to occur, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies Will be Minimized*, would be available to address this adverse effect on nesting California least terns.

NEPA Effects: The potential for take of California least tern associated with Alternative 4A would represent an adverse effect in the absence of the mitigation measure and AMMs described below. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). If nesting were to occur, construction activities could have an adverse effect on California least tern. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would be available to address this effect on nesting California least terns. Temporary impacts on tidal perennial aquatic habitat in Clifton Court Forebay associated with dredging would not be expected to impact California least tern, as this region of the study area is outside of their primary range. The restoration of aquatic habitat associated with the expansion of the Clifton Court Forebay (water conveyance facilities), and Environmental Commitment 4 (tidal restoration) would be sufficient to compensate for permanent impacts on California least tern foraging habitat. With these acres of restoration, in addition to the implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 4A as a whole on California least tern would not be adverse.

CEQA Conclusion: The potential take of California least tern associated with Alternative 4A would represent an adverse effect in the absence of the Mitigation Measure and AMMs described below as a result of potential for take of a special-status species. Although nesting by California least tern is not expected to occur in the study area, restoration sites could attract individuals wherever disturbed or artificial sites mimic habitat conditions sought for nesting (i.e., sandy or gravelly substrates with sparse vegetation). Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall be Avoided and Indirect Effects on Colonies will be Minimized*, would avoid the potential for take of California least tern individuals and reduce this effect to a less-than-significant impact.

Temporary impacts on tidal perennial aquatic habitat in Clifton Court Forebay associated with dredging would not be expected to impact California least tern, as this region of the study area is outside of their primary range. The restoration of aquatic habitat associated with the expansion of the Clifton Court Forebay (water conveyance facilities), and *Environmental Commitment 4 Tidal Natural Communities Restoration* would be sufficient to compensate for permanent impacts on California least tern foraging habitat. With these acres of restoration, in addition to the implementation of *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan*, which would be in place during all project activities, the effects of Alternative 4A as a whole on California least tern would not result in a substantial adverse effect through habitat modifications and would avoid take of individuals. Therefore, the implementation of Alternative 4A would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

If suitable nesting habitat for California least tern (flat unvegetated areas near aquatic foraging habitat) is identified during planning level surveys, DWR will ensure that a qualified biologist with experience observing the species and its nests conducts at least three preconstruction surveys for this species during the nesting season. DWR will design projects to avoid the loss of California least tern nesting colonies. No construction will take place within 500 feet California least tern nests during the nesting season (April 15 to August 15 or as determined through surveys). Only inspection, maintenance, research, or monitoring activities may be performed during the least tern breeding season in areas within or adjacent to least tern breeding habitat with USFWS and CDFW approval under the supervision of a qualified biologist.

Impact BIO-67: Indirect Effects of the Project on California Least Tern

Indirect construction- and operation-related effects: Indirect effects associated with construction that could affect California least tern include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 500 feet from the construction edge. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect California least tern. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect

California least tern or their prey species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to foraging habitat could also affect the species. Noise and visual disturbance is not expected to have an adverse effect on California least tern foraging behavior. As described in Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, if least tern nests were found during planning or preconstruction surveys, no construction would take place within 500 feet of active nests. In addition, AMM1–AMM7, including construction best management practices, would minimize the likelihood of spills or excessive dust being created during construction. Should a spill occur, implementation of these AMMs would greatly reduce the likelihood of individuals being affected.

Methylmercury Exposure: Covered activities have the potential to exacerbate the bioaccumulation of mercury in the California least tern. The operational impacts of new flows with water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability. Largemouth bass were used as a surrogate species for this analysis and results would be expected to be similar or lower for the California least tern. Results indicated that changes in total mercury levels in water and largemouth bass tissues were insignificant (see Appendix 5.D, *Contaminants*, of the Draft BDCP).

Marsh (tidal and nontidal) restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect California least tern, via uptake through consumption of prey (as described in the, Appendix 5.D, *Contaminants*, of the Draft BDCP).

Schwarzbach and Adelsbach (2003) investigated mercury exposure in 15 species of birds inhabiting the Bay-Delta ecosystem. Among the species studied, the highest concentrations of mercury were found in the eggs of piscivorous birds (terns and cormorants) that bioaccumulate mercury from their fish prey. The very highest concentrations were found in Caspian and Forster's terns, especially those inhabiting South San Francisco Bay. Based on three California least tern eggs collected from Alameda Naval Air Station in the San Francisco Central Bay, concentrations in California least tern eggs were a third (0.3 ppm) those of the eggs of the other two terns. Because of the small sample size, there is a high degree of uncertainty regarding the levels of mercury that may be present in California least tern eggs. If the mercury levels measured at Alameda Naval Air Station are representative of the population in the San Francisco Bay, they would not be expected to result in adverse effects on tern hatchlings. Hatching and fledging success were not reduced in common tern eggs in Germany with mercury concentrations of 6.7 ppm (Hothem and Powell 2000).

Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels pre-Alternative 4A, these low level increases could result in some level of effects. Environmental Commitment 12, described below, would be implemented to address this risk of low level increases in methylmercury which could add to the current elevated tissue concentrations.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including California least tern. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4, Environmental Commitment 5) would lead to adverse effects on California least tern.

Because of the uncertainty that exists with respect to specific siting of tidal restoration areas, there could be a substantial effect on California least tern from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects**:** Noise and visual disturbances within 500 feet of construction-related activities from the environmental commitments could disturb California least tern foraging habitat adjacent to work sites. Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid this potential adverse effect.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–7, AMM12, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of Alternative 4A, implementation would not result in an adverse effect on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

CEQA Conclusion**:** Noise and visual disturbances within 500 feet of construction-related activities from the environmental commitments would not be expected to disturb California least tern foraging habitat adjacent to work sites. If terns were to nest in newly graded restoration sites during construction activities, Mitigation Measure BIO-66, *California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized*, would avoid the potential for disturbance and take of California least tern individuals.

AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of spills from occurring and ensure that measures were in place to prevent runoff from the construction area and to avoid negative effects of dust on the species.

Tidal habitat restoration could result in increased exposure of California least tern to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–7, AMM12, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-66, the indirect effects of Alternative 4A implementation would not result in take of California least tern individuals, nor would it result in a substantial adverse effect on the species through habitat modification. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on California least tern.

Mitigation Measure BIO-66, California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized

See Mitigation Measure BIO-66 under Impact BIO-66.

Impact BIO-68: Effects on California Least Tern Associated with Electrical Transmission Facilities

The risk of take of California least tern from the construction of new transmission lines is considered to be minimal based on tern flight behaviors and its unlikely use of habitats near the transmission line corridors. Terns exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions (see Draft BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to California least terns and would further eliminate potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect on California least tern as a result of take of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on California least tern.

CEQA Conclusion: The construction and presence of new transmission lines would represent a less-than-significant impact on California least tern as a result of take of a special-status species because they are uncommon in the vicinity of proposed transmission lines and because the probability of bird-powerline strikes is highly unlikely due to tern flight behaviors. *AMM20 Greater Sandhill Crane* contains the commitment for all new transmission lines constructed as a result of the project to be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, there would be no take of California least tern from the project per Section 86 of the California Fish and Game Code, and the construction and operation of transmission lines would result in a less-than-significant impact on California least tern.

Greater Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on greater sandhill crane. Greater sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the species is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for greater sandhill crane includes permanent and temporary “roosting and foraging” and “foraging” habitat. These habitat types include certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes known, traditional roost sites that also provide foraging habitat (see Appendix 2.A *Covered Species Accounts*, of the Draft BDCP). Both temporary and permanent roost sites were identified for greater Sandhill crane. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those only used in some years. Factors included in assessing the loss of foraging habitat for the greater sandhill crane includes the relative habitat value of specific crop or land cover types, and proximity to known roost sites. Foraging habitat for greater sandhill crane included crop types and natural communities up to 4 miles from known roost sites, within the boundary of the winter crane use area (see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP).

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for greater sandhill crane as indicated in Table 12-4A-27. Full implementation of Alternative 4A would also include the following Resource Restoration and Performance Principles that would benefit the greater sandhill crane.

- Protect at least 3,892 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Resource Restoration and Performance Principle GSC1).

- Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principle GSC2).

- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane (Resource Restoration and Performance Principle GSC3).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principle GSC4).

Greater sandhill crane is a fully protected species and “take” of individuals, per Section 86 of the California Fish and Game Code, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane*, construction activities would not result in take of the species, which would avoid take per Section 86 of the California Fish and Game Code[3]. As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the greater sandhill crane would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

[3] Section 86 of the California Fish and Game Code defines take as “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” The project proponents do not propose to hunt, pursue, catch, or capture greater sandhill cranes. Killing would be avoided through AMM20.

Table 12-4A-27. Changes in Greater Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	3
	Roosting and Foraging–Temporary	16	85
	Foraging	1,799	850
Total Impacts Water Conveyance Facilities		**1,815**	**938**
Environmental Commitments 4, 6–7, 9–11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	0	0
	Foraging	1,985	0
Total Impacts Environmental Commitments 4, 6–9–11[a]		**1,985**	**0**
Total Roosting/Foraging–Permanent		**0**	**3**
Total Roosting/Foraging–Temporary		**16**	**85**
Total Foraging		**3,784**	**850**
TOTAL IMPACTS		**3,800**	**938**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-69: Loss or Conversion of Habitat for and Direct Mortality of Greater Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 104 acres of modeled roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) and 4,634 acres of foraging habitat for greater sandhill crane (3,784 of permanent loss, 850 acres of temporary loss; see Table 12-4A-27). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reuseable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Natural Community Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of habitat to nontidal wetland through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate greater sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities as they are currently designed would result in the combined permanent loss of up to 1,815 acres of modeled greater sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,799 acres of foraging habitat (Table 12-4A-27). Foraging habitat that would be permanently impacted by water conveyance facilities would consist of 474 acres of very high-value, 202 acres of high-value, 579 acres of medium-value, and 544 acres of low-value foraging habitat (Table 12-4A-28). In addition, 3 acres of permanent roosting and foraging habitat, 85 acres of temporary roosting and foraging habitat, and 850 acres of foraging habitat would be temporarily removed (Table 12-4A-27, Table 12-4A-28). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within one year following construction; however, it would not necessarily be restored to its original topography and it could be restored as grasslands in the place of cultivated lands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

The acres of roosting and foraging habitat that would be removed would occur from the construction of a temporary transmission line on Zacharias Island, Bouldin Island, and Venice Island and from the construction of a temporary concrete batch plant and a permanent access road on Bouldin Island; however, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed. The potential for greater sandhill crane bird strike on electrical transmission facilities is addressed below under Impact BIO-70.

Approximately 1,480 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

Construction-related activities would not be expected to result in take of greater sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for greater sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-70.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-71. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-28. Value of Greater Sandhill Crane Foraging Habitat affected by Alternative 4A

Foraging Habitat Value Class	Land Cover Type	Amount Affected by Water Conveyance Facilities permanent [temporary] (acres)	Amount Affected by Environmental Commitments (permanent acres)
Very high	Corn, rice	474 [224]	524
High	Wheat, managed wetlands,	202 [95]	222
Medium	Alfalfa and alfalfa mixtures, irrigated mixed pasture, irrigated native pasture, irrigated pasture, irrigated other pasture, grain and hay crops, miscellaneous grain and hay, mixed grain and hay, nonirrigated mixed grain and hay, other grain crops, sudan, miscellaneous grasses, grassland, alkali seasonal wetlands, vernal pool complex	579 [273]	638
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry), native vegetation	544 [257]	601
Total		**1,799 [850]**	**1,985**

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 59 acres of greater sandhill crane foraging habitat in the north Delta. Loss of foraging habitat from Environmental Commitment 4 would consist of 16 acres of very high-value, 7 acres of high-value, 19 acres of medium-value, and 18 acres of low-value foraging habitat.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss of approximately 251 acres of greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 66 acres of very high-value, 28 acres of high-value, 81 acres of medium-value, and 76 acres of low-value foraging habitat.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of cultivated lands that comprise greater sandhill crane foraging habitat. Loss of foraging habitat from Environmental Commitment 4 would consist of 222 acres of very high-value, 94 acres of high-value, 271 acres of medium-value, and 255 acres of low-value foraging habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the greater sandhill crane. Impacts would consist of approximately 219 acres of very high-value, 93 acres of high-value, 268 acres of medium-value, and 252 acres of low-value foraging habitat (Table 12-4A-28). A portion of the restored nontidal marsh would be expected to provide roosting and foraging habitat value for the greater sandhill crane. However, some of this

restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to result in take of greater sandhill crane would be minimized with the implementation of *AMM20 Greater Sandhill Crane*. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Chapter 4, *Covered Activities and Associated Federal Actions*, of the Draft BDCP). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.
- *Water Facilities Operations and Maintenance:* Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect greater sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2, AMM6 and AMM20 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A environmental commitments that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 104 acres roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,634 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,649 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration,* and *Environmental Commitment 10 Nontidal Marsh Restoration*—1,985 acres). Of these acres of foraging habitat impact, 2,598 acres would be medium- to very high-value habitat (Table 12-4A-28).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection of high- to very high-value foraging habitat for loss of foraging habitat. Using these ratios would indicate that 104 acres of greater sandhill crane roosting habitat should be restored/created and 104 acres should be protected to compensate for the losses of greater sandhill crane roosting and foraging habitat. In addition, 4,634 acres of high- to very high-value foraging habitat should be protected to mitigate the water conveyance facilities losses of greater sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that no greater sandhill crane roost sites were directly impacted by water conveyance facilities covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 104 acres of roosting and foraging habitat. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-71.

Under Alternative 4A, project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that will protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the Draft BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of greater sandhill crane wintering habitat.

At least 4,811 acres of cultivated lands that provide high- to very high-value foraging habitat would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types in any given year (see Table 12-4-28 for greater sandhill crane foraging habitat values).

The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on greater sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting greater sandhill crane habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of greater sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that are greater than the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1–GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and AMM30 *Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Construction activities would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: The effects on greater sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of other environmental commitments, Resource Restoration and Performance Principles GSC1–GSC4, and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines*, which would be in place during all project activities. Construction activities would not be expected to result in greater sandhill crane take because foraging and roosting individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications. Therefore, Alternative 4A would have a less-than-significant impact on greater sandhill cranes under CEQA.

Impact BIO-70: Effects on Greater Sandhill Crane Associated with Electrical Transmission Facilities

Greater sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential take of greater sandhill crane in the area of the proposed transmission lines was estimated for the Draft BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that risk of take could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes.

Alternative 4A substantially reduced the length of permanent and temporary transmission lines as compared to the Draft BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the greater sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by greater sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the Draft BDCP.

In addition, after the BDCP Draft EIR/EIS was issued in December of 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meets the performance standard of no take of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: (1) siting new transmission lines in lower bird strike risk zones; (2) removing, relocating or undergrounding existing lines where feasible; (3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area (4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area, (5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; and/or (6) for areas outside of the Stone Lakes National Wildlife Refuge project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would not result in “take” of greater sandhill crane per Section 86 of the California Fish and Game Code. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. Diverters would be installed on existing lines at a rate of one foot of existing transmission line for every one foot of new project transmission line constructed, in an area with equal or higher greater sandhill crane bird strike risk. Placing diverters on existing lines would be expected to reduce existing take in the Plan Area and therefore result in a net benefit to the greater sandhill crane population because these flight diverters would be maintained in perpetuity. Considering that the temporary lines would be removed within the first 10–14 years of Alternative 4A implementation, and with the implementation of one or a combination of the measures described under *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project per Section 86 of the California Fish and Game Code.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on greater sandhill crane.

CEQA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has the highest crane-use in the greater sandhill crane winter use area. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, there would be no take of greater sandhill crane from the project per Section 86 of the California Fish and Game Code, and the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on greater sandhill crane.

Impact BIO-71: Indirect Effects of the Project on Greater Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other environmental commitments could reduce greater sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect greater sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The Draft BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior.

Table 12-4A-29. Greater Sandhill Crane Habitat Affected by General Construction and Pile Driving Noise Under Alternative 4A (acres)

	General Construction	
Habitat Type	Above 60 dBA	Above 50 dBA
Permanent Roosting	196	1,008
Temporary Roosting	810	1,909
Foraging	7,676	17,327
Total Habitat	8,681	20,243

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see Chapter 5, *Effects Analysis*, of the Draft BDCP). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding (see Chapter 5, *Effects Analysis*, of the Draft BDCP). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see Chapter 5, *Effects Analysis*, of the Draft BDCP).

The effects of noise and visual disturbance on greater sandhill crane would be minimized through the implementation of *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the greater sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect greater sandhill crane in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to greater sandhill crane habitat could also affect the species. The implementation of AMM1–AMM6 (Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP; updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) have the potential to exacerbate bioaccumulation of mercury in greater sandhill crane. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations from the construction of the water conveyance facilities (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on greater sandhill crane because of their position in the food web. Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for greater sandhill crane because they primarily forage on waste grains and, to a lesser extent, invertebrates associated with cultivated crops. The modeled effects of mercury concentrations from changes in water operations with water conveyance facilities on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that greater sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with Environmental Commitment 10 (Nontidal Marsh Restoration) may indirectly affect greater sandhill crane via uptake in lower tropic levels (see Appendix 5.D, *Contaminants*, of the Draft BDCP). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including greater sandhill crane. Environmental Commitment 10 (Nontidal Marsh Restoration) has the potential to mobilize selenium, and therefore increase greater sandhill crane exposure from ingestion of prey items (waste grain and associated invertebrates) with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 10) would lead to adverse effects on greater sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on greater sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to compensate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of greater sandhill crane to methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation on greater sandhill crane would not be adverse under NEPA.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would not result in an adverse effect on greater sandhill crane under NEPA.

***CEQA Conclusion*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for greater sandhill crane. This would be a significant impact. *AMM20 Greater Sandhill Crane* would include requirements (described above) to minimize the effects of noise and visual disturbance on greater sandhill cranes and to mitigate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of greater sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for greater sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27*

Selenium Management, which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of greater sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on greater sandhill crane under CEQA.

Lesser Sandhill Crane

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on lesser sandhill crane. Lesser sandhill cranes in the study area are almost entirely dependent on privately owned agricultural lands for foraging. Long-term sustainability of the lesser sandhill crane is thus dependent on providing a matrix of compatible crop types that afford suitable foraging habitat and maintaining compatible agricultural practices, while sustaining and increasing the extent of other essential habitat elements such as night roosting habitat. The habitat model for lesser sandhill crane includes "roosting and foraging" and "foraging" habitat. Suitable roosting and foraging habitat in the study area includes certain agricultural types, specific grassland types, irrigated pastures and hay crops, managed seasonal wetland, and other natural seasonal wetland. Roosting and foraging habitat includes traditional roost sites that are known to be used by sandhill cranes (both greater and lesser) and that also provide foraging habitat. Detail regarding the roosting and foraging modeled habitat for both subspecies of sandhill crane is included in the BDCP (see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP). Both temporary and permanent roost sites were identified for sandhill cranes. Permanent roosting and foraging sites are those used regularly, year after year, while temporary roosting and foraging sites are those used in some years. Factors included in assessing the loss of foraging habitat for the lesser sandhill crane considers the relative habitat value of specific crop or land cover types. Although both the greater and the lesser sandhill crane use similar crop or land cover types, these provide different values of foraging habitat for the two subspecies based on proportional use of these habitats. Lesser sandhill cranes are less traditional than greater sandhill cranes and are more likely to move between different roost site complexes and different wintering regions (Ivey pers. comm.) The wintering range is ten times larger than the greater sandhill crane and their average foraging flight radius from roost sites is twice that of greater sandhill cranes. Because of this higher mobility, lesser sandhill cranes are more flexible in their use of foraging areas than the greater sandhill crane.

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for lesser sandhill crane as indicated in Table 12-4A-30. Full implementation of Alternative 4A would include the following Resource Restoration and Performance Principles for greater sandhill crane that would similarly benefit the lesser sandhill crane.

- Protect at least 3,892 acres of high- to very high-value habitat for greater sandhill crane, with at least 80% maintained in very high-value types in any given year. This protected habitat will be within 2 miles of known roosting sites in CZs 3, 4, 5, and/or 6 and will consider sea level rise and local seasonal flood events, greater sandhill crane population levels, and the location of foraging habitat loss. Patch size of protected cultivated lands will be at least 160 acres (Resource Restoration and Performance Principles GSC1).

- Create at least 320 acres of managed wetlands in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principles GSC2).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane (Resource Restoration and Performance Principles GSC3).
- Create an additional 95 acres of roosting habitat within 2 miles of existing permanent roost sites. The habitat will consist of active cornfields that are flooded following harvest to support roosting cranes and that provide highest-value foraging habitat. Individual fields will be at least 40 acres and can shift locations throughout the Greater Sandhill Crane Winter Use Area, but will be sited with consideration of the location of roosting habitat loss and will be in place prior to roosting habitat loss (Resource Restoration and Performance Principles GSC4).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments (including *Environmental Commitment 12 Methylmercury Management*) and implementation of AMM1–AMM7, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and *AMM30 Transmission Line Design and Alignment Guidelines*, impacts on the lesser sandhill crane would be less than significant for CEQA purposes, and would not be adverse for NEPA purposes.

Table 12-4A-30. Changes in Lesser Sandhill Crane Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting and Foraging–Permanent	0	3
	Roosting and Foraging–Temporary	16	85
	Foraging	1,838	988
Total Impacts Water Conveyance Facilities		**1,854**	**1,076**
Environmental Commitments 4, 6––11[a]	Roosting and Foraging–Permanent	0	0
	Roosting and Foraging–Temporary	0	0
	Foraging	1,985	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**1,985**	**0**
Total Roosting/Foraging–Permanent		**0**	**3**
Total Roosting/Foraging–Temporary		**16**	**85**
Total Foraging		**3,823**	**988**
TOTAL IMPACTS		**3,839**	**1,076**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-72: Loss or Conversion of Habitat for and Direct Mortality of Lesser Sandhill Crane

Alternative 4A would result in the combined permanent and temporary loss of up to 104 acres of modeled roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) and 4,811 acres of foraging habitat (3,823 acres of permanent loss, 988 acres of temporary loss, Table 12-4A-30). Project measures that would result in these losses are water conveyance facilities and transmission line construction, establishment and use of reusable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration*, *Environmental Commitment 8 Grassland Natural Communities Restoration*, *Environmental Commitment 10 Nontidal Marsh Natural Community Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. The majority of habitat loss would result from water conveyance facility construction and conversion of foraging habitat to nontidal natural communities through Environmental Commitment 10. Habitat enhancement and management activities through Environmental Commitment 11, which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate lesser sandhill crane modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent loss of up to 2,930 acres of modeled lesser sandhill crane habitat. This would consist of the permanent removal of 16 acres of temporary roosting and foraging habitat, and 1,838 acres of foraging habitat. Foraging habitat that would be permanently impacted by water conveyance facilities would consist of 1,049 acres of very high-value, 144 acres of high-value, and 325 acres of medium-value foraging habitat (Table 12-4A-31). In addition, 3 acres of permanent roosting and foraging habitat, 85 acres of temporary roosting and foraging habitat, and 988 acres of foraging habitat would be temporarily removed (Table 12-4A-30). The temporarily removed habitat would consist primarily of cultivated lands and it would be restored within 1 year following construction. However, it would not necessarily be restored to its original topography and it could be restored as grasslands. Water conveyance facilities activities that would result in temporary impacts would include temporary access roads, reusable tunnel material sites, and work areas for construction.

- The acres of roosting and foraging habitat that would be permanently removed is located on Bouldin Island, from the construction of a permanent access road. Temporary impacts on roosting and foraging habitat would occur on Bouldin Island from the construction of a temporary concrete batch plant and a fuel station. Temporary losses would also occur from the construction of temporary transmission lines between the Lambert Road vent shaft and the intermediate forebay, and on Venice Island. However, the implementation of *AMM20 Greater Sandhill Crane* would require that water conveyance facilities activities be designed to avoid direct loss of crane roost sites. This includes a provision that the final transmission line alignment would be designed to avoid crane roost sites. Avoidance of crane roost sites would be accomplished either by siting activities outside of identified roost sites or by relocating the roost site if it consisted of cultivated lands (roost sites consisting of wetlands would not be subject to re-location). Relocated roost sites would be established prior to construction activities affecting the original roost site, as described in *AMM20 Greater Sandhill Crane* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Therefore, there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed.

- Approximately 1,480 acres of the permanent loss of foraging habitat would be from the storage of reusable tunnel material. This material would be stored on Bouldin Island, Zacharias Island and parcels south of Lambert Road and north of the Cosumnes River. The reusable tunnel material would likely be moved to other sites for use in levee build-up and restoration, and the affected areas would likely eventually be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. The implementation of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS), would require that the areas used for reusable tunnel material storage be minimized in crane foraging habitat and completely avoid crane roost sites.

  Construction-related activities would not be expected to result in direct mortality of lesser sandhill crane if they were present in the study area, because cranes would be expected to avoid contact with construction and other equipment. The potential for lesser sandhill crane bird strike on electrical transmission lines is discussed below under Impact BIO-73.

The effects of noise and visual disturbance from water conveyance facilities construction activities are discussed under Impact BIO-74. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-31. Value of Lesser Sandhill Crane Foraging Habitat Affected By Alternative 4A Water Conveyance Facilities

Foraging Habitat Value Class	Land Cover Type	Water Conveyance Facilities Permanent [Temporary] (acres)
Very high	Corn, alfalfa and alfalfa mixtures	1,049 [448]
High	Mixed pasture, native pasture, other pasture, irrigated pasture, native vegetation, rice	144 [43]
Medium	Grain and hay crops, miscellaneous grain and hay, mixed grain and hay, unirrigated mixed grain and hay, other grain crops, miscellaneous grasses, grassland, wheat, other grain crops, managed wetlands	325 [245]
Low	Other irrigated crops, idle cropland, blueberries, asparagus, clover, cropped within the last 3 years, grain sorghum, green beans, miscellaneous truck, miscellaneous field, new lands being prepped for crop production, nonirrigated mixed pasture, nonirrigated native pasture, onions, garlic, peppers, potatoes, safflower, sudan, sugar beets, tomatoes (processing), melons squash and cucumbers all types, artichokes, beans (dry)	292 [244]
None	Vineyards, orchards	28 [8]

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 59 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 251 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: This activity would result in the permanent loss or conversion of approximately 843 acres of lesser sandhill crane foraging habitat in the north Delta.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would result in the permanent conversion of approximately 832 acres of modeled foraging habitat for the lesser sandhill crane. A portion of the restored nontidal marsh would be restored to provide roosting and foraging habitat value for sandhill cranes. However, some of this restored marsh would be unsuitable as it would lack emergent vegetation and consist of open water that would be too deep to provide suitable roosting or foraging habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in *Environmental Commitment 11* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. The potential for these activities to result in direct mortality of lesser sandhill crane would be

minimized with the implementation of *AMM20 Greater Sandhill Crane*. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- *Water Facilities Operations and Maintenance*: Post construction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect lesser sandhill crane use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, could be adverse as sandhill cranes are sensitive to disturbance. However, potential impacts would be reduced by the AMMs listed below. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of *AMM2 Construction Best Management Practices and Monitoring, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material,* and *AMM20 Greater Sandhill Crane* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The following paragraphs summarize the combined effects discussed above and describe Alternative 4A environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA effects and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 104 acres roosting and foraging habitat (16 acres of permanent loss, 88 acres of temporary loss) from the construction of the water conveyance facilities. In addition, 4,811 acres of foraging habitat would be removed or converted (Water Conveyance Facilities—2,826 acres; *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration* and *Environmental Commitment 10 Nontidal Marsh Restoration*—1,985 acres).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 protection and 1:1 restoration for loss of roost sites and 1:1 protection for loss of foraging habitat. Using these ratios would indicate that 104 acres of sandhill crane roosting habitat should be restored/created and 104 acres should be protected to compensate for the losses of lesser sandhill crane roosting and foraging habitat. In addition, 4,811 acres of high- to very high-value foraging habitat should be protected to mitigate the water conveyance facilities losses of lesser sandhill crane foraging habitat.

The implementation of *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would require that no sandhill crane roost sites were directly impacted by water conveyance facilities covered activities (including transmission lines and their associated footprints). Therefore there would be no loss of crane roosting and foraging habitat as a result of water conveyance facility construction once the facilities were fully designed, which would avoid the water conveyance facilities impact on 104 acres of roosting and foraging habitat once the project design is final. Indirect effects of construction-related noise and visual disturbance are discussed below under Impact BIO-74.

Alternative 4A also includes the following performance standards for the greater sandhill crane which would also benefit the lesser sandhill crane, as they utilize similar habitats and face similar threats within their winter use areas.

Project proponents would commit to creating up to 95 acres of roosting habitat within 2 miles of existing permanent roost sites (Resource Restoration and Performance Principle GSC4). These roosts would consist of active cornfields that are flooded following harvest to support roosting cranes and also provide the highest-value foraging habitat for the species. Individual fields would be at least 40 acres could shift locations throughout the Greater Sandhill Crane Winter Use Area, and would be in place prior to roosting habitat loss. In addition, 320 acres of roosting habitat would be created in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6 (Resource Restoration and Performance Principle GSC2). Restoration sites would be identified with consideration of sea level rise and local seasonal flood events. These wetlands would be created within 2 miles of existing permanent roost sites and protected in association with other protected natural community types at a ratio of 2:1 upland to wetland habitat to provide buffers that would protect cranes from the types of disturbances that would otherwise result from adjacent roads and developed areas (e.g., roads, noise, visual disturbance, lighting). The creation of 180 acres of crane roosting habitat would be constructed within the Stone Lakes NWR project boundary (see Figure 3.3-7 in the Draft BDCP) and would be designed to provide connectivity between the Stone Lakes and Cosumnes greater sandhill crane populations (Resource Restoration and Performance Principle GSC3). The large patch sizes of these wetland complexes would provide additional conservation to address the threats of vineyard conversion, urbanization to the east, and sea level rise to the west of sandhill crane wintering habitat.

At least 4,811 acres of cultivated lands that provide high- to very high-value foraging habitat would be protected. This habitat would occur within 2 miles of known roost sites and at least 80% would be maintained in very high-value habitat types for greater sandhill crane in any given year (which would be high- to very high-value crop types for the lesser sandhill crane; see Table 12-4-28 and Table 12-4-32 for sandhill crane foraging habitat values).The Plan also includes commitments to implement the following avoidance and minimization measures that will help to avoid and minimize adverse effects on lesser sandhill crane: *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM30 Transmission Line Design and Alignment Guidelines*. All of these AMMs include elements that would avoid or minimize the risk of affecting lesser sandhill crane habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

***NEPA Effects*:** The loss of lesser sandhill crane habitat under Alternative 4A would not be adverse under NEPA because Alternative 4A has committed the project proponents to avoiding and minimizing effects and to restoring and protecting acreages that meet the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles GSC1–GSC4, and by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and AMM30 *Transmission Line Design and Alignment Guidelines,* which would be in place during all project activities. Considering these commitments, the implementation of Alternative 4A would not result in an adverse effect on lesser sandhill crane.

CEQA Conclusion: The effects on lesser sandhill crane habitat under Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of environmental commitments, Resource Restoration and Performance Principles GSC1-GSC4 for greater sandhill crane (which would also benefit lesser sandhill crane), and AMMs. However, the project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 10 that are greater than the mitigation ratios described above. These conservation actions would be guided by AMM1–AMM6, *AMM20 Greater Sandhill Crane*, and *AMM30 Transmission Line Design and Alignment Guidelines*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, Alternative 4A would have a less-than-significant impact on lesser sandhill cranes under CEQA.

Impact BIO-73: Effects on Lesser Sandhill Crane Associated with Electrical Transmission Facilities

Sandhill cranes are susceptible to collision with power lines and other structures during periods of inclement weather and low visibility (Avian Power Line Interaction Committee 1994, Brown and Drewien 1995, Manville 2005). There are extensive existing transmission and distribution lines in the sandhill crane winter use area. These include a network of distribution lines that are between 11- and 22-kV. In addition, there are two 115-kV lines that cross the study area, one that overlaps with the greater sandhill crane winter use area between Antioch and I-5 east of Hood, and one that crosses the northern tip of the crane winter use area north of Clarksburg. There are 69-kv lines within the study area that parallel Twin Cities Road, Herzog Road, Lambert Road, and the Southern Pacific Dredge Cut in the vicinity of Stone Lakes National Wildlife Refuge. At the south end of the winter use area, there are three 230-kV transmission lines that follow I-5, and then cut southwest through Holt, and two 500-kV lines cross the southwestern corner of the winter use area. This existing network of power lines in the study currently poses a collision and electrocution risk for sandhill cranes, because they cross over or surround sandhill crane roost sites in the study area.

Both permanent and temporary electrical transmission lines would be constructed to supply construction and operational power to Alternative 4A facilities, as described below. The potential mortality of greater sandhill crane in the area of the proposed transmission lines was estimated for the Draft BDCP using collision mortality rates developed by Brown and Drewien (1995) and an estimate of potential crossings along the proposed lines (See Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). This analysis concluded that mortality risk could be substantially reduced by marking new transmission lines to increase their visibility to sandhill cranes. Mortality risk would be similarly reduced for lesser sandhill cranes by marking new transmission lines.

The transmission line footprint for Alternative 4A was changed substantially from the Draft BDCP to reduce potential risk of greater sandhill crane collisions. The following changes also reduce potential risk of lesser sandhill crane collisions:

Alternative 4A substantially reduced the length of permanent and temporary transmission lines as compared to the Draft BDCP, substantially reducing the likelihood of crane collisions. Under Alternative 4A, no permanent transmission lines would be constructed within the greater sandhill crane winter use area. In addition, no new transmission lines (permanent or temporary) would be constructed in the vicinity of Staten Island which is one of the most important wintering sites for greater sandhill cranes in the Delta. The Alternative 4A transmission line alignment within the greater sandhill crane winter use area would be limited to three segments of temporary transmission lines: a temporary 11-mile segment extending north and south between Intake 2 and the intermediate forebay, a temporary 9-mile segment extending east and west between the intermediate forebay and the SMUD/WAPA substation, and an 11-mile segment extending north and south between Bouldin Island and Victoria Island. These three temporary lines would be removed after construction of the water conveyance facilities, after 10–14 years. Limiting the proposed transmission line footprint to temporary lines and siting these lines away from the highest use areas by both greater and lesser sandhill cranes, substantially reduces the potential for sandhill crane bird strike in Alternative 4A as compared to the Draft BDCP.

In addition, after the BDCP Draft EIR/EIS was issued in December of 2013, additional avoidance features were added to *AMM20 Greater Sandhill Crane*. *AMM20 Greater Sandhill Crane* requires that Alternative 4A meets the performance standard of no mortality of greater sandhill crane associated with the new facilities. This would be achieved by implementing one or any combination of the following: (1) siting new transmission lines in lower bird strike risk zones; (2) removing, relocating or undergrounding existing lines where feasible; (3) using natural gas generators in lieu of installing transmission lines in high-risk zones of the greater sandhill crane winter use area (4) undergrounding new lines in high-risk zones of the greater sandhill crane winter use area, (5) permanently installing flight diverters on existing lines over lengths equal to or greater than the length of the new temporary transmission lines in the crane winter use area; and/or (6) for areas outside of the Stone Lakes National Wildlife Refuge project boundary, shifting locations of flooded areas that provide crane roosts to lower risk areas. These measures are described in detail in *AMM20 Greater Sandhill Crane* (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The implementation of the measures described above under *AMM20 Greater Sandhill Crane*, in addition to the project design changes to avoid high crane use areas, would substantially reduce potential collisions of lesser sandhill cranes with transmission lines. Potential measures include using natural gas generators in lieu of transmission lines or undergrounding new lines in high-risk zones in the greater sandhill crane winter use area. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality, including for sandhill cranes (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new temporary transmission lines would be fitted with flight diverters. The installation of flight diverters on existing permanent lines would be prioritized in the highest risk zones for greater sandhill crane (as described in Draft BDCP Appendix 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*) and diverters would be installed in a configuration that research indicates would reduce bird strike risk by at least 60%. Diverters would be installed on existing lines at a rate of one foot of existing transmission line for every one foot of new project transmission line constructed, in an area with equal or higher greater sandhill crane bird strike risk. Placing diverters on existing lines would be expected to reduce existing lesser and greater sandhill crane mortality in the Plan Area and therefore result in a net benefit to the lesser sandhill crane population because these flight diverters would be maintained in perpetuity.

NEPA Conclusion: Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on lesser sandhill crane.

***CEQA Conclusion*:** Sandhill cranes are known to be susceptible to collision with overhead wires. The existing network of power lines in the study area currently poses a risk for lesser sandhill cranes. Under Alternative 4A, proposed transmission lines have been designed to substantially reduce the likelihood of a crane collision with transmission lines. New transmission lines constructed as part of the project would be limited to temporary lines which would be removed within the first 10–14 years of Alternative 4A implementation. In addition, no new transmission lines would be sited in the vicinity of Staten Island, which has high use by wintering lesser sandhill cranes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By incorporating one or a combination of the measures to greatly reduce the risk of bird strike described in *AMM20 Greater Sandhill Crane*, described in *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines under Alternative 4A would have a less-than-significant impact on lesser sandhill crane.

Impact BIO-74: Indirect Effects of the Project on Lesser Sandhill Crane

Indirect construction-and operation-related effects: Sandhill cranes are sensitive to disturbance. Noise and visual disturbances from the construction of water conveyance facilities and other environmental commitments could reduce lesser sandhill crane use of modeled habitat adjacent to work areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet of the construction edge. Furthermore, maintenance of the aboveground water conveyance facilities could result in ongoing but periodic postconstruction noise and visual disturbances that could affect lesser sandhill crane use of surrounding habitat. These effects could result from periodic vehicle use along the conveyance corridor, inspection and maintenance of aboveground facilities, and similar activities. These potential effects would be minimized with implementation of *AMM20 Greater Sandhill Crane* described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

The BDCP includes an analysis of the indirect effects of noise and visual disturbance that would result from the construction of the Alternative 4 water conveyance facilities on greater sandhill crane (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). The analysis addressed the potential noise effects on cranes, and concluded that as much as 20,243 acres of crane habitat could potentially be affected by general construction noise (including pile driving) above baseline level (50–60 dBA; Table 12-4A-29). This would include 1,008 acres of permanent crane roosting habitat, 1,909 acres of temporary crane roosting habitat, and 17,327 acres of crane foraging habitat. The analysis was conducted based on the assumption that there would be direct line-of-sight from sandhill crane habitat areas to the construction site, and, therefore, provides a worst-case estimate of effects. In many areas the existing levees would partially or completely block the line-of-sight and would function as effective noise barriers, substantially reducing noise transmission. However, there is insufficient data to assess the effects that increased noise levels would have on sandhill crane behavior. Similar acreages of lesser sandhill crane habitat would be expected to be indirectly affected. However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost and forage in more suitable habitat.

Evening and nighttime construction activities would require the use of extremely bright lights. Nighttime construction could also result in headlights flashing into roost sites when construction vehicles are turning onto or off of construction access routes. Proposed surge towers would require the use of safety lights that would alert low-flying aircraft to the presence of these structures because of their height. Little data is available on the effects of impact of artificial lighting on roosting birds. Direct light from automobile headlights has been observed to cause roosting cranes to flush and it is thought that they may avoid roosting in areas where lighting is bright (see Chapter 5, *Effects Analysis*, of the Draft BDCP). If the birds were to roost in a brightly lit site, they may be vulnerable to sleep-wake cycle shifts and reproductive cycle shifts, and be more vulnerable to predators. Potential risks of visual impacts from lighting include a reduction in the cranes' quality of nocturnal rest, and effects on their "sense of photo-period which might cause them to shift their physiology towards earlier migration and breeding." (see Chapter 5 of the Draft BDCP). Effects such as these could prove detrimental to the cranes' overall fitness and reproductive success (which could in turn have population-level impacts). A change in photo-period interpretation could also cause cranes to fly out earlier from roost sites to forage and might increase their risk of power line collisions if they were to leave roosts before dawn (see Chapter 5 of the Draft BDCP).

The effects of noise and visual disturbance on lesser sandhill crane would be minimized through the implementation of AMM20 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Activities within 0.75 mile of crane roosting habitat would reduce construction noise during night time hours (from one hour before sunset to one hour after sunrise) such that construction noise levels do not exceed 50 dBA L_{eq} (1 hour) at the nearest temporary or permanent roosts during periods when the roost sites are available (flooded). In addition, the area of crane foraging habitat that would be affected during the day (from one hour after sunrise to one hour before sunset) by construction noise exceeding 50 dBA L_{eq} (1 hour) would also be minimized. Unavoidable noise related effects would be compensated for by the enhancement of 0.1 acre of foraging habitat for every acre indirectly affected within the 50 dBA L_{eq} (1 hour) construction noise contour. With these measures in place, indirect effects of noise and visual disturbance from construction activities are not expected to reduce the lesser sandhill crane population in the study area.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect lesser sandhill cranes in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to lesser sandhill crane habitat could also affect the subspecies. The implementation of AMM1–AMM6 (Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP; updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and negative effects of dust on foraging habitat.

Methylmercury Exposure: Changes in water operations from the construction of the water conveyance facilities and the implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) have the potential to exacerbate bioaccumulation of mercury in lesser sandhill cranes. Largemouth bass was used as a surrogate species for analysis of impacts from changes in operations from the construction of the water conveyance facilities (see Appendix D, *Substantive BDCP Revisions*, in this RDEIR/SDEIS). Results of the quantitative modeling of mercury effects on largemouth bass as a surrogate species overestimate the effects on lesser sandhill crane because of their position in the food web. Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). Potential indirect effects of increased mercury exposure are likely low for lesser sandhill crane because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. The modeled effects of mercury concentrations from changes in water conveyance facilities operations on largemouth bass did not differ substantially from existing conditions; therefore, results also indicate that lesser sandhill crane tissue concentrations would not measurably increase as a result of water conveyance facilities construction.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with Environmental Commitment 10 (Nontidal Marsh Restoration) may indirectly affect lesser sandhill crane via uptake in lower tropic levels (see Appendix 5.D, *Contaminants, of the Draft BDCP*). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At

Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including the lesser sandhill crane. Environmental Commitment 10 (Nontidal Marsh Restoration) has the potential to mobilize selenium, and therefore increase lesser sandhill crane exposure from ingestion of prey items with elevated selenium levels. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 10) would lead to adverse effects on lesser sandhill crane.

Because of the uncertainty that exists with respect to the location of nontidal restoration activities, there could be an effect on lesser sandhill crane from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) which would provide specific habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal and nontidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the restoration design.

***NEPA Effects*:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites than greater sandhill cranes and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. *AMM20 Greater Sandhill Crane*, which would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to compensate for affected habitat.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of lesser sandhill crane to selenium which could result in the mortality of a special status species. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of lesser sandhill crane to methylmercury and selenium. methylmercury and selenium. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on waste grains, other cultivated crops, and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill crane. Therefore, the indirect effects of Alternative 4A implementation on lesser sandhill crane would not be adverse under NEPA.

CEQA Conclusion**:** Crane habitat could potentially be affected by general construction noise above baseline level (50–60 dBA). However, lesser sandhill cranes are less traditional in their winter roost sites and may be more likely to travel away from disturbed areas to roost in more suitable habitat. Construction in certain areas would take place 7 days a week and 24 hours a day and evening and nighttime construction activities would require the use of extremely bright lights, which could adversely affect roosting cranes by impacting their sense of photo-period and by exposing them to predators. Effects of noise and visual disturbance could substantially alter the suitability of habitat for lesser sandhill crane. This would be a significant impact. With *AMM20 Greater Sandhill Crane* in place, would include requirements (described above) to minimize the effects of noise and visual disturbance on sandhill cranes and to mitigate for affected habitat, there would not be an adverse effect on lesser sandhill crane.

The implementation of Environmental Commitment 10 (Nontidal Marsh Restoration) could result in increased exposure of lesser sandhill crane to methylmercury and selenium. This would be a significant impact. The potential indirect effect of increased mercury exposure is likely low for lesser sandhill crane because they primarily forage on cultivated crops and associated invertebrates. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure. The potential effect of selenium exposure would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in restored habitats.

With AMM1–AMM6, *AMM20 Greater Sandhill Crane*, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of lesser sandhill cranes. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on lesser sandhill crane.

Least Bell's Vireo and Yellow Warbler

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on least Bell's vireo and yellow warbler. Least Bell's vireo and yellow warbler modeled habitat identifies suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a dense shrub component, including all willow-dominated alliances.

Alternative 4A would result in both temporary and permanent losses of least Bell's vireo and yellow warbler modeled habitat as indicated in Table 12-4A-32. Full implementation of Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles that would benefit least Bell's vireo and yellow warbler.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2).
- The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation and will be a minimum width of 330 feet (Resource Restoration and Performance Principle VFR3).

As explained below, with the restoration and protection of these amounts of habitat, in addition to natural community enhancement and management commitments and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, and Mitigation Measure BIO-75, impacts on least Bell's vireo and yellow warbler would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-32. Changes in Least Bell's Vireo and Yellow Warbler Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Migratory and breeding	32	27
Total Impacts Water Conveyance Facilities		**32**	**27**
Environmental Commitments 4, 6–7, 9–11[a]	Migratory and breeding	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**37**	**27**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-75: Loss or Conversion of Habitat for and Direct Mortality of Least Bell's Vireo and Yellow Warbler

Alternative 4A would result in the combined permanent and temporary loss of 64 acres of modeled habitat (37 acres of permanent loss and 27 acres of temporary loss) for least Bell's vireo and yellow warbler (Table 12-4A-32). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas and *Environmental Commitment 4 Tidal Natural Communities Restoration*. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could also result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate least Bell's vireo and yellow warbler habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 59 acres of modeled least Bell's vireo and yellow warbler habitat (Table 12-4A-32). Of the 59 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 32 acres would be a permanent loss and 27 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of the construction of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3, 4, 5, 6, and 8. Permanent habitat loss would result from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would resulted from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require a period of time for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. However, restored riparian vegetation can have the habitat structure to support breeding vireos within 3 to 5 years, particularly if the restored vegetation is adjacent to established riparian areas (Kus 2002), and similar habitat would be suitable for yellow warbler. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete. There are no occurrences of least Bell's vireo or yellow warbler that intersect with the water conveyance facilities footprint. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove approximately 5 acres of modeled least Bell's vireo and yellow warbler habitat.

- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected least Bell's vireo and yellow warbler habitats are expected to maintain and improve the functions of the habitat. Least Bell's vireo and yellow warbler would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for future species establishment in the study area. If least Bell's vireo and yellow warbler established breeding populations in restored riparian habitats in the study area, occupied habitat would be monitored to determine if there were a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the least Bell's vireo and yellow warbler by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  Habitat management- and enhancement-related activities could disturb least Bell's vireo and yellow warbler nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in direct mortality of least Bell's vireo or yellow warbler would be minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least Bell's vireo and yellow warbler use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Nesting of least Bell's vireo and yellow warbler has not been confirmed in the study area. Although there have been recent occurrences of least Bell's vireo in the Yolo Bypass and of both least Bell's vireo and yellow warbler at the San Joaquin River National Wildlife Refuge, the reestablishment of a breeding population of either species unlikely over the term of the project (14 years). If present in the study area, construction-related activities would not be expected to result in direct mortality of least Bell's vireo or yellow warbler because adults and fledged young would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* In addition, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow warblers.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,850 acres of modeled habitat for least Bell's vireo and yellow warbler. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 64 acres of habitat for these species during the term of the Plan (<1% of the total habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 64 acres of valley/foothill riparian habitat should be restored/created and 64 acres should be protected to compensate for the losses of least Bell's vireo and yellow warbler habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature riparian forest would be maintained within either CZ 4 (in the vicinity of Cosumnes River Preserve) or CZ 7 (in the vicinity of San Joaquin National Wildlife Refuge and Caswell State Memorial Park) (Resource Restoration and Performance Principle VFR2). The mature riparian forest would be intermixed with a portion of the early- to mid-successional riparian vegetation and would be a minimum width of 330 feet (Resource Restoration and Performance Principle VFR3).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of least Bell's vireo and yellow warbler habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, and by AMM1–AMM7, and AMM22. Mitigation Measure BIO-75 would be available to address potential adverse effects on nesting yellow warblers. Environmental commitments and AMMs would be in place during all project activities. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. Considering these commitments, losses and conversions of least Bell's vireo and yellow warbler habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of least Bell's vireo and yellow warbler habitat from Alternative 4A would represent an adverse effect in the absence of other conservation actions as a result of habitat modification and potential for direct mortality of a special-status species. However, neither species is an established breeder in the study area and impacts would likely be limited to loss of migratory habitat. In addition, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principles VFR1-VFR3 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, in addition to Mitigation Measure BIO-75, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of least Bell's vireo or yellow warbler. Therefore, Alternative 4A would have a less-than-significant impact on least Bell's vireo and yellow warbler under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

To reduce impacts on nesting birds, DWR will implement the measures listed below.

- To the maximum extent feasible, vegetation (trees, shrubs, ruderal areas) removal and trimming will be scheduled during the nonbreeding season of birds (September 1–January 31). If vegetation removal cannot be removed in accordance with this timeframe, preconstruction/preactivity surveys for nesting birds and additional protective measures will be implemented as described below.

- A qualified wildlife biologist with knowledge of the relevant species will conduct nesting surveys before the start of construction. A minimum of three separate surveys will be conducted within 30 days prior to construction, with the last survey within 3 days prior to construction. Surveys will include a search of all suitable nesting habitat (trees, shrubs, ruderal areas, field crops) in the construction area. In addition, a 500-foot area around the project area will be surveyed for nesting raptors, and a 500-foot buffer area will be surveyed for other nesting birds. If no active nests are detected during these surveys, no additional measures are required.

- If active nests are found in the survey area, no-disturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the project area (this date varies by species). A qualified wildlife biologist will monitor construction activities in the vicinity of the nests to ensure that construction activities do not affect nest success. The extent of the buffers will be determined by the biologists in coordination with USFWS and CDFW and will depend on the level of noise or construction disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Impact BIO-76: Fragmentation of Least Bell's Vireo and Yellow Warbler Habitat

Grading, filling, contouring, and other initial ground-disturbing operations may temporarily fragment modeled least Bell's vireo and yellow warbler habitat. This could temporarily reduce the affected habitat's extent and functions, including exposure to cowbird parasitism, a nest parasite of both species. Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, future occupancy would likely consist of only a small number of individuals, and any such habitat fragmentation is expected to have no or minimal effect on the species. Preconstruction surveys under *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* and Mitigation Measure BIO-75, Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would identify any nesting pairs and the potential for habitat fragmentation to affect either species. If a nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11 which includes the control of nonnative predators through habitat manipulation techniques or trapping to reduce nest predation.

***NEPA Effects*:** Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations is not expected to affect either species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11. Therefore, the effect of habitat fragmentation would not have an adverse effect on least Bell's vireo or yellow warbler.

***CEQA Conclusion*:** Because there are only two recent occurrences of least Bell's vireo within the study area, and no occurrences of yellow warbler breeding in the study area, habitat fragmentation resulting from ground-disturbing operations would not be expected to substantially modify habitat or result in the direct mortality of special status species. If nesting pairs of either species were detected where fragmentation has occurred, nests would be monitored for edge effects or other effects caused by the disturbance. The habitat would be adaptively managed to avoid or minimize impacts (e.g., cowbird control) under Environmental Commitment 11. Therefore, the effect of habitat fragmentation, as a result of Alternative 4A would have a less-than-significant impact on least Bell's vireo and yellow warbler.

Impact BIO-77: Effects on Least Bell's Vireo and Yellow Warbler Associated with Electrical Transmission Facilities

Both least Bell's vireo and yellow warbler typically occur in early to mid-successional riparian habitat, which is used to meet all of its life requisites. Least Bell's vireo are rarely observed in open habitats away from riparian vegetation. Neither species form flocks and individuals generally remain at or below the riparian canopy, below the height of proposed transmission lines (see Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*, of the Draft BDCP). The lack of occurrences in the study area, and the behavior and habitat requirements of least Bell's vireo and yellow warbler make collision with the proposed transmission lines highly unlikely. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and

Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would substantially reduce any potential for mortality of least Bell's vireo or yellow warbler individuals from powerline collisions.

***NEPA Effects*:** Installation and presence of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the lack of occurrences in the study area and the behavior and habitat requirements of these species. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on least Bell's vireo or yellow warbler.

***CEQA Conclusion*:** Installation and presence of new transmission lines would result in less-than-significant impact on least Bell's vireo or yellow warbler because the probability of bird-powerline strikes is unlikely due to the lack of occurrences in the study area and the behavior and habitat requirements of these species. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would substantially reduce the risk of mortality from bird strike for least Bell's vireo and yellow warbler from the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on least Bell's vireo or yellow warbler.

Impact BIO-78: Indirect Effects of The Project on Least Bell's Vireo and Yellow Warbler

Indirect construction- and operation-related effects: If least Bell's vireo or yellow warbler were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect least Bell's vireo or yellow warbler. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would reduce the potential for adverse effects of construction-related activities on survival and productivity of nesting least Bell's vireo and a 500 foot no-disturbance buffer would be established around the active nest. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to reduce the potential for adverse effects of construction-related activities on nesting yellow warbler. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect least Bell's vireo and yellow warbler in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including the least Bell's vireo and yellow warbler. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community and floodplain restoration could indirectly affect least Bell's vireo and yellow warbler, via uptake in lower tropic levels (as described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

NEPA Effects: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities on least Bell's vireo would not be adverse with the implementation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo.* Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting yellow warblers. The implementation of tidal natural communities restoration could result in increased exposure of least Bell's vireo and yellow warbler to methylmercury. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would have an adverse effect on least Bell's vireo and yellow warbler in the absence of environmental commitments and AMMs as a result of habitat modification and potential for direct mortality of special-status species. With the implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and *AMM2 Construction Best Management Practices and Monitoring* in place, the effect would not be adverse. The implementation of tidal natural communities restoration could result in increased exposure of least Bell's vireo and yellow warbler to methylmercury. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

With AMM1–AMM7, AMM22, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of least Bell's vireo or yellow warbler. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on least Bell's vireo or yellow warbler.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-79: Periodic Effects of Inundation of Least Bell's Vireo and Yellow Warbler Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on least Bell's vireo or yellow warbler.

NEPA Effects: No effect.

***CEQA Conclusion*:** No impact.

Suisun Song Sparrow and Saltmarsh Common Yellowthroat

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on Suisun song sparrow and saltmarsh common yellowthroat. The habitat model used to assess effects on Suisun song sparrow and saltmarsh common yellowthroat is based on primary breeding habitat and secondary habitat. Suisun song sparrow and saltmarsh common yellowthroat primary habitat consists of all *Salicornia*-dominated tidal brackish emergent wetland and all *Typha*-, *Scirpus*-, and *Juncus*-dominated tidal freshwater emergent wetland in the study area west of Sherman Island, with the exception that *Scirpus acutus* and *S. californicus* plant communities (low marsh) and all of the plant communities listed below that occur in managed wetlands were classified as secondary habitat. Upland transitional zones, providing refugia during high tides, within 150 feet of the wetland edge were also included as secondary habitat. Secondary habitats generally provide only a few ecological functions such as foraging (low marsh and managed wetlands) or extreme high tide refuge (upland transition zones), while primary habitats provide multiple functions, including breeding, effective predator cover, and high-value forage.

Alternative 4A would result in no effects on modeled Suisun song sparrow and saltmarsh common yellowthroat modeled habitat as indicated in Table 12-4A-33. There is no modeled habitat for Suisun song sparrow and saltmarsh common yellowthroat in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-33. Changes in Suisun Song Sparrow Saltmarsh Common Yellowthroat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	0	0
	Secondary	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	0	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-80: Loss or Conversion of Habitat for and Direct Mortality of Suisun Song Sparrow and Saltmarsh Common Yellowthroat

No habitat would be lost or converted and there would be no direct mortality of Suisun song sparrow or saltmarsh common yellowthroat under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species are known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Impact BIO-81: Indirect Effects of Alternative 4A on Suisun Song Sparrow and Saltmarsh Common Yellowthroat

No indirect effects on Suisun song sparrow and saltmarsh common yellowthroat were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where these species are known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No Impact.

Impact BIO-82: Effects on Suisun Song Sparrow and Saltmarsh Common Yellowthroat Associated with Electrical Transmission Facilities

The range of the Suisun song sparrow extends eastward into the study area to approximately Kimball Island. There are several reported occurrences from Kimball Island, Browns Island, and in the Suisun Marsh in the western portion of the study area. The easternmost range of the saltmarsh common yellowthroat also ends in Suisun Marsh. These species ranges, along with areas of suitable habitat, are far from the proposed transmission line routes (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Location of the current populations, species ranges, and suitable habitat in the study area make collision with the proposed transmission lines highly unlikely. Therefore the construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat.

NEPA Effects: The construction and presence of new transmission lines would not have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely.

CEQA Conclusion: The construction and presence of new transmission lines would not be expected to have an adverse effect on Suisun song sparrow and saltmarsh common yellowthroat because the location of the current populations, species ranges, and suitable habitat for the species make collision with the proposed transmission lines highly unlikely. Therefore, the construction and presence of new transmission lines under Alternative 4A would have a less-than-significant impact on Suisun song sparrow and saltmarsh common yellowthroat.

Swainson's Hawk

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on Swainson's hawk. The habitat model used to assess impacts on Swainson's hawk includes plant alliances and land cover types associated with Swainson's hawk nesting and foraging habitat. Alternative 4A would result in both temporary and permanent losses of Swainson's hawk modeled habitat as indicated in Table 12-4A-34. The majority of the losses would occur from the construction of the water conveyance facilities. Although protection and restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized through specific requirements of *AMM18 Swainson's Hawk*, including transplanting mature trees in the near-term time period. Full implementation of Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles which would benefit the Swainson's hawk.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principles VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7. The mature riparian forest intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum width of 330 feet (Resource Restoration and Performance Principles VFR1 and VFR2).
- Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres (Resource Restoration and Performance Principle SH1).
- Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) production (Resource Restoration and Performance Principle SH2).

- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM18 Swainson's Hawk* to minimize potential effects, impacts on Swainson's hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-34. Changes in Swainson's Hawk Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	20	13
	Foraging	3,415	1,178
Total Impacts Water Conveyance Facilities		**3,435**	**1,191**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
	Foraging	2,212	0
Total Impacts Environmental Commitments 4, 6–9–11[a]		**2,217**	**0**
Total Nesting		**25**	**13**
Total Foraging		**5,627**	**1,178**
TOTAL IMPACTS		**5,652**	**1,191**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-83: Loss or Conversion of Habitat for and Direct Mortality of Swainson's Hawk

Alternative 4A would result in the combined permanent and temporary loss of up to 6,843 acres of modeled habitat (38 acres of nesting habitat and 6,805 acres of foraging habitat) for Swainson's hawk (Table 12-4A-34). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could affect Swainson's hawk modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 33 acres of Swainson's hawk nesting habitat (20 acres of permanent loss habitat and 13 acres of temporary loss). In addition, 4,593 acres of foraging habitat would be removed (3,415 acres of permanent loss, 1,178 acres of temporary loss; Table 12-4A-34). Activities that would impact modeled Swainson's hawk habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are at least 12 occurrences of nesting Swainson's hawk that overlap with the construction footprint of water conveyance facilities, primarily from the construction of intakes 2, 3, and 5, and the construction footprint for the permanent and temporary transmission lines. The implementation of *AMM18 Swainson's Hawk*, would minimize the effects of construction on nesting Swainson's hawks if present in the area (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Impacts on foraging habitat would occur throughout the central Delta in CZs 3–6, and CZ 8. Permanent foraging habitat impacts would include 883 acres of very high-value habitat (Table 12-4A-35). Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

Table 12-4A-35. Acres of Impacted Foraging Habitat by Value Classes for Swainson's Hawk

Foraging Habitat Value Class	Cultivated Land and Other Land Cover Types	Water Conveyance Facilities Permanent (temporary)	Environmental Commitments permanent (temporary)
Very high	Alfalfa hay	883 (174)	549 (0)
Moderate	Irrigated pasture, other hay crops	1,456 (529)	1,121 (0)
Low	Other irrigated field and truck/berry crops	92 (67)	256 (0)
Very low	Safflower, sunflower, corn, grain sorghum	986 (408)	286 (0)

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of Swainson's hawk nesting habitat and 54 acres of foraging habitat. Because the species is highly mobile and wide-ranging, habitat fragmentation is not expected to reduce the use of remaining cultivated lands or preclude access to surrounding lands. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of Swainson's hawk foraging habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands that provide Swainson's hawk foraging habitat to grassland.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of Swainson's hawk foraging habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb Swainson's hawk nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Swainson's hawk habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Swainson's hawk habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM18 Swainson's Hawk* and updated versions of *AMM2 Construction Best Management Practices and Monitoring and AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- Permanent and temporary nesting habitat losses from the above environmental commitments, would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of cultivated lands and grassland communities that provide foraging habitat for Swainson's hawk are expected to be restored relatively quickly (within 10–14 years of Alternative 4A implementation).

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Swainson's hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and *AMM18 Swainson's Hawk* described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Swainson's hawk if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if Swainson's hawk were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM18 Swainson's Hawk* into the Alternative 4A.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments and Resource Restoration and Performance Principles that offset or avoid these effects. NEPA and CEQA conclusions are also provided at the end of the section.

The study area supports approximately 9,796 acres of modeled nesting habitat and 477,879 acres of modeled foraging habitat for Swainson's hawk. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 38 acres of potential nesting habitat (<1% of the potential nesting habitat in the study area) and 6,805 acres of foraging habitat (1% of the foraging habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 38 acres of nesting habitat should be restored/ created and 38 acres should be protected to compensate for the losses of Swainson's hawk nesting habitat. In addition, 6,805 acres of foraging habitat should be protected to mitigate the losses of Swainson's hawk foraging habitat.

Project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (Resource Restoration and Performance Principle SH1). These acres of cultivated lands and grasslands would be located above 1 foot above sea level, and at least 50% would be in very high-value production (Resource Restoration and Performance Principle SH2). These Resource Restoration and Performance Principles would be associated with Environmental Commitment 3 and would occur in the same timeframe as the construction and early restoration losses.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland, which would provide nesting habitat for Swainson's hawk. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. A single, contiguous patch of 100 acres of mature riparian forest would be maintained in either CZ 4 or CZ 7, ensuring that acres of restored and protected habitat provide habitat for nesting raptors. In addition, small but essential nesting habitat for Swainson's hawk associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Environmental Commitment 3).

The 251 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Swainson's hawks. This time lag between the removal and restoration of nesting habitat could have a substantial impact on Swainson's hawk in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Swainson's hawk nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least 5 trees (five gallon container size) would be planted for every tree anticipated to be removed by construction during the near-term period that was suitable for nesting by Swainson's hawks (20 feet or taller). A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted in areas that support high-value foraging habitat in clumps of at least 3 trees each at appropriate sites within or adjacent to conserved cultivated lands, or they could be incorporated as a component of the riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for Swainson's hawk. To enhance Swainson's hawk and reproductive output until the replacement nest trees become suitable for nesting, 100 acres of high-quality foraging habitat (alfalfa rotation) would be protected in the near-term for each potential nest site removed (a nest site is defined as a 125-acre block in which more than 50% of nest trees are 20 feet or greater in height) as a result of construction activity during the near-term. The foraging habitat to be protected would be within 6 kilometers of the removed tree within an otherwise suitable foraging landscape and on land not subject to threat of seasonal flooding, construction disturbances, or other conditions that would reduce the foraging value of the land.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of Swainson's hawk nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets or exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1, VFR2, SH1, SH2, and CL1, and by AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. Considering these commitments, losses and conversions of Swainson's hawk habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on Swainson's hawk habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11 that meet or exceed the typical mitigation ratios described above. These conservation activities would be guided by Resource Restoration and Performance Principles VFR1, VFR2, SH1, SH2, and

CL1s, and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Swainson's hawk. Therefore, Alternative 4A would have a less-than-significant impact on Swainson's hawk under CEQA.

Impact BIO-84: Effects on Swainson's Hawk Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that Swainson's hawks could be subject to power line strikes, which could result in injury or mortality of Swainson's hawks. However, this species would be at low risk of bird strike mortality based on factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Factors analyzed include the height of the new transmission lines and the flight behavior of the species. The existing network of transmission lines in the study area currently poses the same small risk for Swainson's hawk, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to Swainson's hawks and would further reduce any potential for powerline collisions.

***NEPA Effects*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on Swainson's hawk.

***CEQA Conclusion*:** New transmission lines would minimally increase the risk for Swainson's hawk power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would result in a less-than-significant impact on Swainson's hawk.

Impact BIO-85: Indirect Effects of The Project on Swainson's Hawk

Noise and visual disturbances from the construction of water conveyance facilities and other environmental commitments could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4). However, there are no available data to determine the extent to which these noise levels could affect Swainson's hawk. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. Swainson's hawks are seasonally abundant across much of the study area wherever adequate nest trees occur within a cultivated landscape that supports suitable foraging habitat. There would be a potential for noise and visual disturbances associated with Alternative 4A actions to temporarily displace Swainson's hawks and temporarily reduce the use of suitable habitat adjacent to construction areas. These adverse effects would be minimized with the implementation of *AMM18 Swainson's Hawk*.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Swainson's hawk foraging in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on habitat.

NEPA Effects**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not have an adverse effect on Swainson's hawk with the implementation of AMM1–AMM7, and *AMM18 Swainson's Hawk.*

CEQA Conclusion**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Swainson's hawk use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Swainson's hawk use of the surrounding habitat. The effects of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would result in a less-than-significant impact on Swainson's hawk with the implementation of AMM1–AMM7, and *AMM18 Swainson's Hawk.*

Impact BIO-86: Periodic Effects of Inundation of Swainson's Hawk Nesting and Foraging Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on Swainson's hawk.

NEPA Effects**:** No effect.

CEQA Conclusion**:** No impact.

Tricolored Blackbird

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on tricolored blackbird. The habitat model used to assess effects for tricolored blackbird is based on breeding habitat and nonbreeding habitat. Although nesting colonies have been documented along the fringe of Suisun Marsh, in the Yolo Bypass, along the southwestern perimeter of the study area, and in the southeast corner of the study area near the San Joaquin River, breeding colonies are uncommon in the study area. Modeled breeding habitat includes bulrush/cattail wetlands and shrub communities that may provide suitable nesting substrate, and adjacent high-value foraging areas that occur within 5 miles of nesting colonies documented in the study area. The nesting component consists of nontidal freshwater perennial emergent marsh, and valley foothill riparian natural communities that occur within 5 miles of breeding colonies documented between 1998 and 2012. The foraging component includes cultivated lands and noncultivated land cover types known to support abundant insect populations such as grasslands, pasturelands (including alfalfa), natural seasonal wetlands, and sunflower croplands. The Delta is recognized as a major wintering area for tricolored blackbird (Hamilton 2004, Beedy 2008). Modeled nonbreeding habitat includes emergent wetlands and shrub stands that provide suitable roosting habitat, as well as cultivated lands and noncultivated lands that provide foods sought by tricolored blackbirds during the winter. Outside of the breeding season, tricolored blackbirds are primarily granivores that forage opportunistically across the study area in grasslands, pasturelands, croplands, dairies, and livestock feed lots. Factors considered in assessing the value of affected habitat for the tricolored blackbird, include patch size, suitability of vegetation, and proximity to recorded occurrences.

Alternative 4A would result in both temporary and permanent losses of tricolored blackbird modeled breeding and nonbreeding habitat as indicated in Table 12-4A-36. Full implementation of Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles to benefit the tricolored blackbird.

- Protect and manage occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat will be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence. If sufficient acres of protection are not available, create suitable nesting habitat at a ratio of 1:1 (Resource Restoration and Performance Principle TB1).
- Protect high- to very high-value breeding-foraging habitat (as defined in Table 12-4A-37 (within 5 miles of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat. At least 130 acres will be within 5 miles of the 42 acres of nontidal wetland nesting habitat protected (Resource Restoration and Performance Principle TB2).
- Protect moderate-, high-, or very high-value cultivated lands (as defined in Table 12-4A-37) as nonbreeding foraging habitat, at least 50% of which is of high- or very high-value (Resource Restoration and Performance Principle TB3).
- Protect 119 acres and restore 832 acres of nontidal wetland (Environmental Commitment 3 and Environmental Commitment 10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird,* impacts on tricolored blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-36. Changes to Tricolored Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type		Permanent	Temporary
Water Conveyance Facilities	Breeding	Nesting	16	4
		Foraging-cultivated	1,430	190
		Foraging-noncultivated	311	92
	Nonbreeding	Roosting	10	31
		Foraging-cultivated	1,088	543
		Foraging-noncultivated	198	57
Total Impacts Water Conveyance Facilities			**3,053**	**917**
Environmental Commitments 4, 6–7, 9–12, and 15–16[a]	Breeding	Nesting	0	0
		Foraging-cultivated	723	0
		Foraging-noncultivated	0	0
	Nonbreeding	Roosting	0	0
		Foraging-cultivated	1,179	0
		Foraging-noncultivated	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–12, and 15–16[a]			**1,902**	**0**
Total Breeding			**2,480**	**287**
Total Nonbreeding			**2,475**	**630**
TOTAL IMPACTS			**4,955**	**917**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-87: Loss or Conversion of Habitat for and Direct Mortality of Tricolored Blackbird

Alternative 4A would result in the combined permanent and temporary loss of up to 5,872 acres of modeled habitat (2,767 acres of breeding habitat and up to 3,105 acres of nonbreeding habitat) for tricolored blackbird (Table 12-4A-36). Project components that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate tricolored blackbird habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the permanent loss of 1,757 acres of tricolored blackbird breeding habitat (16 acres nesting habitat, 1,430 acres of cultivated lands, and 311 acres of noncultivated lands suitable for foraging) and 1,296 acres of nonbreeding habitat (10 acres roosting habitat, 1,088 acres of cultivated lands, and 198 acres of noncultivated lands suitable for foraging, Table 12-4A-36). Approximately 771 of the 1,757 acres permanently impacted would be lost as reusable tunnel material storage areas, which would likely be moved to other sites for use in levee build-up and restoration, and the affected area would likely be restored. This effect is categorized as permanent because there is no assurance that the material would eventually be moved. In addition, water conveyance facilities would result in the temporary removal of 631 acres of breeding habitat (4 acres nesting habitat, 190 acres of cultivated lands, and 92 acres of noncultivated lands suitable for foraging) and 631 acres of nonbreeding habitat (31 acres roosting habitat, 543 acres of cultivated lands, and 57 acres of noncultivated lands suitable for foraging, Table 12-4A-36). *AMM21 Tricolored Blackbird* (described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) would minimize the effects of construction on nesting tricolored blackbirds if present in the area. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within 10–14 years.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal natural communities restoration would result in the inundation of approximately 59 acres of nonbreeding habitat (all acres consisting of cultivated lands suitable for foraging).
- *Environmental Commitment 7 Riparian Natural Communities Restoration*: Riparian natural communities restoration could remove approximately 251 acres of nonbreeding foraging habitat consisting of cultivated lands.
- *Environmental Commitment 8 Grassland Natural Communities Restoration*: Grassland natural communities restoration would convert approximately 407 acres of breeding foraging habitat and 663 acres of nonbreeding foraging habitat consisting of cultivated lands to grasslands. Grassland provides high-value foraging habitat for tricolored blackbird during the breeding season. Therefore, while impacted habitat may be temporarily unavailable, restored grasslands would be expected to provide foraging habitat for the species if in the vicinity of breeding colonies.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Marsh restoration activities would result in the permanent removal or conversion of approximately 316 acres of breeding foraging habitat and 516 acres of nonbreeding foraging habitat (all cultivated lands suitable for foraging). Some portion of the restored nontidal marsh would be open water, and the remainder would support emergent wetland vegetation that could provide roosting habitat for tricolored blackbird depending on vegetation density and composition.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in protected habitats could result in localized ground disturbances that could temporarily remove small amounts of tricolored blackbird habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available tricolored blackbird habitat and are expected to result in overall improvements to and maintenance of tricolored blackbird habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of *AMM2 Construction Best Management Practices and Monitoring* and *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and*

Dredged Material is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). Trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. Surveys would be conducted under *AMM21 Tricolored Blackbird* to ensure that areas identified for recreational development did not contain active breeding or foraging tricolored blackbirds (Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect tricolored blackbird use of the surrounding habitat in or adjacent to work areas. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Operation of construction equipment may cause injury to or mortality of tricolored blackbirds. Risk would be greatest to eggs and nestlings susceptible to land clearing activities, nest abandonment, or increased exposure to the elements or to predators. Injury to or mortality of adults and fledged juveniles would not be expected as individuals would be expected to avoid contact with construction equipment. Construction activities could temporarily fragment existing tricolored blackbird habitat during grading, filling, contouring, and other initial ground-disturbing operations that could temporarily reduce the extent and functions supported by the affected habitat. To the maximum extent practicable, construction activity will be avoided up to 1,300 feet, but not less than a minimum of 300 feet, from an active tricolored blackbird nesting colony. If monitoring determines an activity is adversely affecting a nesting colony, construction will be modified, as practicable, by either delaying construction until the colony site is abandoned or until the end of the breeding season, whichever occurs first, by temporarily relocating staging areas, or temporarily rerouting access to the construction site. These measures to avoid injury or mortality of nesting tricolored blackbirds are described in *AMM21 Tricolored Blackbird* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Table 12-4A-37. Tricolored Blackbird Foraging Habitat Value Classes

Foraging Habitat Value Class	Agricultural Crop Type/Habitats	
	Breeding Season[a] Foraging Habitat	Nonbreeding Season Foraging Habitat
Very high	Native pasture, nonirrigated native pasture, annual grasslands, vernal pool grasslands, alkali grasslands, unsprayed alfalfa, unsprayed sunflower, unsprayed mixed alfalfa	Livestock feed lots
High	Sunflower, alfalfa and mixed alfalfa, mixed pasture, induced high water table native pasture, nonirrigated mixed pasture, dairies	Corn, sunflower, alfalfa and mixed alfalfa, mixed pasture, native pasture, nonirrigated native pasture, rice, dairies, annual grasslands, vernal pool grasslands, alkali grasslands, native vegetation[b],
Moderate	Miscellaneous grasses, fallow lands cropped within 3 years, new lands prepped for crop production, livestock feed lots, organic rice	Miscellaneous grass pasture, nonirrigated mixed pasture, fallow lands cropped within 3 years, new lands prepped for crop production
Low	Mixed grain and hay crops, farmsteads, unirrigated mixed grain and hay, farm residences	Wheat, oats, mixed grain and hay, farmsteads, unirrigated mixed grain and hay, and on-irrigated misc. grain and hay
Marginal	Rice	None
None	All remaining crop types	All remaining crop types

[a] Generally March through August; occasional breeding in fall (September through November).

[b] Native vegetation is a land use designation within the California Department of Water Quality crop type dataset (2007). For the purposes of incorporating native vegetation classes into the correct species models, and, when applicable, assigning habitat foraging values, the management on these lands most resembles that of grassland or a nonirrigated pasture type.

Based on the habitat model, the study area approximately 164,947 acres of breeding and 259,093 acres of nonbreeding habitat for tricolored blackbird. The Delta is an important wintering area for the tricolored blackbird (Hamilton 2004, Beedy 2008). Although there is a large acreage of modeled breeding habitat available, the study area does not currently support many nesting tricolored blackbirds with the exception of a few occurrences on the fringes of the Suisun Marsh, in the Yolo Bypass, and along the southwestern perimeter of the study area. Alternative 4A would result in the combined permanent and temporary loss of up to 5,872 acres of modeled habitat (2,767 acres of breeding habitat and up to 3,105 acres of nonbreeding habitat) for tricolored blackbird (2% of the total breeding habitat in the study area and 1% of the total nonbreeding habitat in the study area). These impacts would consist of 20 acres of nesting habitat, 41 acres of roosting habitat, 657 acres of noncultivated foraging habitat, and 5,463 acres of cultivated lands suitable for foraging.

Typical NEPA and CEQA project-level mitigation ratios would be 2:1 for protection of nesting habitat, 1:1 creation and 1:1 protection of roosting wetland habitat, 2:1 protection for loss of noncultivated lands suitable for foraging (for the breeding and nonbreeding season), and 1:1 protection for the loss of cultivated lands.

Project proponents would commit to protecting and managing 42 acres of occupied or recently occupied (within the last 15 years) tricolored blackbird nesting habitat located within 3 miles of high-value foraging habitat in Conservation Zones 1, 2, 8, or 11. Nesting habitat would be managed to provide young, lush stands of bulrush/cattail emergent vegetation and prevent vegetation senescence (Resource Restoration and Performance Principle TB1). These acres would compensate for impacts on 20 acres of tricolored blackbird nesting habitat. An additional 41 acres of nontidal wetland would be protected and 41 acres would be restored which would provide sufficient compensation for impacts on 41 acres of roosting habitat. Alternative 4A would also commit to protecting 1,620 acres of high- to very high-value breeding-foraging habitat (as defined in Table 4A-38) within 5 miles of occupied or recently occupied - within the last 15 years - tricolored blackbird nesting habitat. At least 130 acres would be within 5 miles of the 42 acres of nontidal wetland nesting habitat protected (Resource Restoration and Performance Principle TB2). In addition, 5,463 acres of moderate-, high-, or very high-value cultivated lands (as defined in Table 4A-38) would be protected as nonbreeding foraging habitat, at least 50% of which would be of high- or very high-value (Resource Restoration and Performance Principle TB3). These acres would be sufficient to compensate for impacts on tricolored blackbird foraging habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of tricolored blackbird breeding and nonbreeding habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting acreages that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles TB1–TB4, and by AMM1–AMM7, and *AMM21 Tricolored Blackbird*, which would be in place during all project activities. Considering these commitments, losses and conversions of tricolored blackbird habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on tricolored blackbird habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles TB1–TB4, and by AMM1–AMM6, and *AMM21 Tricolored Blackbird*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of tricolored blackbird. Therefore, Alternative 4A would have a less-than-significant impact on tricolored blackbird under CEQA.

Impact BIO-88: Effects on Tricolored Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that tricolored blackbirds could be subject to power line strikes, which could result in injury or mortality of individuals. Tricolored blackbirds would have the potential to intersect the proposed transmission lines largely due to winter movements throughout the study area, when individuals are migrating in large flocks and dense fog is common in the area. Although migratory movements and daily flights between roosting and foraging habitat make tricolored blackbird vulnerable to collision with transmission lines, daily flights associated with winter foraging likely occurs in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would further reduce any potential for tricolored blackbird collision with transmission lines.

Transmission line poles and towers provide perching substrate for raptors, which are predators on tricolored blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on tricolored blackbirds, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is minimal.

***NEPA Effects*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily in winter during daily flights between roosting and foraging sites and during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is considered minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on tricolored blackbird.

***CEQA Conclusion*:** New transmission lines would increase the risk for tricolored blackbird powerline strikes, primarily in winter during daily flights between roosting and foraging sites and during migration movements. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on tricolored blackbird. The increase in predation risk on tricolored blackbird from an increase in raptor perching opportunities is considered minimal. The construction and operation of new transmission lines under Alternative 4A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on tricolored blackbird.

Impact BIO-89: Indirect Effects of the Project on Tricolored Blackbird

Indirect construction- and operation-related effects: Tricolored blackbird nesting habitat within the vicinity of proposed construction areas that could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect tricolored blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. Construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. *AMM21 Tricolored Blackbird* would require preconstruction surveys, and if detected, covered activities would be avoided within a minimum 300 feet of an active nesting colony and up to 1,300 feet where practicable until breeding has ceased. In addition, monitoring would be implemented to ensure that construction does not adversely affect the nesting colony. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect tricolored blackbird in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to tricolored blackbird habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including tricolored blackbird. Tidal and nontidal marsh restoration also have the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury.

Breeding tricolored blackbirds are not thought to be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects and increased methylmercury associated with natural community restoration could indirectly affect tricolored blackbird, via uptake in lower tropic levels (as described in the, Appendix 5.D, *Contaminants*, of the Draft BDCP). A detailed review of the methylmercury issues associated with implementation of the Alternative 4A is contained in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. The review includes an overview of the project-related mechanisms that could result in increased mercury in the food web, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase.

Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including tricolored blackbird. Tidal and nontidal marsh restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4 and Environmental Commitment 5) would lead to adverse effects on tricolored blackbird.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on tricolored blackbird from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see

Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** The effects of noise, potential spills of hazardous material, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would not be adverse with the implementation of AMM1–AMM7 and *AMM21 Tricolored Blackbird*.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

***CEQA Conclusion*:** Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of *AMM21 Tricolored Blackbird* and AMM1–AMM7.

Tidal habitat restoration could result in increased exposure of tricolored blackbird to selenium. This impact would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

The implementation of tidal natural communities restoration could result in increased exposure of tricolored blackbird to methylmercury. It is unlikely that breeding tricolored blackbird would be highly susceptible to methylmercury exposure because tidal wetlands are not expected to be a major foraging area for the species. However, it is unknown what concentrations of methylmercury are harmful to this species. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on tricolored blackbird.

Therefore, with AMM1–AMM7, AMM21, AMM27, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on tricolored blackbird.

Impact BIO-90: Periodic Effects of Inundation of Tricolored Blackbird Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on tricolored blackbird.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Burrowing Owl

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on western burrowing owl. Western burrowing owl modeled habitat consisted of high- and low-value habitat for nesting and foraging. High-value habitat consists of plant alliances within the grassland and vernal pool natural communities and pasture. Low-value habitat includes plant alliances and crop types from managed wetland, alkali seasonal wetland, and cultivated lands. Value was determined through reported species use patterns from the literature.

Alternative 4A would result in both temporary and permanent losses of western burrowing owl modeled habitat as indicated in Table 12-4A-38. Full implementation of Alternative 4A would also include the following environmental commitments Resource Restoration and Performance Principles which would benefit the western burrowing owl.

- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres and would also benefit western burrowing owl:
  - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in a minimum of 40-acre patches (Resource Restoration and Performance Principle SH1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and *AMM23 Western Burrowing Ow*l, impacts on western burrowing owl would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-38. Changes in Western Burrowing Owl Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	High-value	920	220
	Low-value	2,403	747
Total Impacts Water Conveyance Facilities		**3,323**	**967**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	2,212	0
	Low-value	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
Total High-value		**3,132**	**220**
Total Low-value		**2,403**	**747**
TOTAL IMPACTS		**5,535**	**967**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-91: Loss or Conversion of Habitat for and Direct Mortality of Western Burrowing Owl

Alternative 4A would result in the combined permanent and temporary loss of up to 6,502 acres of modeled habitat for western burrowing owl (of which 3,352 acres is of high-value and 3,150 acres is of low value, Table 12-4A-38). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 8 Grassland Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management.* Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western burrowing owl habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 1,140 acres of acres of modeled high-value western burrowing owl habitat (920 acres of permanent loss, 220 acres of temporary loss) from CZs 3–6 and CZ 8. In addition, 3,150 acres of low-value burrowing owl habitat would be removed (2,403 acres of permanent loss, 747 acres of temporary loss). The majority of high-value grassland habitat that would be removed would be in CZ 8, from the construction of the new forebay in CZ 8. There is a high concentration of CNDDB and DHCCP survey records for western burrowing owls in CZ 8 to the west and the south of the Clifton Court Forebay. The loss of high-value habitat from facility construction and the establishment of the forebay reusable tunnel material storage area could remove occupied habitat, displace nesting and wintering owls, and fragment occupied burrowing owl habitat.
- The reusable tunnel material storage area overlaps with six occurrences of western burrowing owl and there are also several occurrences west of the new forebay control structure that could be indirectly affected by construction activities. The amount of storage area needed for reusable

tunnel material is flexible (dependent on storage pile height and other factors) and the footprint used in the effects analysis is based on a worst case scenario. However, the actual area to be affected by reusable tunnel material storage would likely be less than the estimated acreage. The implementation of *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material* and *AMM23 Western Burrowing Owl* would require that to the extent practicable, the reusable tunnel material storage area footprint avoided locations where active burrows are present. The footprints of a permanent transmission line and a permanent access road, both located west of the Clifton Court Forebay overlap with an additional 8 occurrences of western burrowing owl. Preconstruction surveys would be conducted prior to any construction activities under *AMM23 Western Burrowing Owl* during the nonbreeding and the breeding season. If avoidance was not possible, passive relocation would be considered in consultation with CDFW. If owls were to be excluded from existing burrows, artificial burrows would be used if it were possible for them to be installed within 100 meters from the existing burrows on protected lands. A substantial portion of the high-value grassland protection and enhancement under *Environmental Commitment 8 Grassland Natural Community Restoration* would be expected to occur to the west and to the south of these occurrences in CZ 8, which would provide high-value protected lands in close proximity to the disturbed habitat.

- Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 59 acres of high-value western burrowing owl habitat.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of high-value western burrowing owl habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would permanently remove approximately 1,070 acres of high-value western burrowing owl habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Implementation would result in the permanent removal of 832 acres of high-value western burrowing owl habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of western burrowing owl habitat. The burrowing owl's fossorial habits make the species more sensitive to the effects of ground disturbance than other raptors. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western burrowing owl habitat and would be expected to result in overall improvements to and maintenance of habitat values. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- Habitat management- and enhancement-related activities and equipment operation could destroy nests burrows, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. The potential for these activities to result in nest failure and mortality or other adverse effects on western burrowing owl would be avoided or minimized with the incorporation of *AMM23 Western Burrowing Owl* which would require surveys to determine presence or absence and the establishment of no-disturbance buffers around active sites.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western burrowing owl use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of western burrowing owl. However, if nest burrows were occupied in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to abandonment. *AMM23 Western Burrowing Owl* would ensure that preconstruction surveys detected any occupied burrows and no-disturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Based on the habitat model, the study area supports approximately 152,014 acres of high-value and 254,352 acres of low-value habitat for western burrowing owl. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 3,352 acres of high-value habitat (2% of the habitat in the study area) and 3,150 acres of low-value western burrowing owl habitat (<2% of the habitat in the study area). These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 2:1 protection of high-value habitat, and 1:1 protection of low-value habitat. Using these typical ratios would indicate that 6,704 acres should be protected to compensate for the loss of high-value habitat and 3,150 acres should be protected to compensate for the loss of low-value habitat.

Project proponents would commit to protect 1,060 acres of grassland and 11,870 acres of cultivated lands, which would be sufficient to compensate for impacts on western burrowing owl habitat. As part of these acres of protection, Alternative 4A would conserve 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (which would also benefit western burrowing owl), which would total 6,805 acres. These acres would be sufficient to compensate for impacts on western burrowing owl habitat.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged*

Material, and AMM7 Barge Operations Plan. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of western burrowing owl habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle SH1, and by AMM1–AMM7, and *AMM23 Western Burrowing Owl*, which would be in place during all project activities. Considering these commitments, losses and conversions of western burrowing owl habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on western burrowing owl habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle SH1, and by AMM1–AMM6 and *AMM23 Western Burrowing Owl*, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of western burrowing owl. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on western burrowing owl under CEQA.

Impact BIO-92: Effects on Western Burrowing Owl Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes and/or electrocution, which could result in injury or mortality of western burrowing owl. The species is large-bodied but with relatively long and rounded wings, making it moderately maneuverable. While burrowing owls may nest in loose colonies, they do not flock or congregate in roosts or foraging groups. Collectively, the species' keen eyesight and largely ground-based hunting behavior make it a relatively low-risk species for powerline collision. While the species in not widespread in the study area, it may become more widely distributed as grassland enhancement improves habitat for the species. Even so, the risk of effects on the population are low, given its physical and behavioral characteristics (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*) and new transmission lines would not be expected to have an adverse effect on the species. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would make transmission lines highly visible to western burrowing owls and would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60%, which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western burrowing owl because the risk of bird strike is considered to be minimal based on the owl's physical and behavioral characteristics. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60%, which would further reduce any potential for powerline collisions.

Impact BIO-93: Indirect Effects of the Project on Western Burrowing Owl

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western burrowing owl use of up to 13,922 acres of modeled burrowing owl habitat (6,113 acres of high-value habitat) within 500 feet of covered activities will temporarily be made less suitable as a result of construction noise and visual disturbances adjacent to proposed construction areas. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Any disturbance within 250 feet of a burrow occupied by burrowing owl during the breeding season (February 1–August 31) and within 160 feet during the nonbreeding season (September 1–January 31) could potential displace winter owls or cause abandonment of active nests. These potential effects would be minimized with incorporation of *AMM23 Western Burrowing Owl* into Alternative 4A, which would require preconstruction surveys and establish no-disturbance buffers around active burrows. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect western burrowing owl.

The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western burrowing owl in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western burrowing owl habitat could also affect the species. AMM1–AMM7 in addition to *AMM23 Western Burrowing Owl* would minimize the likelihood of such spills and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

***NEPA Effects*:** Indirect effects on western burrowing owl as a result of Alternative 4A implementation could have adverse effects on this species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work area. With the implementation of AMM1–AMM7, and *AMM23 Western Burrowing Owl*, the indirect effects from Alternative 4A implementation would not be adverse under NEPA.

***CEQA Conclusion*:** Indirect effects on western burrowing owl as a result of Alternative 4A implementation could have significant impacts on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting owls or active burrows in the high-value grassland habitat surrounding Clifton Court Forebay and adjacent to work areas. With the implementation of AMM1–AMM7 and *AMM23 Western Burrowing Owl*, the indirect effects resulting from Alternative 4A implementation would have a less-than-significant impact on western burrowing owl.

Impact BIO-94: Periodic Effects of Inundation on Western Burrowing Owl Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on western burrowing owl.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Western Yellow-Billed Cuckoo

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on western yellow-billed cuckoo. The habitat model for Western yellow-billed cuckoo includes potential breeding habitat, which includes plant alliances from the valley/foothill riparian modeled habitat that contain a dense forest canopy for foraging with understory willow for nesting, and a minimum patch size of 50 acres, and migratory habitat, which includes the same plant alliances as breeding habitat without the minimum 50 acres patch size requirement.

The western yellow-billed cuckoo is uncommon in the study area at present, and the likelihood that it would be found using the modeled habitat is low relative to more abundant riparian species. Nesting of the species in the study area has not been confirmed for approximately 100 years. Western yellow-billed cuckoo was detected in the study area during 2009 DHCCP surveys, but nesting was not confirmed and the bird is suspected to have been a migrant (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS). Alternative 4A would result in both temporary and permanent losses of Western yellow-billed cuckoo modeled habitat as indicated in Table 12-4A-39. Full implementation Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles which would benefit the western yellow-billed cuckoo.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7. The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation and will be a minimum width of 330 feet (Resource Restoration and Performance Principles VFR2 and VFR3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities,* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on Western yellow-billed cuckoo would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-39. Changes in Western Yellow-Billed Cuckoo Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Breeding	6	4
	Migratory	18	19
Total Impacts Water Conveyance Facilities		**24**	**23**
Environmental Commitments 4, 6–7, 9–11[a]	Breeding	1	0
	Migratory	4	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
Total Breeding		**7**	**4**
Total Migratory		**22**	**19**
TOTAL IMPACTS		**29**	**23**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-95: Loss or Conversion of Habitat for and Direct Mortality of Western Yellow-Billed Cuckoo

Alternative 4A would result in the combined permanent and temporary loss of up to 52 acres of modeled habitat for western yellow-billed cuckoo (11 acres of breeding habitat, 41 acres of migratory habitat, Table 12-4A-39). Project components that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate western yellow-billed cuckoo modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 10 acres of breeding habitat (6 acres of permanent loss, 4 acres of temporary loss) for yellow-billed cuckoo. In addition, 37 acres of migratory habitat would be removed (18 acres of permanent loss, 19 acres of temporary loss, see Table 12-4A-39). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary barge unloading facilities and work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and 8. Permanent habitat loss would occur from the construction of Intakes 2, 3, and 5 on the east bank of the Sacramento River between Freeport and Courtland. Some habitat would also be impacted by the construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Additional losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. Permanent and temporary habitat losses from the above environmental commitments, would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

There are no extant occurrences of yellow-billed cuckoo nests in the study area; however, habitat loss from the construction of water conveyance facilities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would minimize the effects of construction on nesting cuckoos if present in the area (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP). Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 1 acres of modeled yellow-billed cuckoo breeding habitat and 4 acres of modeled migratory habitat. There are no extant nesting records of yellow-billed cuckoo in the study area. However, a yellow-billed cuckoo detection was recorded during DHCCP surveys in 2009 (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, in the Draft EIR/EIS) in CZ 5 between Twin Cities Road and Walnut Grove.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat protection and management activities that could be implemented in protected western yellow-billed cuckoo habitats would maintain and improve the functions of the habitat. With conditions favorable for its future establishment in the study area, western yellow-billed cuckoo would be expected to benefit from the increase in protected habitat. However, habitat management- and enhancement-related activities could disturb western yellow-billed cuckoo nests if they were present near work sites. Environmental Commitment 11 actions designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of western yellow-billed cuckoo habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available western yellow-billed cuckoo habitat and would be expected to result in overall improvements and maintenance of western yellow-billed cuckoo habitat values.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect western yellow-billed cuckoo use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Western yellow-billed cuckoo nesting has not been confirmed in the Delta for approximately 100 years. However, an unconfirmed breeding detection during 2009 DHCCP surveys (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIR) and the presence of suitable habitat indicate that the species is potentially breeding in the study area, or may nest there in the future. Construction-related activities would not be expected to result in direct mortality of adult or fledged western yellow-billed cuckoo if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. Although there is minimal habitat in the Plan Area that is of appropriate width, and suitable understory to support nesting cuckoos, if western yellow-billed cuckoo were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. These effects would be avoided and minimized with the incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The habitat model indicates that the study area supports approximately 12,395 acres of modeled breeding and migratory habitat for yellow-billed cuckoo. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 52 acres of modeled habitat (<1% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat. Using these ratios would indicate that 52 acres of valley/foothill riparian habitat should be restored/created and 52 acres should be protected to compensate for the losses of western yellow-billed cuckoo habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature riparian forest would be maintained within either CZ 4 (in the vicinity of Cosumnes River Preserve) or CZ 7 (in the vicinity of San Joaquin National Wildlife Refuge and Caswell State Memorial Park) to ensure that restored and protected riparian would be of sufficient size to provide suitable habitat for yellow-billed cuckoo (Resource Restoration and Performance Principle VFR2). The mature riparian forest would be intermixed with a portion of the early- to mid-successional riparian vegetation and would be a minimum width of 330 feet (Resource Restoration and Performance Principle VFR3).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of western yellow-billed cuckoo habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, and by AMM1–AMM7, AMM10, and AMM22. These environmental commitments and AMMs would be in place during all project activities. Considering these commitments, losses and conversions of western yellow-billed cuckoo habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of western yellow-billed cuckoo habitat from Alternative 4A would represent an adverse effect in the absence of environmental commitments and AMMs as a result of habitat modification and potential for direct mortality of a special-status species. However, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principles VFR1-VFR3 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of western yellow-billed cuckoo. Therefore, Alternative 4A would have a less-than-significant impact on western yellow-billed cuckoo under CEQA.

Impact BIO-96: Fragmentation of Western Yellow-Billed Cuckoo Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing operations for water conveyance facilities construction may temporarily fragment modeled western yellow-billed cuckoo habitat. This could temporarily reduce the extent and functions supported by the affected habitat. Because western yellow-billed cuckoo is not currently known to breed in the study area, and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, habitat fragmentation would have a minimal effect on the species.

NEPA Effects: Because western yellow-billed cuckoo is not currently known to breed in the study area and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, fragmentation of habitat would not have an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: Because western yellow-billed cuckoo is not currently known to breed in the study area and the protection and restoration of riparian habitat will expand contiguous habitat block requirements, fragmentation of habitat would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-97: Effects on Western Yellow-Billed Cuckoo Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of western yellow-billed cuckoo. Because the western yellow-billed cuckoo uses riparian forests to meet all of its breeding and wintering life requisites, the species remains primarily within the canopy of riparian forests and rarely ventures into open spaces except during migration, limiting its opportunity to encounter the proposed transmission lines. As a summer resident, if the species were to occur in the study area it would be during periods of relatively high visibility and clear weather conditions, thus further reducing collision risk from daily use patterns or seasonal migration flights. Finally, western yellow-billed cuckoo wing shape is characterized by low wing loading and a moderate aspect ratio, making the species moderately maneuverable and presumably able to avoid collisions, especially during high-visibility conditions (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*).

Transmission line poles and towers also provide perching substrate for raptors, which are predators on western yellow-billed cuckoo. Although there is potential for transmission lines to result in increased perching opportunities for raptors, the existing network of transmission lines in the study area currently poses these risks and any incremental risk associated with the new power line corridors would not be expected to affect the population. In addition, the transmission lines that would be constructed in the vicinity of modeled western yellow-billed cuckoo habitat would be temporary and would be removed within 10–14 years of Alternative 4A implementation. Because there is low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities is minimal.

NEPA Effects: The risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence in the study area during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities is minimal. Therefore the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on western yellow-billed cuckoo.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on western yellow-billed cuckoo because the risk of bird-strike is considered to be minimal based on the species' rarity in the study area, its proclivity to remain in the riparian canopy, its presence during periods of relative high visibility, and its overall ability to successfully negotiate around overhead wires that it may encounter. Transmission line poles and towers also provide perching substrate for raptors, which could result in increased predation pressure on western yellow-billed cuckoo. However, because there is a low probability for the species to occur in the study area, and because the transmission lines that would be constructed near modeled habitat would be temporary, any increase in predation risk on western yellow-billed cuckoo from an increase in raptor perching opportunities is minimal. Therefore the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-98: Indirect Effects of the Project on Western Yellow-Billed Cuckoo

Construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect western yellow-billed cuckoo use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect western yellow-billed cuckoo. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If western yellow-billed cuckoo were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect western yellow-billed cuckoo in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to western yellow-billed cuckoo habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests.

***NEPA Effects*:** Indirect effects on western yellow-billed cuckoo as a result of Alternative 4A implementation could have adverse effects on the species through the modification of habitat and potential for direct mortality. However, due to the species' minimal presence in the study area, and with the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A, indirect effects would not have an adverse effect on western yellow-billed cuckoo.

***CEQA Conclusion*:** Indirect effects on western yellow-billed cuckoo as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on western yellow-billed cuckoo.

Impact BIO-99: Periodic Effects of Inundation of Western Yellow-Billed Cuckoo Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on western yellow-billed cuckoo.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

White-Tailed Kite

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on white-tailed kite. The habitat model used to assess impacts on white-tailed kite includes nesting habitat and foraging habitat. Most white-tailed kites in the Sacramento Valley are found in oak and cottonwood riparian forests, valley oak woodlands, or other groups of trees and are usually associated with compatible foraging habitat for the species in patches greater than 1,500 square meters (Erichsen et al. 1996). Modeled foraging habitat for white-tailed kite consists of pasture and hay crops, compatible row and grain crops and natural vegetation such as seasonal wetlands and annual grasslands (Erichsen et al. 1995).

Alternative 4A would result in both temporary and permanent losses of white-tailed kite modeled habitat as indicated in Table 12-4A-402. The majority of the losses would result from the construction of the water conveyance facilities. Although restoration for the loss of nesting and foraging habitat would be initiated in the same timeframe as the losses, it could take one or more decades (for nesting habitat) for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM39 White-Tailed Kite*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles which would benefit the white-tailed kite.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).
- Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7.The mature riparian forest will be intermixed with a portion of the early- to mid-successional riparian vegetation will be a minimum width of 330 feet (Resource Restoration and Performance Principles VFR2 and VFR3).
- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres and would also benefit white-tailed kite:

- Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in minimum patch sizes of 40 acres (as part of the total cultivated lands protected) (Resource Restoration and Performance Principle SH1).
- Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) (Resource Restoration and Performance Principle SH2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands within the reserve system including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

White-tailed kite is a fully protected species and take of white-tailed kite individuals is prohibited under Section 3511 of the Fish and Game Code. With the implementation of *AMM39 White-Tailed Kite*, construction activities would not result in take and effects on the species would be avoided. As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM39 White-Tailed Kite,* impacts on white-tailed kite would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-40. Changes in White-Tailed Kite Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	31	21
	Foraging	3,420	1,181
Total Impacts Water Conveyance Facilities		**3,451**	**1,202**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
	Foraging	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,217**	**0**
Total Nesting		**36**	**21**
Total Foraging		**5,632**	**1,181**
TOTAL IMPACTS		**5,668**	**1,202**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-100: Loss or Conversion of Habitat for and Direct Mortality of White-Tailed Kite

Alternative 4A would result in the combined permanent and temporary loss of up to 6,870 acres of modeled habitat (57 acres of nesting habitat and 6,813 acres of foraging habitat) for white-tailed kite (Table 12-4A-40). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could affect white-tailed kite modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 52 acres of white-tailed kite nesting habitat (31 acres of permanent loss and 21 acres of temporary loss). In addition, 4,601 acres of foraging habitat would be removed (3,420 acres of permanent loss, 1,181 acres of temporary loss). Activities that would impact modeled white-tailed kite habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. Most of the permanent loss of nesting habitat would occur where Intakes 1–3 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. There are no occurrences of nesting white-tailed kite that overlap with the construction footprint of water conveyance facilities. White-tailed kite is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If white-tailed kite were to nest in or adjacent to work areas, the implementation of *AMM39 White-Tailed Kite* would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings by restricting construction activities during the breeding season or establishing suitable buffers around active nests. (*AMM39 White-Tailed Kite* is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Impacts on foraging habitat would occur throughout the central Delta in CZs 3–6, and CZ 8. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of white-tailed kite nesting habitat and 59 acres of foraging habitat. The conversion of cultivated lands to tidal wetlands over fairly broad areas within the tidal restoration footprints could result in the removal or abandonment of nesting territories that occur within or adjacent to the restoration areas. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *Environmental Commitment 7 Riparian Natural Community Restoration:* Riparian restoration would permanently remove approximately 251 acres of white-tailed kite foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration:* Grassland restoration would permanently convert approximately 1,070 acres of cultivated lands suitable for foraging by white-tailed kite to grassland.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent conversion of 832 acres of cultivated lands to nontidal marsh. This would not result in a loss of foraging habitat as both natural communities are foraging habitat for white-tailed kite. Small patches of riparian vegetation that support White-tailed kite nesting habitat may develop along the margins of restored nontidal marsh restoration would also provide foraging habitat for the species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb white-tailed kite nests if they were present near work sites. A variety of habitat management actions that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of white-tailed kite habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available white-tailed kite habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM39 White-Tailed Kite* and updated versions of *AMM2 Construction Best Management Practices and Monitoring* and *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). The implementation of *AMM39 White-Tailed Kite* would avoid disturbance and nest abandonment by requiring restrictions on construction activities during the breeding season or establishing nodisturbance buffers. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- Permanent and temporary white-tailed kite nesting habitat losses from the above environmental commitments would primarily consist of small, fragmented riparian stands. Temporarily affected nesting habitat would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. The restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. *AMM39 White-Tailed Kite* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees and planting of trees near high-value foraging habitat. The functions of agricultural and grassland communities that provide foraging habitat for white-tailed kite are expected to be restored relatively quickly.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect white-tailed kite use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. Effects of operations and maintenance activities on active white-tailed kite nests would be avoided by the implementation of *AMM39 White-Tailed Kite* which would restriction activities during the breeding season or require a construction buffer to minimize disturbance. If emergency repairs were required during the breeding season that could potentially result in take, CDFW consultation would be initiated (*AMM39 White-Tailed Kite* is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

- Injury and Direct Mortality: Construction-related activities would not be expected to result in take of adult or fledged white-tailed kite if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. However, if white-tailed kite were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment. White-tailed kite is a fully protected species and take is prohibited under Section 3511 of the Fish and Game Code. If active nests were present in or adjacent to work areas, the implementation of *AMM39 White-Tailed Kite*, would restrict construction activities during the breeding season, or require a construction buffer that would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings (*AMM39 White-Tailed Kite* is described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,069 acres of modeled nesting habitat and 507,922 acres of modeled foraging habitat for white-tailed kite. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 57 acres of potential nesting habitat (<1% of the potential nesting habitat in the study area) and the loss or conversion of 6,813 acres of foraging habitat (1% of the foraging habitat in the study area). The locations of these losses are described above in the analyses of individual environmental commitments.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat, and 1:1 protection for foraging habitat. Using these ratios would indicate that 57 acres of nesting habitat should be restored/ created and 57 acres should be protected to mitigate the losses of white-tailed kite nesting habitat. In addition, 6,813 acres of foraging habitat of should be protected to compensate for the losses of white-tailed kite foraging habitat.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. Project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat which would protect a total of 6,805 acres of white-tailed kite foraging habitat (Resource Restoration and Performance Principle SH1). These acres of cultivated lands and grasslands would be located above -1 foot above mean sea level. At least 50% of these lands would be in very high-value production for the Swainson's hawk (alfalfa) (Resource Restoration and Performance Principle SH2). These Swainson's hawk Resource Restoration and Performance Principles would be associated with Environmental Commitment 3 and would occur in the same timeframe as the construction and early restoration losses and would compensate for effects on white-tailed kite foraging habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland, which would provide nesting habitat for white-tailed kite. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1). A single, contiguous patch of 100 acres of mature, riparian forest would be maintained in either CZ 4 or CZ 7 (Resource Restoration and Performance Principle VFR2), as part of the acres of restoration and protection under Environmental Commitment 7. In addition, small but essential nesting habitat for white-tailed kite associated with cultivated lands would also be maintained and protected such as isolated trees, tree rows along field borders or roads, or small clusters of trees in farmyards or at rural residences (Environmental Commitment 3).

The 251 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by white-tailed kite. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active white-tailed kite nests within the study area until restored riparian habitat is sufficiently developed.

AMM39 White-Tailed Kite would implement a program to plant large mature trees, including transplanting trees scheduled for removal. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A reserve system for every tree 20 feet or taller anticipated to be removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A reserve system in areas that support high-value foraging habitat in clumps of at least three trees each at appropriate sites within or adjacent to conserved cultivated lands, or they could be incorporated as a component of the riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Replacement trees that were incorporated into the riparian restoration would not be clustered in a single region of the study area, but would be distributed throughout the lands protected as foraging habitat for white-tailed kite.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. The implementation of these AMMs, in addition to *AMM39 White-Tailed Kite*, would avoid the risk of take of individuals in habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP; AMM2, AMM6 and AMM39 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of white-tailed kite nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles VFR1-VFR3, SH1, SH2, and CL1, AMM1–

AMM7, AMM10, and *AMM39 White-Tailed Kite*, which would restrict construction activities during the breeding season and would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings and would be in place during all project activities. Considering these commitments, losses and conversions of white-tailed kite habitat under Alternative 4A would not be adverse.

***CEQA Conclusion*:** The effects on white-tailed kite habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for take in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles VFR1–VFR3, SH1, SH2, and CL1, AMM1–AMM6, AMM10, and *AMM39 White-Tailed Kite*, which would restrict construction activities during the breeding season and would avoid disturbance and nest abandonment, mortality of eggs, nestlings, or fledglings and would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not result in "take" of white-tailed kite per Section 86 of the California Fish and Game Code. Therefore, Alternative 4A would have a less-than-significant impact on white-tailed kite under CEQA.

Impact BIO-101: Effects on White-Tailed Kite Associated with Electrical Transmission Facilities

There are several known occurrences of nesting white-tailed kite within 5 miles of the proposed transmission line alignment. While white-tailed kite flight behavior puts them regularly within the range of heights proposed for the new transmission lines (50 to 110 feet), their keen vision and high maneuverability substantially reduce powerline collision risk for the species. Like other diurnal raptors, white-tailed kites have highly developed eyesight (Jones et al. 2007), allowing them to detect small prey while hunting from relatively high altitudes. Keen eyesight also allows for detection and avoidance of other aerial objects, including above-ground utility lines. Like many other falcons, the white-tailed kite has long, narrow, tapered wings and body size that allow for efficient soaring flight and highly developed aerial maneuverability. White-tailed kite are at low risk of take from bird strike from the construction of new transmission lines based on its general maneuverability, its keen eyesight, and lack of flocking behavior (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would substantially reduce any risk of collision with lines.

***NEPA Effects*:** The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further eliminate risk of take from bird strike for white-tailed kite from the project. Therefore, the construction and operation of new transmission lines would not result in an adverse effect on white-tailed kite.

CEQA Conclusion: The construction and presence of new transmission lines would not result in "take" of white-tailed kite per Section 86 of the California Fish and Game Code because the risk of bird strike is considered to be minimal based on the species' general maneuverability, keen eyesight, and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further eliminate any risk of take from bird strike for white-tailed kite from the project. Therefore, the construction and operation of new transmission lines would result in a less-than-significant impact on white-tailed kite.

Impact BIO-102: Indirect Effects of the Project on White-Tailed Kite

White-tailed kite nesting habitat within the vicinity of proposed construction areas could be indirectly affected by construction activities. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect white-tailed kite. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If white-tailed kite were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. The implementation of *AMM39 White-Tailed Kite* would avoid the risk of take of individual white-tailed kites in habitats in or adjacent to work areas by restricting construction activities during the breeding season or establishing nodisturbance buffers around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect white-tailed kite in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to white-tailed kite habitat could also affect the species. AMM1–AMM7, and *AMM39 White-tailed Kite*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including white-tailed kite. Marsh (tidal and nontidal) an restoration also has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Increased methylmercury associated with natural community restoration may indirectly affect white-tailed kite (see Appendix 5.D, *Contaminants*, of the Draft BDCP). However, the potential mobilization or creation of methylmercury within the study area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that would determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including white-tailed kite. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4, Environmental Commitment 5) would lead to adverse effects on white-tailed kite.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on white-tailed kite from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27*

Selenium Management, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*: **Noise and visual disturbances from the construction of water conveyance facilities could reduce white-tailed kite use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect use of the surrounding habitat by white-tailed kite. Noise, potential spills of hazardous materials, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would not have an adverse effect on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite* which would avoid the risk of take of individuals*.* Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4A implementation would not have an adverse effect on white-tailed kite. Tidal habitat restoration is unlikely to have an adverse effect on white-tailed kite through increased exposure to methylmercury, as kites currently forage in tidal marshes where elevated methylmercury levels exist. However, it is unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Site-specific restoration plans in addition to monitoring and adaptive management, described in *Environmental Commitment 12 Methylmercury Management,* would address the uncertainty of methylmercury levels in restored tidal marsh. The site-specific planning phase of marsh restoration would be the appropriate place to assess the potential for risk of methylmercury exposure for white-tailed kite, once site specific sampling and other information could be developed.

***CEQA Conclusion*: **Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on white-tailed kite with the implementation of AMM1–AMM7, and *AMM39 White-Tailed Kite*, which would avoid the risk of take of individuals. Tidal habitat restoration could result in increased exposure of white-tailed kite to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of white-tailed kite to methylmercury. However, it is unknown what concentrations of methylmercury are harmful to this species. *Environmental Commitment 12 Methylmercury Management* includes provisions for project-specific Mercury Management Plans. Site-specific restoration plans that address the creation and mobilization of mercury, as well as monitoring and adaptive management as described in Environmental Commitment 12, would better inform potential impacts and address the uncertainty of methylmercury levels in restored tidal marsh in the study area on white-tailed kite. With these measures in place, the indirect effects associated with noise and visual disturbances, potential spills of hazardous material, and increased exposure to selenium from Alternative 4A implementation would have a less-than-significant impact on white-tailed kite.

Impact BIO-103: Periodic Effects of Inundation of White-Tailed Kite Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on white-tailed kite.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Yellow-Breasted Chat

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on yellow-breasted chat. Yellow-breasted chat modeled habitat includes suitable nesting and migratory habitat as those plant alliances from the valley/foothill riparian modeled habitat that contain a shrub component and an overstory component. Primary nesting and migratory habitat is qualitatively distinguished from secondary habitat in Delta areas as those plant associations that support a greater percentage of a suitable shrub cover, particularly blackberry, and California wild rose, and have an open to moderately dense overstory canopy, using data from Hickson and Keeler-Wolf (2007). No distinction is made between primary and secondary habitat for Suisun Marsh/Yolo Basin habitats because supporting information is lacking.

Alternative 4A would result in both temporary and permanent losses of yellow-breasted chat modeled habitat as indicated in Table 12-4A-41. Full implementation of Alternative 4A would also include the following environmental commitments and Resource Restoration and Performance Principles which would benefit the yellow-breasted chat.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance these natural communities for the species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, impacts on yellow-breasted chat would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-41. Changes in Yellow-Breasted Chat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Nesting and Migratory Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Primary	16	16
	Secondary	17	10
Total Impacts Water Conveyance Facilities		**33**	**26**
Environmental Commitments 4, 6–7, 9–11[a]	Primary	5	0
	Secondary	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
Total Primary		**21**	**16**
Total Secondary		**17**	**10**
TOTAL IMPACTS		**38**	**26**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-104: Loss or Conversion of Habitat for and Direct Mortality of Yellow-Breasted Chat

Alternative 4A would result in the combined permanent and temporary loss of up to 64 acres of modeled nesting and migratory habitat for yellow-breasted chat (38 acres of permanent loss, 26 acres of temporary loss, Table 12-4A-41). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate yellow-breasted chat habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 32 acres of primary habitat (16 acres of permanent loss, 16 acres of temporary loss). In addition, 27 acres of secondary habitat would be removed (17 acres of permanent loss, 10 acres of temporary loss, Table 12-4A-41). Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and temporary work areas. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and 8. Most of the permanent loss of habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some habitat would be lost due to construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Permanent habitat loss would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary loss of habitat would occur from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation.

- Habitat loss from water conveyance facilities activities would have the potential to displace individuals, if present, and remove the functions and value of modeled habitat for nesting, protection, or foraging. There are no occurrences of yellow-breasted chat that overlap with the water conveyance facilities construction footprint. The implementation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the effects of construction on nesting yellow-breasted chats if they were to occur in the area (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP). Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of modeled yellow-breasted chat migratory habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat protection and management activities that could be implemented in protected yellow-breasted chat habitats would be expected to maintain and improve the functions of the habitat. Yellow-breasted chat would be expected to benefit from the increase in protected habitat, which would maintain conditions favorable for the chat's use of the study area.

  Habitat management- and enhancement-related activities could disturb yellow-breasted chat nests if they are present near work sites. Equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would ensure that these activities do not result in direct mortality of yellow-breasted chat or other adverse effects.

  Occupied habitat would be monitored to determine if there is a need to implement controls on brood parasites (brown-headed cowbird) or nest predators. If implemented, these actions would be expected to benefit the yellow-breasted chat by removing a potential stressor that could, if not addressed, adversely affect the stability of newly established populations.

  A variety of habitat management actions included in *Environmental Commitment 11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored riparian habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-breasted chat habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor adverse effects on available yellow-breasted chat habitat and are expected to result in overall improvements to and maintenance of yellow-breasted chat habitat values.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-breasted chat use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Construction is not expected to result in direct mortality of yellow-breasted chat because adults and fledged young are expected to occur only in very small numbers and, if present, would avoid contact with construction and other equipment. If yellow-breasted chat were to nest in the vicinity of construction activities, equipment operation could destroy nests and noise and visual disturbances could lead to nest abandonment. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect.

- Permanent and temporary habitat losses from the above environmental commitments would primarily consist of small, fragmented riparian stands in CZ 2–CZ 8 that do not provide high-value habitat for the species. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 5 years to several decades, for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. The majority of the riparian vegetation to be temporarily removed is early- to mid-successional; therefore, the replaced riparian vegetation would be expected to have structural components comparable to the temporarily removed vegetation within the first 5 to 10 years after the initial restoration activities are complete.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The habitat model indicates that the study area supports approximately 14,547 acres of modeled nesting and migratory habitat for yellow-breasted chat. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 64 acres of modeled habitat (less than 1% of the modeled habitat in the study area). These losses would occur from the construction of the water conveyance facilities and from *Environmental Commitment 4 Tidal Natural Communities Restoration*. The locations of these losses would be in fragmented riparian habitat throughout the study area.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of dense shrubby successional valley/foothill riparian habitat. Using these ratios would indicate that 64 acres of valley/foothill riparian habitat should be restored/created and 64 acres should be protected to compensate for the losses of yellow-breasted chat habitat.

Alternative 4A includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western*

Yellow-Billed Cuckoo. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of yellow-breasted chat habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and AMM22. These environmental commitments and AMMs would be in place during all project activities. Considering these commitments, losses and conversions of yellow-breasted chat habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The loss of yellow-breasted chat habitat from Alternative 4A would represent an adverse effect in the absence of environmental commitments and AMMs as a result of habitat modification and potential for direct mortality of a special-status species. However, habitat protection and restoration associated with Environmental Commitment 3 and Environmental Commitment 7, guided by Resource Restoration and Performance Principle VFR1 and by *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, *AMM7 Barge Operations Plan*, *AMM10 Restoration of Temporarily Affected Natural Communities* and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo*, would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-breasted chat. Therefore, Alternative 4A would have a less-than-significant impact on yellow-breasted chat under CEQA.

Impact BIO-105: Fragmentation of Yellow-Breasted Chat Habitat as a Result of Constructing the Water Conveyance Facilities

Grading, filling, contouring, and other initial ground-disturbing activities for water conveyance facilities construction may temporarily fragment modeled yellow-breasted chat habitat. This could temporarily reduce the extent of and functions supported by the affected habitat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

NEPA Effects: Temporary fragmentation of habitat would not result in an adverse effect on yellow-breasted chat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

CEQA Conclusion: Temporary fragmentation of habitat would have a less-than-significant impact on yellow-breasted chat. Any such habitat fragmentation is expected to have no or minimal effect on the species.

Impact BIO-106: Effects on Yellow-Breasted Chat Associated with Electrical Transmission Facilities

Yellow-breasted chats are migratory and usually arrive at California breeding grounds in April from their wintering grounds in Mexico and Guatemala. Departure for wintering grounds occurs from August to September. These are periods of relative high visibility when the risk of powerline collisions will be low. The species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer contribute to a low risk of collision with the proposed transmission lines (BDCP Attachment 5.J-2*, Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters. Bird flight diverters would further reduce any potential for powerline collisions.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters which would further reduce any potential for powerline collisions.

CEQA Conclusion: The construction and presence of new transmission lines would have a less-than-significant impact on yellow-breasted chat because the risk of bird strike is considered to be minimal based on the species' small, relatively maneuverable body; its foraging behavior; and its presence in the project area during the summer during periods of high visibility. Under *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with bird diverters which would further reduce any potential for powerline collisions.

Impact BIO-107: Indirect Effects of the Project on Yellow-Breasted Chat

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-breasted chat use of modeled habitat adjacent to proposed construction areas. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect yellow-breasted chat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations outside the project footprint but within 1,300 feet from the construction edge. If yellow-breasted chat were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. These potential effects would be minimized with incorporation of *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A, which would ensure 250 foot no-disturbance buffers were established around active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect yellow-breasted chat in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-breasted chat habitat could also affect the species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, in addition to *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would minimize the likelihood of such spills from occurring and ensure that measures were in place to prevent runoff from the construction area and any adverse effects of dust on active nests. If present, yellow-breasted chat individuals could be temporarily affected by noise and visual disturbances adjacent to water conveyance construction sites, reducing the use of an estimated 59 acres of modeled primary nesting and migratory habitat and 119 acres of secondary nesting and migratory habitat. *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* would avoid and minimize this effect on the species.

NEPA Effects: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would not result in an adverse effect on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A.

CEQA Conclusion: The potential for noise and visual disturbance, hazardous spills, increased dust and sedimentation, and the potential impacts of operations and maintenance of the water conveyance facilities would have a less-than-significant impact on yellow-breasted chat with the incorporation of AMM1–AMM7, and *AMM22 Suisun Song Sparrow, Yellow-Breasted Chat, Least Bell's Vireo, Western Yellow-Billed Cuckoo* into the Alternative 4A.

Impact BIO-108: Periodic Effects of Inundation of Yellow-Breasted Chat Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on yellow-breasted chat.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Cooper's Hawk and Osprey

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on Cooper's hawk and osprey. Although osprey often nest on manmade structures such as telephone poles, and Cooper's hawk will nest in more developed landscapes, modeled nesting habitat for these species is restricted to valley/foothill riparian forest.

Alternative 4A would result in both temporary and permanent losses of Cooper's hawk and osprey modeled habitat as indicated in Table 12-4A-42. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would also benefit Cooper's hawk and osprey.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).

- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

Maintain a single contiguous patch of 100 acres of mature riparian forest in either CZ 4 or CZ 7. As explained below, with the acres of restoration or protection included in the project, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, and Mitigation Measure BIO-75, impacts on Cooper's hawk and osprey would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-42. Changes in Cooper's Hawk and Osprey Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	31	21
Total Impacts Water Conveyance Facilities		**31**	**21**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**36**	**21**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-109: Loss or Conversion of Habitat for and Direct Mortality of Cooper's Hawk and Osprey

Alternative 4A would result in the combined permanent and temporary loss of up to 57 acres (36 acres of permanent loss, 21 acres of temporary loss) of modeled nesting habitat for Cooper's hawk and osprey (Table 12-4A-42). Project measures that would result in these losses are water facilities and operation (which would involve construction of water conveyance facilities and transmission lines and establishment and use of reusable tunnel material areas), and tidal restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which would include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other Alternative 4A physical facilities could affect Cooper's hawk and osprey modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 52 acres of modeled Cooper's hawk and osprey habitat (Table 12-4A-42). Of the 52 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 31 acres would be a permanent loss and 21 acres would be a temporary loss of habitat. Activities that would impact modeled habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities and work areas. Most of the permanent loss of nesting habitat would occur where Intakes 1–3 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost due to construction of a permanent access road from the new forebay west to an reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from water conveyance facilities would occur in the central Delta in CZ 3, CZ 4, CZ 5, CZ 6, and CZ 8. These losses would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of Cooper's hawk or osprey that overlap with the construction footprint for water conveyance facilities; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on Cooper's hawk and osprey if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration would permanently remove up to 5 acres of potential Cooper's hawk and osprey nesting habitat. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Habitat management- and enhancement-related activities could disturb Cooper's hawk and osprey nests if they were present near work sites. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of Cooper's hawk and osprey habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available Cooper's hawk and osprey habitat and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM18 Swainson's Hawk* and updated versions of *AMM2 Construction Best Management Practices and Monitoring* and *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

- Permanent and temporary habitat losses from the above environmental commitments would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require 1 to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of nesting habitat, including the transplanting of mature trees.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Cooper's hawk or osprey use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Cooper's hawk or osprey if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If Cooper's hawk or osprey were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on Cooper's hawk and osprey.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 14,069 acres of modeled nesting habitat for Cooper's hawk and osprey. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 57 acres of potential nesting habitat (less than 1% of the potential nesting habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat. Using these ratios would indicate that 57 acres of nesting habitat should be restored/ created and 57 acres should be protected to mitigate the losses of Cooper's hawk and osprey nesting habitat.

The 251 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by Cooper's hawk or osprey. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active Cooper's hawk or osprey nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A reserve system for every tree 20 feet or taller anticipated to be removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A reserve system in areas that support high-value foraging habitat in clumps of at least three trees each at appropriate sites within or adjacent to conserved cultivated lands, or they could be incorporated as a component of the riparian restoration (Environmental Commitment 7).

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities.* All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of Cooper's hawk and osprey nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents committed to avoiding and minimizing effects from and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of Cooper's hawk and osprey habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on Cooper's hawk and osprey habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM6, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Cooper's hawk and osprey. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on Cooper's hawk and osprey under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-110: Effects on Cooper's Hawk and Osprey Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Cooper's hawk and osprey. However, the flight behavior of these species, their keen vision, and high maneuverability substantially reduce the risk of powerline collisions. The existing network of transmission lines in the project area currently poses the same small risk for Cooper's hawk and osprey, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters, which would further reduce any risk of collision with lines.

NEPA Effects: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the general maneuverability and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on Cooper's hawk and osprey.

CEQA Conclusion: The construction and presence of new transmission lines would not represent an adverse effect because the risk of bird strike is considered to be minimal based on the general maneuverability and keen eyesight of Cooper's hawk and osprey. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would further reduce any risk of mortality from bird strike for Cooper's hawk and osprey from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on Cooper's hawk and osprey.

Impact BIO-111: Indirect Effects of the Project on Cooper's Hawk and Osprey

Indirect construction- and operation-related effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect Cooper's hawk or osprey. If Cooper's hawk or osprey were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting Cooper's hawk and osprey. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect Cooper's hawk and osprey in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including Cooper's hawk and osprey. Future operational impacts under water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see Draft BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect cooper's hawk and osprey, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP).

The potential mobilization or creation of methylmercury within the project area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability.
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

NEPA Effects**:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could adversely affect Cooper's hawk and osprey use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, in addition to AMM1–AMM7, would be available to address this adverse effect. The implementation of tidal natural communities restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Cooper's hawk and osprey.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Cooper's hawk and osprey use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Cooper's hawk and osprey use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on Cooper's hawk and osprey with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of Cooper's hawk or osprey to methylmercury, through the ingestion of fish or small mammals in tidally restored areas. This would be a significant impact. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Cooper's hawk and osprey.

With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of Cooper's hawk or osprey. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on Cooper's hawk or osprey.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-112: Periodic Effects of Inundation of Cooper's Hawk and Osprey Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on Cooper's hawk and osprey.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Golden Eagle and Ferruginous Hawk

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on golden eagle and ferruginous hawk. Modeled foraging habitat for these species consists of grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Alternative 4A would result in both temporary and permanent losses of golden eagle and ferruginous hawk modeled foraging habitat as indicated in Table 12-4A-43. Full implementation of

Alternative 4A would include the following environmental commitments that would benefit golden eagles or ferruginous hawk.

- Protect 1,060 acres of grassland (Environmental Commitment 3).
- Protect 11,870 acres of cultivated lands (Environmental Commitment 3).

Golden eagle is a fully protected species and "take" of individuals, per Section 86 of the California Fish and Game Code, is prohibited. With the implementation of *AMM20 Greater Sandhill Crane*, construction activities would not result in mortality of the species, which would avoid take per Section 86 of the California Fish and Game Code[4]. As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, impacts on golden eagle and ferruginous hawk would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-43. Changes in Golden Eagle and Ferruginous Hawk Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Foraging	1,967	503
Total Impacts Water Conveyance Facilities		**1,967**	**503**
Environmental Commitments 4, 6–7, 9–11[a]	Foraging	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
TOTAL IMPACTS		**4,179**	**503**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-113: Loss or Conversion of Habitat for and Direct Mortality of Golden Eagle and Ferruginous Hawk

Alternative 4A would result in the combined permanent and temporary loss of up 4,682 acres of modeled foraging habitat for golden eagle and ferruginous hawk (4,179 acres of permanent loss and 503 of temporary loss, Table 12-4A-43). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate golden eagle foraging habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,470 acres of modeled golden eagle

[4] Section 86 of the California Fish and Game Code defines take as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The Lead Agencies do not propose to hunt, pursue, catch, or capture golden eagles and ferruginous hawk. Killing would be avoided through AMM20.

and ferruginous hawk habitat (1,967 acres of permanent loss, 503 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; the rerouting of SR 160; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 796 acres would be affected by placement of a reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Some of the grassland habitat lost at the sites of new canals south of Clifton Court Forebay is composed of larger stands of ruderal and herbaceous vegetation and California annual grassland, which is also suitable foraging habitat for the species. There are no occurrences of golden eagle or ferruginous hawk that intersect with the water conveyance facilities footprint. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 59 acres of modeled golden eagle and ferruginous hawk habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of Golden eagle and foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for foraging raptors but would not permanently reduce foraging habitat for either species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of Swainson's hawk foraging habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of golden eagle and ferruginous hawk foraging habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available habitat for these species. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible. Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect golden eagle and ferruginous hawk use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of golden eagle and ferruginous hawk because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,682 acres of modeled golden eagle and ferruginous hawk foraging habitat. These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration, and Environmental Commitment 10 Nontidal Marsh Restoration*).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,364 acres should be protected to compensate for the losses of golden eagle and ferruginous hawk habitat. Project proponents would commit to protect 1,060 acres of grassland and 11,870 acres of cultivated lands, which would provide suitable habitat for golden eagle and ferruginous hawk.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of golden eagle and ferruginous hawk foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by and by AMM1–AMM7, which would be in place during all project activities. Considering these commitments, losses and conversions of mountain plover habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on golden eagle and ferruginous hawk foraging habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. These conservation activities would be guided by and by AMM1–AMM7, which would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications. Therefore, Alternative 4A would have a less-than-significant impact on golden eagle and ferruginous hawk under CEQA.

Impact BIO-114: Effects on Golden Eagle and Ferruginous Hawk Associated with Electrical Transmission Facilities

Golden eagle and ferruginous hawk would be at low risk of bird strike mortality from the construction of new transmission lines based on their maneuverability, their keen eyesight, their lack of flocking behavior, and other factors assessed in the bird strike vulnerability analysis (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines would be fitted with flight diverters which would substantially reduce any potential for powerline collisions.

***NEPA Effects*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. All new transmission lines constructed as a result of the project would be fitted with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

***CEQA Conclusion*:** Golden eagle and ferruginous hawk are already at a low risk of bird strike mortality based on their general maneuverability, keen eyesight and lack of flocking behavior. In addition, *AMM20 Greater Sandhill Crane* contains the commitment to fit new transmission lines constructed as a result of the project with bird diverters, which have been shown to reduce avian mortality by 60%. By implementing *AMM20 Greater Sandhill Crane*, there would be no take of golden eagle from the project per Section 86 of the California Fish and Game Code, and the construction and operation of transmission lines would not result in an adverse effect on golden eagle or ferruginous hawk.

Impact BIO-115: Indirect Effects of the Project on Golden Eagle and Ferruginous Hawk

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for golden eagle and ferruginous hawk. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect golden eagle or ferruginous hawk. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to golden eagle and ferruginous hawk grassland habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat.

With the incorporation of AMM1–AMM7 into the Alternative 4A, indirect effects as a result of Alternative 4A implementation would not have an adverse effect on golden eagle and ferruginous hawk.

***CEQA Conclusion*:** Indirect effects on golden eagle and ferruginous hawk as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. With the incorporation of AMM1–AMM7 into the Alternative 4A, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on golden eagle and ferruginous hawk.

Impact BIO-116: Periodic Effects of Inundation on Golden Eagle and Ferruginous Hawk Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on golden eagle and ferruginous hawk.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Cormorants, Herons and Egrets

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron. Modeled breeding habitat for these species consists of valley/foothill riparian forest.

Alternative 4A would result in both temporary and permanent losses of cormorant, heron, and egret modeled habitat as indicated in Table 12-4A-44. The majority of the losses would take place over an extended period of time as tidal marsh is restored in the study area. Although restoration for the loss of nesting habitat would be initiated in the same timeframe as the losses, it could take one or more decades for restored habitats to replace the functions of habitat lost. This time lag between impacts and restoration of habitat function would be minimized by specific requirements of *AMM18 Swainson's Hawk*, including the planting of mature trees in the near-term time period. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would benefit cormorants, herons, and egrets.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance natural communities for species and implementation of AMM1–AMM7, *AMM10 Restoration of Temporarily Affected Natural Communities, AMM18 Swainson's Hawk*, Mitigation Measure BIO-75, and Mitigation Measure BIO-117, impacts on cormorants, herons, and egrets would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-44. Changes in Cormorant, Heron and Egret Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting (Rookeries)	42	31
Total Impacts Water Conveyance Facilities		**42**	**31**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting (Rookeries)	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**47**	**31**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-117: Loss or Conversion of Nesting Habitat for and Direct Mortality of Cormorants, Herons and Egrets

Alternative 4A would result in the combined permanent and temporary loss of up to 78 acres of modeled nesting habitat (47 acres of permanent loss, 31 acres of temporary loss) for double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron (Table 12-4A-44). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal natural communities restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11) which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate cormorant, heron, and egret modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 73 acres of modeled nesting habitat for cormorants, herons, and egrets. (Table 12-4A-44). Of the 73 acres of modeled habitat that would be removed for the construction of the conveyance facilities, 42 acres would be a permanent loss and 31 acres would be a temporary loss of habitat. Activities that would impact modeled nesting habitat consist of tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, barge unloading facilities, and temporary work areas. Most of the permanent loss of nesting habitat would occur where Intakes 2, 3, and 5 impact the Sacramento River's east bank between Freeport and Courtland. The riparian areas here are very small patches, some dominated by valley oak and others by nonnative trees. Some nesting habitat would be lost as a result of construction of a permanent access road from the new forebay west to a reusable tunnel material disposal area and where the realigned SR 160 would cross Snodgrass Slough. Permanent losses would also occur along Lambert Road where permanent utility lines would be installed and from the construction of an operable barrier at the confluence of Old River and the San Joaquin River. Temporary losses of nesting habitat would result from the construction of a barge unloading facility west of the intermediate forebay in Snodgrass Slough and where temporary work areas surround intake sites. The riparian habitat in these areas is also composed of very small patches or stringers bordering waterways, which are composed of valley oak and scrub vegetation. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and CZ 8. Habitat loss from water conveyance facilities activities would have the potential to displace individuals, if present, and remove the functions and value of potentially suitable habitat. There are no occurrences of nesting cormorants, herons, or egrets that overlap with the construction footprint of water conveyance facilities; however, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on cormorants, herons and egrets if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of nesting habitat for cormorants, herons and egrets. Trees would not be actively removed but tree mortality would be expected over time as areas became tidally inundated. Depending on the extent and value of remaining habitat, this could reduce use of these habitats by these species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb cormorant, heron, and egret nests if they were present near work sites. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in Alternative 4A-protected habitats may result in localized ground disturbances that could temporarily remove small amounts of cormorant, heron, and egret habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, are expected to have minor effects on available habitat for these species and are expected to result in overall improvements to and maintenance of habitat values. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. *AMM18 Swainson's Hawk* and updated versions of *AMM2 Construction Best Management Practices and Monitoring* and *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

- Permanent and temporary habitat losses from the above environmental commitments would primarily consist of fragmented riparian stands. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described in *AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require years to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure for established rookeries. *AMM18 Swainson's Hawk* contains actions described below to reduce the effect of temporal loss of mature riparian habitat, including the transplanting of mature trees.

- *Construction Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect use of the surrounding habitat by cormorants, herons or egrets. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- The primary impact of concern regarding double-crested cormorant, great blue heron, great egret, snowy egret, and black-crowned night heron is the loss of existing known nest trees, and other large trees associated with known nest sites. Because these species are highly traditional in their use of rookeries, the establishment of new nest sites is unpredictable. To avoid adverse effects on these species, existing known nest sites would have to be avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects on cormorants, herons, and egrets.
- Injury and Direct Mortality: If birds were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could affect nests or lead to their abandonment, potentially resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address these effects on cormorants, herons, and egrets.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Based on modeled habitat, the study area supports approximately 17,966 acres of modeled nesting habitat for cormorants, herons, and egrets. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 78 acres of potential breeding habitat (<1% of the potential breeding habitat in the study area).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of valley/foothill riparian habitat for nesting habitat. Using these ratios would indicate that 78 acres of nesting habitat should be restored/ created and 78 acres should be protected to mitigate the losses of cormorant, heron, and egret nesting habitat.

The 251 acres of restored riparian habitat would be initiated in the near-term to offset the loss of modeled nesting habitat, but would require one to several decades to functionally replace habitat that has been affected and for trees to attain sufficient size and structure suitable for nesting by cormorants, herons, and egrets. This time lag between the removal and restoration of nesting habitat could have a substantial impact on white-tailed kite in the near-term time period. Nesting habitat is limited throughout much of the study area, consisting mainly of intermittent riparian, isolated trees, small groves, tree rows along field borders, roadside trees, and ornamental trees near rural residences. The removal of nest trees or nesting habitat would further reduce this limited resource and could reduce or restrict the number of active cormorant, heron, and egret nests within the study area until restored riparian habitat is sufficiently developed.

AMM18 Swainson's Hawk would implement a program to plant large mature trees, including transplanting trees scheduled for removal. These would be supplemented with additional saplings and would be expected to reduce the temporal effects of loss of nesting habitat. The plantings would occur prior to or concurrent with (in the case of transplanting) the loss of trees. In addition, at least five trees (5-gallon container size) would be planted within the Alternative 4A reserve system for every tree 20 feet or taller anticipated to be removed by construction during the near-term period. A variety of native tree species would be planted to provide trees with differing growth rates, maturation, and life span. Trees would be planted within the Alternative 4A reserve system in areas that support high-value foraging habitat in clumps of at least three trees each at appropriate sites within or adjacent to conserved cultivated lands, or they could be incorporated as a component of the riparian restoration (Environmental Commitment 7).

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of cormorant, heron, and egret nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that meets the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM7, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of cormorant, heron, and egret habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on cormorant, heron, and egret habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle VFR1, and by AMM1–AMM6, AMM10, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 and Mitigation Measure BIO-117 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Cooper's hawk and osprey. Therefore, with the implementation of Mitigation Measure BIO-75 and Mitigation Measure BIO-117, Alternative 4A would have a less-than-significant impact on Cooper's hawk and osprey under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries); therefore, DWR will avoid all direct and indirect impacts on rookeries.

Impact BIO-118: Effects Associated with Electrical Transmission Facilities on Cormorants, Herons and Egrets

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons and egrets. New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new transmission lines constructed as a result of the project would be fitted with flight diverters which would reduce bird strike risk of cormorants, herons, and egrets.

NEPA Effects**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on cormorants, herons, and egrets.

CEQA Conclusion**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of cormorants, herons, and egrets. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of cormorants, herons, and egrets by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on cormorants, herons, and egrets.

Impact BIO-119: Indirect Effects of the Project on Cormorants, Herons and Egrets

Indirect construction- and operation-related effects: Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect cormorants, herons, or egrets. If cormorants, herons or egrets were to nest in or adjacent to work areas, construction and subsequent maintenance-related noise and visual disturbances could mask calls, disrupt foraging and nesting behaviors, and reduce the functions of suitable nesting habitat for these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would avoid the potential for adverse effects of construction-related activities on survival and productivity of nesting cormorants, herons or egrets. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect cormorants, herons or egrets in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to suitable habitat could also have an adverse effect on these species. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills and ensure that measures are in place to prevent runoff from the construction area and negative effects of dust on active nests.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including cormorants, herons or egrets. Future operational impacts under water conveyance facilities were analyzed using a DSM-2 based model to assess potential effects on mercury concentration and bioavailability resulting from proposed flows. Subsequently, a regression model was used to estimate fish-tissue concentrations under these future operational conditions (evaluated starting operations or ESO). Results indicated that changes in total mercury levels in water and fish tissues due to ESO were insignificant (see Draft BDCP Appendix 5.D, *Contaminants*, Tables 5D.4-3, 5D.4-4, and 5D.4-5).

Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect cormorants, herons or egrets, via uptake in lower tropic levels (as described in the Appendix 5.D, *Contaminants*, of the Draft BDCP).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including cormorants, herons, and egrets. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4, Environmental Commitment 5) would lead to adverse effects on cormorants, herons, and egrets.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on cormorants, herons, and egrets from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce cormorant, heron, and egret use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect cormorant, heron, and egret use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of cormorants, herons or egrets to methylmercury through the ingestion of fish in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on the species.

CEQA Conclusion: Impacts of noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities would be less than significant with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and Mitigation Measure BIO-117, *Avoid Impacts on Rookeries*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of cormorants, herons or egrets to methylmercury, through the ingestion of fish in tidally restored areas. This would be a significant impact. However, it is unknown what concentrations of methylmercury are harmful to these species. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on cormorants, herons, and egrets. Tidal habitat restoration could result in increased exposure of cormorants, herons, and egrets to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

With AMM1–AMM7, AMM27, and Environmental Commitment 12 in place, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of cormorants, herons, and egrets. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on cormorants, herons, and egrets.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Mitigation Measure BIO-117: Avoid Impacts on Rookeries

Herons, egrets, and cormorants are highly traditional in their use of nest sites (rookeries), therefore all direct and indirect impacts on rookeries must be avoided.

Impact BIO-120: Periodic Effects of Inundation on Cormorants, Herons and Egrets as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on cormorants, herons, and egrets.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Short-Eared Owl and Northern Harrier

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on short-eared owl and northern harrier. Modeled habitat for short-eared owl and northern harrier include tidal brackish and freshwater emergent wetland, nontidal freshwater perennial emergent wetland, managed wetland, other natural seasonal wetland, grassland, alkali seasonal wetland, vernal pool complex, and selected cultivated lands.

Alternative 4A would result in both temporary and permanent losses of modeled habitat for short-eared owl and northern harrier as indicated in Table 12-4A-45. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would benefit short-eared owl and northern harrier.

- Restore or create 37 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta (Resource Restoration and Performance Principle CBR1).
- Protect 119 acres of nontidal wetlands and create 832 acres of nontidal wetlands (Environmental Commitment 3 and Environmental Commitment 10).
- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres:
  - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in patch sizes of a minimum of 40 acres (Resource Restoration and Performance Principle SH1).
  - Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) (Resource Restoration and Performance Principle SH2).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species, AMM1–AMM7, *AMM27 Selenium Management* and Mitigation Measure BIO-75, impacts on short-eared owl and northern harrier would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-45. Changes in Short-Eared Owl and Northern Harrier Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting and Foraging	2,152	683
Total Impacts Water Conveyance Facilities		**2,152**	**683**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting and Foraging	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
TOTAL IMPACTS		**4,364**	**683**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-121: Loss or Conversion of Habitat for and Direct Mortality of Short-Eared Owl and Northern Harrier

Alternative 4A would result in the combined permanent and temporary loss of up to 5,047 acres of modeled habitat for short-eared owl and northern harrier (of which 4,364 acres would be a permanent loss and 683 acres would be a temporary loss of habitat, Table 12-4A-45). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate short-eared owl and northern harrier modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,835 acres of modeled short-eared owl and northern harrier habitat (2,152 acres of permanent loss, 683 acres of temporary loss) from CZs 3–6 and CZ 8. Activities that would impact modeled habitat include tunnel, forebay, and intake construction, permanent and temporary access roads, construction of transmission lines, and temporary work areas. The majority of habitat removed would consist of grassland and alfalfa fields. There are no CNDDB or DHCCP surveys records of occurrences of nesting short-eared owl that overlap with the construction footprint of water conveyance facilities. However, there are two DHCCP occurrences of northern harrier that overlap with the footprint of a shaft associated with the pumps at Clifton Court Forebay and a permanent transmission line north of the forebay. Two DHCCP occurrences also overlap with the temporary impact footprint from geotechnical explorations. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize impacts on short-eared owl and northern harrier if they were to nest in the vicinity of construction activities. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal restoration actions through Environmental Commitment 4 would restore an estimated 59 acres of tidal natural communities. These restored wetland areas could provide suitable nesting habitat for short-eared owl and northern harrier. Consequently, although existing nesting habitat for short-eared owl and northern harrier would be removed, restoration of wetland habitats is expected to benefit marsh associated ground nesting birds by increasing the value of their nesting habitat.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of short-eared owl and northern harrier foraging habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for foraging short-eared owl and northern harrier but would not permanently reduce foraging habitat for either species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of short-eared owl and northern harrier foraging habitat. Some portion of nontidal marsh restoration would be expected to provide habitat for both species.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values.

- Habitat management- and enhancement-related activities could short-eared owl and northern harrier nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to minimize these adverse effects.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect short-eared owl and northern harrier use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and Mitigation Measure BIO-75 as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged short-eared owl and northern harrier if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to minimize these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

The study area supports approximately 406,784 acres of modeled nesting and foraging habitat for short-eared owl and northern harrier. Alternative 4A would result in the permanent loss of and temporary effects on 5,047 acres of modeled habitat for short-eared owl and northern harrier (<1% of the modeled habitat in the study area). Of the 5,047 acres of modeled habitat impacted, 77 acres consist of wetlands.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by water conveyance facilities would be 1:1 protection of non-wetland habitats and 1:1 protection and 1:1 restoration of wetland habitat. Using these typical ratios would indicate that 4,970 acres of grassland and cultivated lands should be protected, 77 acres of wetlands should be restored or created, and 77 acres of wetlands should be protected to compensate for the losses of short-eared owl and northern harrier habitat.

Short-eared owl and northern harrier nest in open habitats within cultivated lands including alfalfa, irrigated pasture, and other grain fields in addition to tidal and nontidal wetlands. A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. Within these acres of grassland and cultivated lands protection, project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat (Resource Restoration and Performance Principle SH1), which would total 6,805 acres. These acres of cultivated lands and grasslands would be located above 1 foot above mean sea level and at least 50% of these lands would be in very high-value production for the Swainson's hawk (alfalfa) (Resource Restoration and Performance Principle SH2).

In addition, 59 acres of tidal freshwater emergent wetland would be restored or created and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created in the Delta. The restored and protected acres described above would provide suitable nesting and foraging habitat for these species. Environmental Commitment 3, Environmental Commitment 4, and Environmental Commitment 10 would occur in the same timeframe as the construction and early restoration losses.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

For the project to avoid adverse effects on individuals, preconstruction surveys would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of short-eared owl and northern harrier nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principles CBR1, SH1, and SH2, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of short-eared owl and northern harrier habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on short-eared owl and northern harrier habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles CBR1, SH1, and SH2, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of short-eared owl and northern harrier. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on short-eared owl and northern harrier under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-122: Effects on Short-Eared Owl and Northern Harrier Associated with Electrical Transmission Facilities

New transmission lines would increase the risk that short-eared owl and northern harrier could be subject to power line strikes, which could result in injury or mortality of these species. Short-eared owl and northern harrier would be at low risk of bird strike mortality based on their keen eyesight and largely ground-based foraging behavior (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). The existing network of transmission lines in the project area currently poses the same small risk for these species, and any incremental risk associated with the new power line corridors would also be expected to be low. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. With the implementation of *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would further reduce any bird strike risk of short-eared owl and northern harrier.

NEPA Effects: The construction and presence of new transmission lines would not result in an adverse effect on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60%, which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4A would not result in an adverse effect on short-eared owl or northern harrier.

CEQA Conclusion: The construction and presence of new transmission lines would not result in a significant impact on short-eared owl or northern harrier because the risk of bird strike is considered to be low for both species based on their keen eyesight and behavioral characteristics. New transmission lines would minimally increase the risk for short-eared owl and northern harrier power line strikes. All new transmission lines constructed as a result of the project would be fitted with bird diverters (*AMM20 Greater Sandhill Crane*), which have been shown to reduce avian mortality by 60%, which would further reduce any potential for powerline collisions. Therefore, the construction and operation of transmission lines under Alternative 4A would result in a less-than-significant impact on short-eared owl or northern harrier.

Impact BIO-123: Indirect Effects of the Project on Short-Eared Owl and Northern Harrier

Indirect construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect short-eared owl and northern harrier use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect short-eared owl or northern harrier. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix D which includes an overview of the Alternative 4A-related mechanisms that could result in increased mercury in the food web, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management,* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 will be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.

Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including short-eared owl and northern harrier. Marsh (tidal and nontidal) restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4, Environmental Commitment 5) would lead to adverse effects on short-eared owl and northern harrier.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on short-eared owl and northern harrier from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Indirect effects on short-eared owl and northern harrier as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of environmental commitments and AMMs. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of short-eared owl and northern harrier to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community restoration could indirectly affect short-eared owl and northern harrier, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on short-eared owl and northern harrier.

***CEQA Conclusion*:** Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on short-eared owl and northern harrier and their habitat as a result of Alternative 4A implementation would represent a substantial adverse effect in the absence of environmental commitments and AMMs. This impact would be significant. The incorporation of AMM1–AMM7 into the Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. The implementation of tidal natural communities restoration could result in increased exposure of short-eared owl and northern harrier to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on short-eared owl and northern harrier.

Indirect effects of Alternative 4A implementation would represent an adverse effect on short-eared owl and northern harrier in the absence of other environmental commitments. This would be a significant impact. With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on short-eared owl and northern harrier.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-124: Periodic Effects of Inundation on Short-Eared Owl and Northern Harrier as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on short-eared owl and northern harrier.

NEPA Effects**:** No effect.

CEQA Conclusion**:** No impact.

Redhead and Tule Greater White-Fronted Goose

Impacts, relevant protection and restoration actions, and mitigation requirements under CEQA are discussed for these species in Section 4.3.4.8, *General Terrestrial Biology Effects*, of the RDEIR/SDEIS under Impacts BIO-178 through BIO-183. Further details of the methods of analysis for waterfowl and shorebirds can be found in the *BDCP Waterfowl and Shorebird Effects Analysis* (Ducks Unlimited 2013).

Mountain Plover

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on mountain plover. Mountain plover does not breed in California, but winters in the study area. Modeled habitat for mountain plover include grassland, alkali seasonal wetland, vernal pool complex, alfalfa, grain and hay, pasture, and idle cropland throughout the study area.

Alternative 4A would result in both temporary and permanent losses of modeled habitat for mountain plover as indicated in Table 12-4A-46. Full implementation of Alternative 4A would include the following environmental commitments which could benefit the mountain plover.

- Protect 1,060 acres of grassland (Environmental Commitment 3).
- Protect 11,870 acres of cultivated lands (Environmental Commitment 3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to AMM1-AMM7, management activities that would enhance these natural communities for the species, impacts on mountain plover would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-46. Changes in Mountain Plover Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Wintering	1,967	503
Total Impacts Water Conveyance Facilities		**1,967**	**503**
Environmental Commitments 4, 6–7, 9–11[a]	Wintering	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
TOTAL IMPACTS		**4,179**	**503**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-125: Loss or Conversion of Habitat for and Direct Mortality of Mountain Plover

Alternative 4A would result in the combined permanent and temporary loss of up to 4,682 acres of modeled wintering habitat for mountain plover (4,179 acres of permanent loss and 503 of temporary loss, Table 12-4A-46). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate mountain plover modeled wintering habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,470 acres of modeled mountain plover habitat (1,967 acres of permanent loss, 503 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; the rerouting of SR 160; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable habitat for the species. Approximately 796 acres would be affected as a result of the placement of an reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. There are no CNDDB occurrences of mountain plover that intersect with the water conveyance facilities footprint. However, the study area does overlap with the wintering range for the species. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.
- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 59 acres of modeled mountain plover habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of mountain plover wintering habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for mountain plover but would not permanently reduce foraging habitat for the species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of mountain plover wintering habitat.
- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of mountain plover habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities would be expected to have minor adverse effects on available mountain plover habitat. Management of grasslands and cultivated lands for mountain plover such as grazing or mowing would make habitat temporarily unavailable for the species but would ultimately make the habitat more suitable for mountain plover. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.
- *Water Conveyance Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect mountain plover use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction would not be expected to result in direct mortality of mountain plover because foraging individuals would be expected to temporarily avoid the increased noise and activity associated with construction areas.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,682 acres of modeled mountain plover wintering habitat. These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,364 acres should be protected to compensate for the losses of mountain plover wintering habitat. Project proponents would commit to protect 1,060 acres of grassland and 11,870 acres of cultivated lands, which could provide suitable wintering habitat for mountain plover. *Environmental Commitment 11 Natural Communities Enhancement and Management* would be implemented to ensure that sufficient acres of grassland and cultivated lands were managed to provide suitable habitat for mountain plover and other species with similar habitat requirements (e.g., minimal vegetation, heavily grazed, high invertebrate productivity).

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS

NEPA Effects: The loss of mountain plover wintering habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. AMM1–AMM7 would be in place during all project activities. Considering these commitments, losses and conversions of mountain plover habitat under Alternative 4A would not be adverse.

CEQA Conclusion: The effects on mountain plover wintering habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. AMM1–AMM7 would be in place during all project activities. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of mountain plover. Therefore, Alternative 4A would have a less-than-significant impact on mountain plover under CEQA.

Impact BIO-126: Effects on Mountain Plover Associated with Electrical Transmission Facilities

Mountain plovers congregate in flocks during the winter and travel between grasslands and cultivated lands that provide foraging habitat for the species. This flocking behavior puts them at risk of collisions with powerlines. However, plovers exhibit low wing loading and high aspect-ratio wings and as a result can maneuver relatively quickly around an obstacle such as a transmission line. Their wing structure and design allows for rapid flight and quick, evasive actions. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. Plovers are primarily visual foragers and therefore, the risk for collision would be further reduced by *AMM20 Greater Sandhill Crane*, which would require the installation of bird flight diverters on all new transmission lines in the study area.

***NEPA Effects*:** New transmission lines are not expected to have an adverse effect on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* which would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on mountain plover.

***CEQA Conclusion*:** New transmission lines would have a less-than-significant impact on mountain plover because the probability of bird-powerline strikes is highly unlikely due to their flight behaviors. The implementation of *AMM20 Greater Sandhill Crane* which would require the installation of bird flight diverters on all new transmission lines, which would further reduce any potential for mortality. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on mountain plover.

Impact BIO-127: Indirect Effects of the Project on Mountain Plover

Construction- and subsequent maintenance-related noise and visual disturbances could disrupt foraging, and reduce the functions of suitable foraging habitat for mountain plover. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect mountain plover. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to mountain plover wintering habitat could also have a negative effect on the species. However, AMM1–AMM7 would also ensure that measures would be in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on mountain plover as a result of Alternative 4A implementation could have adverse effects on the species through the modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4A implementation would not have an adverse effect mountain plover.

CEQA Conclusion: Indirect effects on mountain plover as a result of Alternative 4A implementation could have a significant impact on the species from modification of habitat. With the implementation of AMM1–AMM7, indirect effects as a result of Alternative 4A implementation would have a less-than-significant impact on mountain plover.

Impact BIO-128: Periodic Effects of Inundation on Mountain Plover as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on mountain plover.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Black Tern

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on black tern. Modeled nesting habitat for black tern in the study area is currently limited to rice in CZ 2.

Alternative 4A would not result in effects on modeled habitat for black tern as indicated in Table 12-4A-47. There is no modeled habitat for the species in the water conveyance facilities footprint and proposed areas of tidal restoration under Alternative 4A.

Table 12-4A-47. Changes in Black Tern Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	0	0
Total Impacts Water Conveyance Facilities		**0**	**0**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**0**	**0**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-129a: Loss or Conversion of Habitat for and Direct Mortality of Black Tern

No habitat would be lost or converted and there would be no direct mortality of black tern under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Conservation Zone 2, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Impact BIO-129b: Indirect Effects of the Project on Black Tern

No indirect effects on black tern were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Conservation Zone 2, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Impact BIO-129c: Periodic Effects of Inundation on Black Tern Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on black tern habitat under Alternative 4A.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

California Horned Lark and Grasshopper Sparrow

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on California horned lark and grasshopper sparrow. The primary impact of concern for grasshopper sparrow and California horned lark would be the loss of breeding habitat in the project area, which includes grassland vernal pool complex, and alkali seasonal wetland natural communities and selected cultivated lands including grain and hay crops and pasture. Alternative 4A would result in both temporary and permanent losses of modeled breeding habitat for California horned lark and grasshopper sparrow as indicated in Table 12-4A-48. Full implementation of Alternative 4A would include the following environmental commitments which could benefit the California horned lark and the grasshopper sparrow.

- Protect 1,060 acres of grassland (Environmental Commitment 3).
- Protect 11,870 acres of cultivated lands (Environmental Commitment 3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species and implementation of AMM1–AMM7 and Mitigation Measure BIO-75, impacts on California horned lark and grasshopper sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-48. Changes in California Horned Lark and Grasshopper Sparrow Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Breeding	1,967	503
Total Impacts Water Conveyance Facilities		**1,967**	**503**
Environmental Commitments 4, 6–7, 9–11[a]	Breeding	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
TOTAL IMPACTS		**4,179**	**503**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-130: Loss or Conversion of Habitat for and Direct Mortality of California Horned Lark and Grasshopper Sparrow

Alternative 4A would result in the combined permanent and temporary loss of up to 4,682 acres of modeled nesting habitat for California horned lark and grasshopper sparrow (of which 4,179 acres would be a permanent loss and 503 acres would be a temporary loss of habitat, Table 12-4A-48). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate California horned lark and grasshopper sparrow modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,470 acres of modeled California horned lark and grasshopper sparrow habitat (1,967 acres of permanent loss, 503 acres of temporary loss). Impacts would result from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; the rerouting of SR 160; construction of the intermediate forebay; and from an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 796 acres would be affected as the result of the placement of an reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Grasshopper sparrows were detected in DHCCP surveys south of Byron Highway in CZ 8 (1 occurrence) and east of Intakes 2 and 3 (6 occurrences), in the Stone Lakes NWR. However, the water conveyance facilities footprint does not overlap with any grasshopper sparrow or California horned lark occurrences. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting California horned larks or grasshopper sparrows. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would permanently remove an estimated 59 acres of modeled California horned lark and grasshopper sparrow habitat. The majority of the acres lost would consist of cultivated lands in the West Delta ROA.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of California horned lark and grasshopper sparrow habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for California horned lark and grasshopper sparrow during restoration, but would not permanently reduce habitat availability for either species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of California horned lark and grasshopper sparrow habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation (mechanical or grazing) and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values for California horned lark and grasshopper sparrow. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered*

Activities and Associated Federal Actions). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

- Habitat management- and enhancement-related activities could disturb California horned lark and grasshopper sparrow nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect California horned lark and grasshopper sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7 and Mitigation Measure BIO-75 as described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged California horned lark and grasshopper sparrow if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these adverse effects.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,682 acres of modeled California horned lark and grasshopper sparrow habitat. These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*).

The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 for protection of habitat. Using this ratio would indicate that 9,364 acres should be protected to compensate for the losses of California horned lark and grasshopper sparrow habitat. Project proponents would commit to protect 1,060 acres of grassland and 11,870 acres of cultivated lands, which could provide suitable habitat for California horned lark and grasshopper sparrow. *Environmental Commitment 11 Natural Communities Enhancement and Management* would be implemented to ensure that sufficient acres of grassland and cultivated lands were managed to provide suitable habitat for mountain plover and other species with similar habitat requirements (e.g., minimal vegetation, heavily grazed, high invertebrate productivity).

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects**:** The loss of California horned lark and grasshopper sparrow habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. AMM1–AMM7 would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of California horned lark and grasshopper sparrow under Alternative 4A would not be adverse.

CEQA Conclusion**:** The effects on California horned lark and grasshopper sparrow habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3 and Environmental Commitment 11. AMM1–AMM7 would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of California horned lark and grasshopper sparrow. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on California horned lark and grasshopper sparrow under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-131: Effects on California Horned Lark and Grasshopper Sparrow and Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. *AMM20 Greater Sandhill Crane* would minimize the risk of bird strikes by installing flight-diverters on new and selected existing powerlines.

NEPA Effects**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the implementation of *AMM20 Greater Sandhill Crane*, the effect of new transmission lines on California horned lark and grasshopper sparrow would not be adverse.

CEQA Conclusion**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of grasshopper sparrow and California horned lark. With the incorporation of *AMM20 Greater Sandhill Crane*, new transmission lines would have a less-than-significant impact on grasshopper sparrow and California horned lark.

Impact BIO-132: Indirect Effects of the Project on California Horned Lark and Grasshopper Sparrow

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect California horned lark and grasshopper sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect California horned lark or grasshopper sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to California horned lark and grasshopper sparrow nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

***NEPA Effects*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. California horned lark and grasshopper sparrow are not covered species under the Alternative 4A, and potential mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this effect.

***CEQA Conclusion*:** Indirect effects on California horned lark and grasshopper sparrow as a result of Alternative 4A implementation could have a significant impact on these species. The incorporation of AMM1–AMM7 into the Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-133: Periodic Effects of Inundation on California Horned Lark and Grasshopper Sparrow as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on California horned lark or grasshopper sparrow.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Least Bittern and White-Faced Ibis

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on least bittern and white-faced ibis. Modeled breeding habitat for least bittern and white-faced ibis includes tidal freshwater, nontidal freshwater emergent wetlands, managed wetlands, and other natural seasonal wetlands in CZ 2, 4, and 11. Alternative 4A would result in both temporary and permanent losses of modeled habitat for least bittern and white-faced ibis as indicated in Table 12-4A-49. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles that would also benefit least bittern and white-faced ibis.

- Restore or create 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta (Environmental Commitment 4 and Resource Restoration and Performance Principle CBR1).
- Protect 119 acres of nontidal wetlands and create 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for these species (including Environmental Commitment 12 Methylmercury Management) and implementation of AMM1–AMM7, *AMM27 Selenium Management*, *AMM37 Recreation*, and Mitigation Measure BIO-75, impacts on least bittern and white-faced ibis would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-49. Changes in Least Bittern and White-Faced Ibis Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	1	5
Total Impacts Water Conveyance Facilities		**1**	**5**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**6**	**5**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-134: Loss or Conversion of Habitat for and Direct Mortality of Least Bittern and White-Faced Ibis

Alternative 4A would result in the combined permanent and temporary loss of up to 11 acres of modeled habitat for least bittern and white-faced ibis (6acres of permanent loss and 5 of temporary loss, Table 12-4A-49). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate least bittern and white-faced ibis habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 5 acres of modeled least bittern and white-faced ibis habitat (1 acre of permanent loss, 5 acres of temporary loss) from CZ 4. Permanent impacts on habitat would result from an reusable tunnel material storage site north of Twin Cities Road and east of the intermediate forebay. Temporary impacts would result from the construction of two temporary transmission lines, one extending east along Lambert Road from the Lambert Road Vent Shaft, and one extending south from the Lambert Road Vent Shaft to the intermediate forebay. The construction footprint for water conveyance facilities does not overlap with any occurrences of least bittern or white-faced ibis. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize effects on least bittern and white-faced ibis if they were to nest in the vicinity of the construction footprint. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 5 acres of modeled least bittern and white-faced ibis habitat.

- Environmental Commitment 11 Natural Communities Enhancement and Management: A variety of habitat management actions included in Environmental Commitment 11 Natural Communities Enhancement and Management that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of least bittern and white-faced ibis habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available least bittern and white-faced ibis habitat. The implementation of *AMM37 Recreation* would address potential disturbance on least bittern and white-faced ibis by requiring that trails avoid access to marshes and requiring signage for boaters to slow down when passing sensitive marsh habitats.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect least bittern and white-faced ibis use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMM1–AMM7. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to further reduce effects.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of least bittern and white-faced ibis because adults and fledged young would be expected to avoid contact with construction and other equipment. However, if either species were to nest in the construction area, equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Construction-related activities could also flush least bittern adults from nests and lead to collision with man-made objects (Sterling 2008). Mitigation Measure BIO-75 would require preconstruction surveys in and adjacent to work areas and, if nests were present, nodisturbance buffers would be implemented.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would result in the permanent loss of and temporary effects on 11 acres (6 acres of permanent loss, 5 acres of temporary loss) of least bittern and white-faced ibis habitat.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected would be 1:1 for restoration/creation and 1:1 protection of least bittern and white-faced ibis habitat. Using these ratios would indicate that 11 acres of habitat should be restored and 11 acres of habitat should be protected to compensate for the losses of least bittern and white-faced ibis habitat.

Alternative 4A includes the following conservation commitments: 22 acres of tidal freshwater emergent wetland would be restored or created in the central Delta (Resource Restoration and Performance Principle CBR1) and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created. These would be implemented as part of Environmental Commitment 4, and Environmental Commitment 10 and would be more than sufficient to compensate for impacts on least bittern and white-faced ibis habitat.

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan.*

If least bittern or white-faced ibis were to nest in or adjacent to work areas, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address this potentially adverse effect.

- ***NEPA Effects*:** The loss of least bittern and white-faced ibis nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7 and *AMM37 Recreation*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of least bittern and white-faced ibis habitat under Alternative 4A would not be adverse.

***CEQA Conclusion*:**

- The effects on least bittern and white-faced ibis habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental

Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7 and *AMM37 Recreation*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of least bittern and white-faced ibis. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on least bittern and white-faced ibis under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-135: Effects on Least Bittern and White-Faced Ibis Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Waterbirds have a higher susceptibility to collisions than passerines, raptors, and other birds. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species (see Draft BDCP Appendix 5.J, Attachment 5J.C, *Analysis of Potential Bird Collisions at Proposed BDCP Powerlines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. All new project transmission lines would be fitted with flight diverters which would reduce bird strike risk of least bittern and white-faced ibis.

NEPA Effects: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of least bittern and white-faced ibis. Bitterns and ibises have a high wing loading/low aspect ratio which limits their maneuverability and make them more vulnerable to collisions rather than more agile species. The implementation of *AMM20 Greater Sandhill Crane* would require the installation of bird flight diverters on all new transmission lines, which could reduce bird strike risk of least bittern and white-faced ibis by 60%. With the installation of bird flight diverters, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on least bittern and white-faced ibis.

Impact BIO-136: Indirect Effects of the Project on Least Bittern and White-Faced Ibis

Indirect construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect least bittern and white-faced ibis use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-44 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect least bittern or white-faced ibis. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could adversely affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring and would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of the Alternative 4A are contained in Appendix D, *Substantive BDCP Revisions.* The review includes an overview of the Alternative 4A-related mechanisms that could result in increased mercury in the food web, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability

- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including least bittern and white-faced ibis. Marsh (tidal and nontidal) restoration has the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium. Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS, and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4 and Environmental Commitment 5) would lead to adverse effects on least bittern and white-faced ibis.

Because of the uncertainty that exists with respect to the location of tidal restoration activities, there could be a substantial effect on least bittern and white-faced ibis from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management* (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

NEPA Effects: Indirect effects on least bittern and white-faced ibis as a result of constructing the water conveyance facilities could have adverse effects on these species in the absence of environmental commitments and AMMs. However, the implementation of AMM1–AMM7 would help to reduce this effect. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would also be available to address the adverse indirect effects of construction on active nests. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Increased methylmercury associated with natural community restoration could indirectly affect least bittern and white-faced ibis, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP). However, it is unknown what concentrations of methylmercury are harmful to the species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

CEQA Conclusion: Indirect effects of noise and visual disturbance, in addition to the potential for hazardous spills or increased dust on least bittern and white-faced ibis and their habitat as a result of Alternative 4A implementation, would represent a substantial adverse effect in the absence of other environmental commitments and AMMs. This impact would be significant. The incorporation of AMM1–AMM7 into the Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level. Tidal habitat restoration could result in increased exposure of least bittern and white-faced ibis to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. The implementation of tidal natural communities restoration could result in increased exposure of least bittern and white-faced ibis to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on least bittern and white-faced ibis.

Indirect effects of Alternative 4A implementation would represent an adverse effect on least bittern and white-faced ibis in the absence of other environmental commitments. This would be a significant impact. With AMM 1–AMM7, *AMM27 Selenium Management*, and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification and would not substantially reduce the number or restrict the range of either species. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on least bittern and white-faced ibis.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-137: Periodic Effects of Inundation on Least Bittern and White-Faced Ibis as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on least bittern or white-faced ibis.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Loggerhead Shrike

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on loggerhead shrike. Modeled habitat for loggerhead shrike includes both high-value and low-value modeled habitat. High-value habitat includes grassland, vernal pool complex and alkali seasonal wetland natural communities in addition to cultivated lands, including pasture and grain and hay crops. Breeding shrikes require shrubs and tall trees for perching and nest placement, and are generally associated with riparian edge grasslands (Humple 2008) or cultivated lands with associated trees and shrubs. Loggerhead shrike modeled habitat is overestimated as it does not differentiate between lands with or without associated nesting vegetation. Low-value habitat includes row crops such as truck and berry crops and field crops which are not considered to be valuable habitat for the species but were included in the model as they may provide foraging opportunities.

Alternative 4A would result in both temporary and permanent losses of modeled habitat for loggerhead shrike as indicated in Table 12-4A-50. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would benefit loggerhead shrike.

- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3). The following Swainson's hawk Resource Restoration and Performance Principles would be implemented as part of these acres.
    - Conserve 1 acre of Swainson's hawk foraging habitat for each acre of lost foraging habitat in patch sizes of a minimum of 40 acres (Resource Restoration and Performance Principle SH1).
    - Protect Swainson's hawk foraging habitat above 1 foot above mean sea level with at least 50% in very high-value habitat (see Table 12-4A-35 for a definition habitat value) production (Resource Restoration and Performance Principle SH2).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors,

water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore, maintain, and enhance riparian areas to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs (Resource Restoration and Performance Principle VFR1).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities that would enhance habitat for the species and implementation of AMM1–AMM7, and Mitigation Measure BIO-75, impacts on loggerhead shrike would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-50. Changes in Loggerhead Shrike Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	High-value	1,967	503
	Low-value	1,379	610
Total Impacts Water Conveyance Facilities		**3,346**	**1,113**
Environmental Commitments 4, 6–7, 9–11[a]	High-value	2,212	0
	Low-value	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
Total High-value		**4,179**	**503**
Total Low-value		**1,379**	**610**
TOTAL IMPACTS		**6,061**	**1,113**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-138: Loss or Conversion of Modeled Habitat for and Direct Mortality of Loggerhead Shrike

Alternative 4A would result in the combined permanent and temporary loss of up to 6,671 acres of modeled habitat for loggerhead shrike (of which 4,682 acres is of high-value and 1,989 acres is of low value, Table 12-4A-50). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, and the construction of recreational trails, signs, and facilities, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate loggerhead shrike modeled habitat. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 2,470 acres of high-value loggerhead shrike habitat (1,967 acres of permanent loss, 503 acres of temporary loss). In addition, 1,989 acres of low-value habitat would be removed (1,379 acres of permanent loss, 610 acres of temporary loss). Impacts would occur from the construction of Intakes 2, 3, and 5 and associated temporary work areas and access roads in CZ 4 between Clarksburg and Courtland; the rerouting of SR 160; construction of the intermediate forebay; and from a an reusable tunnel material storage area on Bouldin Island. The construction of the permanent and temporary transmission line corridors through CZs 4–6 and 9 would also remove suitable foraging habitat for the species. Approximately 796 acres would be affected by the placement of and reusable tunnel material area west of the Clifton Court Forebay in CZ 8. In addition, permanent habitat loss would result from the construction of the new forebay south of the existing Clifton court Forebay in CZ 8. Temporarily affected areas (grassland, cultivated lands, and associated shrubs or trees) would be restored within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*.

  Loggerhead shrikes nest in high abundance in shrubs associated with the grasslands to the south and to the west of Clifton Court Forebay. Shrikes were detected using this area at a much higher rate than other grasslands and areas in the Delta during DHCCP surveys (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS). Impacts from water conveyance facilities that overlap with recorded loggerhead shrike nest occurrences (from CNDDB and DHCCP surveys) include the construction of the new forebay (5 occurrences), the reusable tunnel material storage area north-west of the existing forebay (2 occurrences), permanent transmission line south of Clifton Court Road and west of the existing Clifton Court Forebay (1 occurrence), a permanent transmission line that extends along the northern extent of the reusable tunnel material storage areas west of the existing forebay (1 occurrence). Mitigation Measure BIO-75 *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting loggerhead shrikes. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 59 acres of high-value loggerhead shrike habitat.

- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of high-value loggerhead shrike habitat.

- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for loggerhead shrike but would not permanently reduce foraging habitat for the species.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of high-value loggerhead shrike habitat.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values. Fences (e.g., barbed wire) installed as part of Environmental Commitment 11, in or adjacent to protected grasslands and cultivated lands could benefit loggerhead shrike by providing hunting perches and impalement opportunities. Environmental Commitment 11 would also include the construction of recreational-related facilities including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.

Habitat management- and enhancement-related activities could disturb loggerhead shrike nests. If either species were to nest in the vicinity of a worksite, equipment operation could destroy nests if shrubs and trees in grasslands or cultivated lands were removed, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities could result in ongoing but periodic disturbances that could affect loggerhead shrike use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and Mitigation Measure BIO-75 as described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged loggerhead shrike if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If either species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these potential effects.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A as a whole would result in the permanent loss of and temporary effects on 4,682 acres of high-value loggerhead shrike habitat and 1,989 acres of low-value loggerhead shrike habitat. These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Communities Restoration, Environmental Commitment 8 Grassland Natural Communities Restoration*, and *Environmental Commitment 10 Nontidal Marsh Restoration*). The typical NEPA and CEQA project-level mitigation ratio for those natural communities affected would be 2:1 protection of high-value habitat. Using this ratio would indicate that 9,364 acres should be protected to compensate for the loss of high-value habitat. The loss of low-value habitat would not require mitigation because a large proportion of the low-value habitat would result from the conversion and enhancement to high-value habitats.

In addition, temporary impacts on cultivated lands would be restored relatively quickly after completion of construction.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. As part of these acres of protection, project proponents would commit to conserving 1 acre of Swainson's hawk foraging habitat for every acre of lost foraging habitat, which would total 6,805 acres and would be located above 1 foot above mean sea level (Resource Restoration and Performance Principle SH1). At least 50% of protected Swainson's hawk foraging habitat would be in very high-value production (Resource Restoration and Performance Principle SH2) (alfalfa) which would also provide suitable high-value habitat for loggerhead shrike. Alternative 4A also contains Resource Restoration and Performance Principle CL1 to maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak trees, trees and shrubs along field borders and roadsides which provide nesting habitat for loggerhead shrike. These Resource Restoration and Performance Principles would be associated with Environmental Commitment 3 and would occur in the same timeframe as the construction and early restoration losses and would benefit loggerhead shrike.

Alternative 4A also includes conservation commitments through *Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. *AMM18 Swainson's Hawk* includes a measure to plant large mature trees, including transplanting trees scheduled for removal. Trees would be planted in areas that support high-value Swainson's hawk foraging habitat within or adjacent to conserved cultivated lands, or as a component of the riparian restoration (Environmental Commitment 7) where they are in close proximity to suitable foraging habitat. Locating tree plantings and riparian restoration adjacent to Swainson's hawk foraging habitat would also provide suitable nesting habitat for loggerhead shrike.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and loggerhead shrike habitat adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Preconstruction surveys for loggerhead shrike would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of loggerhead shrike habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation actions would be guided by Resource Restoration and Performance Principles SH1, SH2, CL1, and VFR1, and by AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of loggerhead shrike habitat under Alternative 4A would not be adverse.

CEQA Conclusion**:** The effects on loggerhead shrike habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 7, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principles SH1, SH2, CL1, and VFR1, and by AMM1–AMM6, AMM1–AMM6, *AMM10 Restoration of Temporarily Affected Natural Communities*, and *AMM18 Swainson's Hawk*, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of loggerhead shrike. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on loggerhead shrike under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-139: Effects on Loggerhead Shrike Associated with Electrical Transmission Facilities

Loggerhead shrike's small, relatively maneuverable body; its lack of flocking behavior, and its diurnal foraging behavior, contribute to a low risk of collision with the proposed transmission lines. Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which would substantially reduce any potential for mortality of loggerhead shrike individuals from powerline collisions.

NEPA Effects**:** Loggerhead shrike's small, relatively maneuverable body; it's lack of flocking behavior, and it's diurnal foraging behavior, contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on loggerhead shrike.

CEQA Conclusion**:** Loggerhead shrike's small, relatively maneuverable body; it's lack of flocking behavior, and it's diurnal foraging behavior, contribute to a low risk of collision with the proposed transmission lines In addition, *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new transmission lines, which would substantially reduce the risk of bird strike for loggerhead shrike from the project. Therefore, the construction and operation of new transmission lines under Alternative 4A would result in a less-than-significant impact on loggerhead shrike.

Impact BIO-140: Indirect Effects of the Project on Loggerhead Shrike

Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect loggerhead shrike use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect loggerhead shrike. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Indirect effects from construction of the new forebay in CZ 8 could result in substantial effects on active loggerhead shrike nests. DHCCP surveys in 2009 detected 10 nest sites south-west of the Clifton Court Forebay (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, of the Draft EIR/EIS) and the large expanses of grassland in CZ 8 provide high-value nesting habitat for the species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance facilities construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills. The inadvertent discharge of sediment or excessive dust adjacent to loggerhead shrike nesting habitat could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

NEPA Effects: Indirect effects on loggerhead shrike as a result of Alternative 4A implementation could have adverse effects on these species through the modification of habitat and potential for direct mortality. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The loggerhead shrike is not a covered species under Alternative 4A, and the potential for mortality would be an adverse effect without preconstruction surveys to ensure that nests are detected and avoided. In conjunction with AMM1–AMM7, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

CEQA Conclusion: Indirect effects on loggerhead shrike as a result of Alternative 4A implementation could have a significant impact on these species. Construction of the new forebay in CZ 8 would have the potential to disrupt nesting loggerhead shrikes in the highly suitable habitat surrounding Clifton Court Forebay and adjacent to work areas. The incorporation of AMM1–AMM7 into Alternative 4A and the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-141: Periodic Effects of Inundation on Loggerhead Shrike as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on loggerhead shrike.

NEPA Effects**:** No effect.

CEQA Conclusion**:** No impact.

Song Sparrow "Modesto" Population

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on Modesto song sparrow. The Modesto song sparrow is common and ubiquitous throughout the project area, excluding CZ 11, and modeled habitat for the species includes managed wetlands, tidal freshwater emergent, nontidal freshwater emergent, and valley/foothill riparian vegetation communities.

Alternative 4A would result in both temporary and permanent removal of Modesto song sparrow habitat in the quantities indicated in Table 12-4A-51. However, project activities are expected to have little impact on the population. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would benefit Modesto song sparrow.

- Restore or create 251 acres of valley/foothill riparian natural community (Environmental Commitment 7).
- Protect 103 acres of existing valley/foothill riparian natural community (Environmental Commitment 3).
- Restore or create 37 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta (Resource Restoration and Performance Principle CBR1).
- Protect 119 acres of nontidal wetlands and create 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).

As explained below, with the restoration or protection of these amounts of habitat, with AMM1–AMM7 and *AMM10 Restoration of Temporarily Affected Natural Communities* in place, and with the implementation of Mitigation Measure BIO-75, impacts on Modesto song sparrow would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-51. Changes in Modesto Song Sparrow Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	68	81
Total Impacts Water Conveyance Facilities		**68**	**81**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	5	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**73**	**81**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-142: Loss or Conversion of Habitat for and Direct Mortality of Modesto Song Sparrow

Alternative 4A would result in the combined permanent and temporary loss of up to 154 acres of modeled habitat for Modesto song sparrow (73 acres of permanent loss and 81 acres of temporary loss, Table 12-4A-51). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate Modesto song sparrow modeled habitat. Temporarily affected areas would be restored as riparian habitat within 1 year following completion of construction activities as described *in AMM10 Restoration of Temporarily Affected Natural Communities*. Although the effects are considered temporary, the restored riparian habitat would require a period of time for ecological succession to occur and for restored riparian habitat to functionally replace habitat that has been affected. Each of these individual activities is described below.

- *Water Facilities Construction:* Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 149 acres of modeled Modesto song sparrow habitat (68 acres of permanent loss, 81 acres of temporary loss) from CZs 3–6 and CZ 8. The water conveyance facilities construction footprint overlaps with 77 Modesto song sparrow occurrences and the species is ubiquitous throughout the Delta. The reusable tunnel material storage areas throughout the central Delta overlap with 24 occurrences, shaft locations along the tunnel alignment overlap with 9 occurrences, the permanent transmission line overlaps with 6 occurrences, and 1 occurrence overlaps with the construction of the new forebay in CZ 8. In addition, areas temporarily affected overlap with species occurrences, including the construction of a transmission line (1 occurrence) and geotechnical exploration zones along the tunnel alignment (17 occurrences). Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would require preconstruction surveys and the establishment of no-disturbance buffers and would be available to address adverse effects on nesting Modesto song sparrows. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Construction of the water conveyance facilities and the resultant impacts would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would result in the conversion of an estimated 5 acres of Modesto song sparrow riparian habitat.

- *Environmental Commitment 6 Channel Margin Enhancement:* Channel margin habitat enhancement could result in removal of small amounts of valley/foothill riparian habitat along 4.6 miles of river and sloughs. The extent of this loss cannot be quantified at this time, but the majority of the enhancement activity would occur along waterway margins where riparian habitat stringers exist, including levees and channel banks. The improvements would occur within the study area on sections of the Sacramento, San Joaquin and Mokelumne Rivers, and along Steamboat and Sutter Sloughs. Some of the restored riparian habitat in the channel margin would be expected to support nesting habitat for Modesto song sparrow.

- *Environmental Commitment 11 Natural Communities Enhancement and Management:* A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of modeled habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on available habitat and would be expected to result in overall improvements to and maintenance of habitat values.

  Habitat management- and enhancement-related activities could affect Modesto song sparrow nests. If the individuals were to nest in the vicinity of a worksite, equipment operation could destroy nests, and noise and visual disturbances could lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address these adverse effects.

- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect Modesto song sparrow use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.

- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged Modesto song sparrow if they were present in the project area, because they would be expected to avoid contact with construction and other equipment. If the species were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address these effects.

The following paragraphs summarize the combined effects discussed above and describe environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 154 acres of modeled habitat (73 permanent, 81 temporary) for Modesto song sparrow in the study area. These effects would result from the construction of the water conveyance facilities and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration*).

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected would be 1:1 for restoration/creation and 1:1 protection of habitat. Using these ratios would indicate that 154 acres of suitable habitat should be restored/created and 154 acres should be protected to compensate for the losses of 154 acres of Modesto song sparrow habitat. Habitat that would be restored or protected to benefit Modesto song sparrow would include valley/foothill riparian and tidal and nontidal wetlands.

Alternative 4A includes conservation commitments through *Environmental Commitment 4 Tidal Natural Communities Restoration, Environmental Commitment 7 Riparian Natural Community Restoration* and *Environmental Commitment 3 Natural Communities Protection and Restoration* to restore or create 251 acres and protect 103 acres of valley/foothill riparian woodland. Riparian areas would be restored, maintained, and enhanced to provide a mix of early-, mid- and late-successional habitat types with a well-developed understory of dense shrubs. In addition, 59 acres of tidal wetlands would be restored or created (37 acres in the north Delta and 22 acres in the central Delta), 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created.

The project also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM7 Barge Operations Plan.*

If Modesto song sparrow were to nest in or adjacent to work areas, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75 would be available to address this potentially adverse effect.

***NEPA Effects*:** The loss of Modesto song sparrow nesting habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of Modesto song sparrow habitat under Alternative 4A would not be adverse.

***CEQA Conclusion*:** The effects on Modesto song sparrow habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of other environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 7, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM6, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, with the implementation of Mitigation

Measure BIO-75, Alternative 4A would have a less-than-significant impact on Modesto song sparrow under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-143: Effects on Modesto Song Sparrow Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of Modesto song sparrow. Existing lines currently pose this risk for Modesto song sparrow and the incremental increased risk from the construction of new transmission lines is not expected to adversely affect the population.

NEPA Effects: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would not adversely affect the Modesto song sparrow population.

CEQA Conclusion: The incremental increased risk of bird-powerline strikes from the construction of new transmission lines would have a less-than-significant impact on the Modesto song sparrow population.

Impact BIO-144: Indirect Effects of the Project on Modesto Song Sparrow

Indirect construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect Modesto song sparrow use of modeled habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (see Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS). However, there are no available data to determine the extent to which these noise levels could affect Modesto song sparrow. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect these species or their prey in the surrounding habitat. AMM1–AMM7 including *AMM2 Construction Best Management Practices and Monitoring* would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to Modesto song sparrow could also have a negative effect on these species. AMM1–AMM7 would ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. Increased methylmercury associated with natural community restoration could indirectly affect Modesto song sparrow, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP).

The potential mobilization or creation of methylmercury within the project area varies with site-specific conditions and would need to be assessed at the project level. Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. If a project is identified where there is a high potential for methylmercury production that could not be fully addressed through restoration design and adaptive management, alternate restoration areas would be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Modesto song sparrow use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could adversely affect Modesto song sparrow use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, in addition to AMM1–AMM7, would be available to address this adverse effect. The implementation of tidal natural communities restoration could result in increased exposure of Modesto song sparrow to methylmercury in tidally restored areas. However, it is currently unknown what concentrations of methylmercury are harmful to the species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Modesto song sparrow.

***CEQA Conclusion*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce Modesto song sparrow use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect Modesto song sparrow use of the surrounding habitat. Noise, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would have a less-than-significant impact on Modesto song sparrow with the implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7. The implementation of tidal natural communities restoration could result in increased exposure of Modesto song sparrow to methylmercury in tidally restored areas. This would be a significant impact. However, it is currently unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on Modesto song sparrow.

With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not substantially reduce the number or restrict the range of Modesto song sparrow. Therefore, with the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on Modesto song sparrow.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-145: Periodic Effects of Inundation on Modesto Song Sparrow as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on Modesto song sparrow.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Bank Swallow

This section describes the effects of Alternative 4A, including construction and implementation of environmental commitments, on bank swallow. Bank swallows nest in colonies along rivers, streams, or other water and require fine textured sandy soils in vertical banks to create their burrows. There is little suitable habitat for bank swallow in the study area because most of the erodible banks have been stabilized with of levee revetment. The placement of rock revetment prevents the lateral migration of rivers, removing the natural river process that creates vertical banks through erosion (Bank Swallow Technical Advisory Committee 2013, Stillwater Sciences 2007). An estimated 70-90% of the bank swallow population in California nests along the Sacramento and Feather Rivers (Bank Swallow Technical Advisory Committee 2013) upstream of the study area. However, there are three CNDDB records of bank swallow colonies in the study area: two in CZ 2 north of Fremont Weir, and one in CZ 5 on Brannan Island, just west of Twitchell Island.

The closest natural community to represent modeled habitat for bank swallow is valley foothill riparian. Although there are impacts to the valley foothill riparian natural community along the northeast corner of Clifton Court Forebay, at the intermediate forebay, and on Bouldin Island, it is highly unlikely that the habitat in these locations is suitable for bank swallow (alluvial soils that form steep, eroded banks that have not been stabilized with levee revetment). Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, if reusable tunnel material areas were to become suitable for swallows over time, Mitigation Measure BIO-146 *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would avoid impacts on nesting bank swallows by requiring surveys to be conducted prior to the removal of reusable tunnel material. Alternative 4A would not result in the direct loss of modeled habitat for bank swallow. However, indirect effects of noise and visual disturbance from *Environmental Commitment 4 Tidal Natural Communities Restoration* could impact bank swallow colonies if they were present near work areas. In addition, there is uncertainty with respect to how water flows upstream of the study area would affect bank swallow habitat.

As explained below, impacts on bank swallow under Alternative 4A would not be adverse for NEPA purposes and would be less than significant for CEQA purposes with the implementation of mitigation measures to monitor colonies and address the uncertainty of upstream operations on the species.

Table 12-4A-52. Changes in Bank Swallow Modeled Habitat Associated with Alternative 4A (acres)[a]

		Permanent		Temporary		Periodic[d]	
Project Component	Habitat Type	NT	LLT[c]	NT	LLT[c]	Yolo	Floodplain
Water Conveyance Facilities	Nesting	0	0	0	0	NA	NA
Total Impacts Water Conveyance Facilities		**0**	**0**	**0**	**0**	**NA**	**NA**
Environmental Commitments[b]	Nesting	0	0	0	0	0	0
Total Impacts Environmental Commitments		**0**	**0**	**0**	**0**	**0**	**0**
TOTAL IMPACTS		**0**	**0**	**0**	**0**	**0**	**0**

[a] See Appendix 12E, *Detailed Accounting of Direct Effects of Alternatives on Natural Communities and Covered Species*, of this RDEIR/SDEIS, for a detailed breakdown of environmental commitments' effects over the project's near-term and late long-term timeframes.

[b] See discussion below for a description of applicable environmental commitments.

[c] LLT acreages are a summation of effects that would occur in the near-term, early long-term and late long-term timeframes. The LLT acreages represent the total amount of habitat that would be affected over the implementation of Alternative 4A and do not reflect habitat increases that would result from restoration, creation and protection activities.

[d] Periodic effects were estimated for the late long-term only.

NT = near-term
LLT = late long-term
NA = not applicable

Impact BIO-146: Indirect Effects of Implementation of Alternative 4A on Bank Swallow

Noise and visual disturbances during restoration activities from *Environmental Commitment 4 Tidal Natural Communities Restoration* including operation of earthmoving equipment and human activities at work sites, could result in temporary disturbances that cause bank swallow to abandon active nest burrows adjacent to construction areas. Bank swallow colonies with occupied burrows have been recorded in CZ 5 and construction-related disturbances could result in an adverse effect on individuals. Various activities related to *Environmental Commitment 11 Natural Communities Enhancement and Management* could also have indirect impacts on bank swallow.

***NEPA Effects*:** Construction activities associated with habitat restoration could adversely affect bank swallow colonies in the absence of other measures. Noise and visual disturbances could result in adverse effects on bank swallows including abandonment of nests if active colonies were present within 500 feet of work areas. Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would be available to address this effect.

CEQA Conclusion: Construction activities associated with habitat restoration could represent an adverse effect on bank swallow colonies as a result of modification of habitat and potential mortality of special status species in the absence of other measures. This impact would be significant. Noise and visual disturbances could result in significant impacts on bank swallows if active colonies were present within 500 feet of work areas. Implementation of Mitigation Measure BIO-146, *Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized*, would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized

To the extent practicable, project proponents will not conduct restoration activities during the bank swallow nesting season (April 1 through August 31). If construction activities cannot be avoided during nesting season, a qualified biologist will conduct preconstruction surveys to determine if active bank swallow nesting colonies are present within 500 feet of work areas. If no active nesting colonies are present, no further mitigation is required. Reusable tunnel material areas are not expected to be colonized by nesting bank swallows, as it is unlikely that the substrate would provide suitable nesting habitat for the species. However, reusable tunnel material sites could become suitable for swallows over time. Surveys of reusable tunnel material areas that have been present for at least 1 year, allowing the substrate to stabilize, will be conducted prior to the removal of reusable tunnel material.

If active colonies are detected, project proponents will establish a nondisturbance buffer (determined in coordination with CDFW and the Bank Swallow Technical Advisory Committee) around the colony during the breeding season. In addition, a qualified biologist will monitor any active colony within 500 feet of construction to ensure that construction activities do not affect nest success.

Impact BIO-147: Effects of Upstream Reservoir and Water Conveyance Facilities Operations on Bank Swallow

Bank swallows are a riparian species that have evolved to deal with a dynamic system that changes with annual variation in variables such as rainfall, or late snowpack runoff. The primary threat to the species is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river process, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breading season. The potential impacts of changes in upstream flows during the breeding season on bank swallows are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and the peak egg-laying occurs during April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after the March when the swallows have nested and laid eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses that resulted in partial or complete colony failure (Stillwater Sciences 2007).

The CALSIM II modeling results of mean monthly flow were analyzed for three flow gauge stations on the Sacramento River (Sacramento River at Keswick, Sacramento River upstream of Red Bluff, Sacramento River at Verona) and two flow gauge stations on the Feather River (Feather River high-flow channel at Thermalito Dam, and Feather River at the confluence with the Sacramento River). Flows were estimated for wet years, above normal years, below normal years, dry years, and critical years. An average also was estimated (see Section 5.3.1, *Methods for Analysis*, in the Draft EIR/EIS for a description of the model).

On the Sacramento River at the Keswick and Red Bluff gauges, mean monthly flows under Alternative 4A could increase between April and August in below normal, dry, and critical years based on modeling assumptions and output (see Table 1 in Section 11C.4.1.1 and Table 3 in Section 11C.4.1.2 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*, of the Draft EIR/EIS). The increased flows could lead to inundation of active colonies. However, model outputs indicate that flows under Existing Conditions and the predicted flows in the late long-term without the project (NAA) also show increases in flows during the breeding season (April through August) in these water year types. Similar trends are shown for the Feather River (see Table 15 in Section 11C.4.1.8 and Table 17 in Section 11C.4.1.9 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*, of the Draft EIR/EIS). In addition, at the Verona flow gauge on the Sacramento River in average water years (see Table 7 in Section 11C.4.1.4 of Appendix 11C, *CALSIM II Model Results Utilized in the Fish Analysis*, of the Draft EIR/EIS) flows are predicted to be greater than 14,000 cfs during the breeding season (April through August,) which could lead to bank collapse. However, flows of this height are recorded under Existing Conditions at this flow gage and are also predicted for the late long-term without the project (NAA).

***NEPA Effects*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4A would not be substantially greater than under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. Soil type, high winter flows, and low spring flows all contribute to successful nesting of bank swallow, and even moderate changes in seasonal flows could have an adverse effect on breeding success for the species. Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would be available to address the uncertainty of potential adverse effects of upstream operations on bank swallow.

***CEQA Conclusion*:** High spring flows on the Sacramento and Feather Rivers may already be impacting bank swallow colonies during the breeding season, and predicted flows under Alternative 4A would not be substantially greater than under the No Action Alternative. However, because of the complexity of variables that dictate suitable habitat for the species, there is uncertainty regarding the potential for and magnitude of impacts on bank swallow from changes in upstream operations. There are many variables that dictate suitable habitat for the species that cannot be clearly quantified, and seasonal changes in flow could increase or decrease suitable habitat for bank swallow depending on soil type and location of current colonies. Implementation of Mitigation Measure BIO-147, *Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area*, would address this potential significant impact and further determine if additional mitigation is required for bank swallow.

Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area

To address the uncertainty of the impact of upstream spring flows on existing bank swallow habitat, DWR will monitor existing colonies upstream of the study area and collect habitat suitability data including soil type, number of active burrows per colony, and height of average burrows. DWR will quantify the magnitude of spring flows that would result in potential mortality of active colonies. In addition, to determine the degree to which reduced winter flows are contributing to habitat loss, DWR will quantify the winter flows required for river meander to create suitable habitat through lateral channel migration and bank resurfacing. If impacts of upstream flows on bank swallow are identified, replacement habitat will be established at a minimum of 2:1 for the length of bank habitat affected. Replacement habitat will consist of removing bank revetment to create habitat for bank swallow at a location subject to CDFW approval (Bank Swallow Technical Advisory Committee 2013).

Yellow-Headed Blackbird

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of environmental commitments, on yellow-headed blackbird. The habitat model used to assess impacts on yellow-headed blackbird includes nesting habitat and foraging habitat. Modeled nesting habitat includes tidal freshwater emergent wetland, other natural seasonal wetland, nontidal freshwater perennial emergent wetland, and managed wetland. These natural communities support aquatic insects which are important prey items for yellow-headed blackbird young (Beedy 2008). Modeled foraging habitat for yellow-headed blackbird consists of cultivated lands and noncultivated land cover types known to support abundant insect populations, including corn, pasture, and feedlots.

Alternative 4A would result in both temporary and permanent losses of yellow-headed blackbird modeled habitat as indicated in Table 12-4A-53. Full implementation of Alternative 4A would include the following environmental commitments and Resource Restoration and Performance Principles which would also benefit yellow-headed blackbird.

- Restore or create 37 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the central Delta (Environmental Commitment 4 and Resource Restoration and Performance Principle CBR1)
- Protect 119 acres of nontidal wetlands and create 832 acres of nontidal wetlands (Environmental Commitments 3 and 10).
- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3).

As explained below, with the restoration or protection of these amounts of habitat, in addition to management activities to enhance habitats for the species and implementation of AMM1–AMM7, *AMM27 Selenium Management*, Environmental Commitment 12, and Mitigation Measure BIO-75, impacts on yellow-headed blackbird would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-53. Changes in Yellow-Headed Blackbird Modeled Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Nesting	27	51
	Foraging	1,582	399
Total Impacts Water Conveyance Facilities		**1,609**	**450**
Environmental Commitments 4, 6–7, 9–11[a]	Nesting	0	0
	Foraging	2,212	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**2,212**	**0**
Total Nesting		**27**	**51**
Total Foraging		**3,794**	**399**
TOTAL IMPACTS		**3,821**	**450**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-148: Loss of Habitat for and Direct Mortality of Yellow-Headed Blackbird

Alternative 4A would result in the combined permanent and temporary loss of up to 4,271 acres of modeled habitat (78 acres of nesting habitat and 4,193 acres of foraging habitat) for yellow-headed blackbird (Table 12-4A-53). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of reusable tunnel material areas, and tidal habitat restoration (Environmental Commitment 4), riparian restoration, (Environmental Commitment 7), grassland restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10). Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other physical facilities could degrade or eliminate yellow-headed blackbird suitable habitat. Each of these individual activities is described below.

- *Water Facilities Construction*: Construction of Alternative 4A water conveyance facilities would result in the combined permanent and temporary loss of up to 78 acres of yellow-headed blackbird nesting habitat (27 acres of permanent loss and 51 acres of temporary loss). In addition, 1,981 acres of foraging habitat would be removed (1,582 acres of permanent loss, 399 acres of temporary loss). Activities that would impact suitable yellow-headed blackbird habitat consist of tunnel, forebay, and intake construction, temporary access roads, and construction of transmission lines. The largest losses of foraging habitat would occur from loss of corn. There are no occurrences of yellow-headed blackbird that overlap with the construction footprint for water conveyance facilities. However, Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds,* would be available to address adverse effects on nesting yellow-headed blackbirds. Impacts from water conveyance facilities would occur in the central Delta in CZs 3–6, and CZ 8. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Impacts from water conveyance facilities would occur within the first 10–14 years of Alternative 4A implementation.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Site preparation and inundation from Environmental Commitment 4 would permanently remove or convert an estimated 59 acres of foraging habitat.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of yellow-headed blackbird foraging habitat.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands. These acres may be temporarily unavailable for yellow-headed blackbird but would not permanently reduce foraging habitat for the species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of yellow-headed blackbird foraging habitat. Resulting nontidal marsh creation could benefit yellow-headed blackbird by creating breeding habitat that also supports aquatic insects for foraging.
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* Habitat management- and enhancement-related activities could disturb yellow-headed blackbird nests if they were present near work sites. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of yellow-headed blackbird habitat and reduce the functions of habitat until restoration is complete. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance, would be expected to have minor effects on available yellow-headed blackbird habitat. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized by the AMMs listed below (AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP. and updated versions of *AMM2 Construction Best Management Practices and Monitoring* and *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material and Dredged Material* are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Environmental Commitment 11 would also include the construction of recreational-related facilities, including trails, interpretive signs, and picnic tables (see Draft BDCP Chapter 4, *Covered Activities and Associated Federal Actions*). The construction of trailhead facilities, signs, staging areas, picnic areas, bathrooms, etc. would be placed on existing, disturbed areas when and where possible.
- *Water Facilities Operations and Maintenance*: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs described below.
- Injury and Direct Mortality: Construction-related activities would not be expected to result in direct mortality of adult or fledged yellow-headed blackbird if they were present in the study area, because they would be expected to avoid contact with construction and other equipment. If yellow-headed blackbird were to nest in the construction area, construction-related activities, including equipment operation, noise and visual disturbances could destroy nests or lead to their abandonment, resulting in mortality of eggs and nestlings. Mitigation Measure BIO-75,

Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds, would be available to address these adverse effects on yellow-headed blackbird.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments, Resource Restoration and Performance Principles, and AMMs that offset or avoid these effects. NEPA and CEQA conclusions are provided at the end of the section.

Alternative 4A would remove 4,271 acres (78 acres of nesting habitat and 4,193 acres of foraging habitat) of yellow-headed blackbird nesting habitat in the study area. These effects would result from the construction of the water conveyance facilities (78 acres of nesting habitat, 1,981 acres of foraging habitat), and implementing other environmental commitments (*Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 8 Grassland Natural Community Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*`,2,212 acres of foraging habitat).Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by water conveyance facilities would be 1:1 for restoration/creation and 1:1 protection of nesting habitat, and 1:1 protection of foraging habitat. Using these ratios would indicate that 78 acres of nesting habitat should be restored/created and 78 acres should be protected to compensate for the water conveyance facilities losses of 78 acres of yellow-headed blackbird nesting habitat. In addition, 4,193 acres of foraging habitat should be protected to compensate for the losses of yellow-headed blackbird foraging habitat.

Project proponents would commit to creating or restoring 59 acres of tidal wetlands (37 acres in the north Delta and 22 acres in the central Delta), creating 832 acres of nontidal wetlands, and protecting 119 acres of nontidal wetlands. These acres of restoration and protection would be more than sufficient to compensate for impacts on 78 acres of yellow-headed blackbird nesting habitat. Alternative 4A would also protect 1,060 acres of grassland and 11,870 acres of cultivated lands, which would provide suitable foraging habitat for yellow-headed blackbird.

The Plan also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, and AMM7 Barge Operations Plan*. All of these AMMs include elements that would avoid or minimize the risk of affecting individuals and species habitats adjacent to work areas. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

For the project to avoid adversely affecting individuals, preconstruction surveys for avian species would be required to ensure that nests are detected and avoided. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address this adverse effect.

NEPA Effects: The loss of yellow-headed blackbird nesting and foraging habitat from Alternative 4A would not be adverse under NEPA because project proponents have committed to avoiding and minimizing effects and to restoring and protecting an acreage that exceeds the typical mitigation ratios described above. This habitat protection, restoration, management, and enhancement would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, losses and conversions of yellow-headed blackbird habitat under Alternative 4A would not be adverse.

***CEQA Conclusion*:** The effects on yellow-headed blackbird habitat from Alternative 4A would represent an adverse effect as a result of habitat modification of a special-status species and potential for direct mortality in the absence of environmental commitments and AMMs. However, project proponents have committed to habitat protection, restoration, management, and enhancement associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 10, and Environmental Commitment 11. These conservation activities would be guided by Resource Restoration and Performance Principle CBR1, and by AMM1–AMM7, which would be in place during all project activities. In addition, Mitigation Measure BIO-75 would be available to address potential impacts on nesting individuals. Considering these commitments, Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of yellow-headed blackbird. Therefore, with the implementation of Mitigation Measure BIO-75, Alternative 4A would have a less-than-significant impact on yellow-headed blackbird under CEQA.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-149: Effects on Yellow-Headed Blackbird Associated with Electrical Transmission Facilities

New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbirds. Yellow-headed blackbirds are colonial and have the potential to collide with the proposed transmission lines when migrating in large flocks. However, similar to tricolored blackbird behavior, daily flights associated with foraging likely occur in smaller flocks at heights that are lower than the transmission lines (BDCP Attachment 5.J-2, *Memorandum: Analysis of Potential Bird Collisions at Proposed BDCP Transmission Lines*). Marking transmission lines with flight diverters that make the lines more visible to birds has been shown to dramatically reduce the incidence of bird mortality (Brown and Drewien 1995). For example, Yee (2008) estimated that marking devices in the Central Valley could reduce avian mortality by 60%. As described in *AMM20 Greater Sandhill Crane*, all new project transmission lines would be fitted with flight diverters which reduce the potential for yellow-headed blackbird collision with transmission lines.

Transmission line poles and towers also provide perching substrate for raptors, which are predators on yellow-headed blackbird. Although there is potential for transmission lines to result in increased perching opportunities for raptors and result in increased predation pressure on yellow-headed blackbirds, the existing network of transmission lines in the study area currently poses this risk for yellow-headed blackbirds, and any incremental risk associated with the new transmission line corridors would not be expected to affect the study area population. Therefore, it is assumed that the increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities is minimal.

***NEPA Effects*:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities is considered minimal. Therefore, the construction and operation of new transmission lines under Alternative 4A would not result in an adverse effect on yellow-headed blackbird.

CEQA Conclusion**:** New transmission lines would increase the risk for bird-power line strikes, which could result in injury or mortality of yellow-headed blackbird. *AMM20 Greater Sandhill Crane* contains the commitment to place bird strike diverters on all new powerlines, which would reduce the potential impact of the construction of new transmission lines on yellow-headed blackbird. The increase in predation risk on yellow-headed blackbird from an increase in raptor perching opportunities is considered minimal. The construction and operation of new transmission lines under Alternative 4A would not substantially reduce the number or restrict the range of the species and would therefore result in a less-than-significant impact on yellow-headed blackbird.

Impact BIO-150: Indirect Effects of the Project on Yellow-Headed Blackbird

Indirect construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect yellow-headed blackbird use of suitable habitat. Construction noise above background noise levels (greater than 50 dBA) could extend 500 to 5,250 feet from the edge of construction activities (Appendix 5.J, Attachment 5J.D, *Indirect Effects of the Construction of the BDCP Conveyance Facility on Sandhill Crane*, Table 5J.D-4 in Appendix D, *Substantive BDCP Revisions,* of this RDEIR/SEIS), although there are no available data to determine the extent to which these noise levels could affect yellow-headed blackbird. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect the species in the surrounding habitat. The inadvertent discharge of sediment or excessive dust adjacent to yellow-headed blackbird habitat could also have a negative effect on the species. Where nests are located above open water, impacts of contamination, dust, and sediment in water could impact fledglings directly, or affect aquatic insect prey, which is important for feeding young. AMM1–AMM7 would minimize the likelihood of spills from occurring and ensure that measures are in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in avian species, including yellow-headed blackbird. Marsh (tidal and nontidal) restoration has the potential to increase exposure to methylmercury. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of mercury. Species sensitivity to methylmercury differs widely and there is a large amount of uncertainty with respect to species-specific effects. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. The review includes an overview of the project-related mechanisms that could result in increased mercury in the food web, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase. Increased methylmercury associated with natural community restoration could indirectly affect yellow-headed blackbird, via uptake in lower tropic levels (as described in Appendix 5.D, *Contaminants*, of the Draft BDCP).

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, *Environmental Commitment 12 Methylmercury Management* is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 would be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment would include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

***NEPA Effects*:** Noise and visual disturbances from the construction of water conveyance facilities could reduce yellow-headed blackbird use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect yellow-headed blackbird use of the surrounding habitat. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals in addition to AMM1–AMM7.

The implementation of tidal natural communities restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12, which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

***CEQA Conclusion*:** In the absence of AMMs, noise and visual disturbance, the potential for hazardous spills, increased dust and sedimentation, and operations and maintenance of the water conveyance facilities under Alternative 4A would represent an adverse effect. This impact would be significant. The implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, and AMM1–AMM7, would reduce this impact to a less-than-significant level.

The implementation of tidal natural communities restoration could result in increased exposure of yellow-headed blackbird to methylmercury in restored tidal areas. However, it is unknown what concentrations of methylmercury are harmful to these species and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on yellow-headed blackbird.

Indirect effects of Alternative 4A implementation would represent an adverse effect on yellow-headed blackbird in the absence of other environmental commitments. This would be a significant impact. With AMM1–AMM7 and Environmental Commitment 12 in place, and with the implementation of Mitigation Measure BIO-75, indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, indirect effects of Alternative 4A implementation would have a less-than-significant impact on yellow-headed blackbird.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-151: Periodic Effects of Inundation of Yellow-Headed Blackbird Nesting Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic inundation effects on yellow-headed blackbird.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Riparian Brush Rabbit

The habitat model used to assess effects on the riparian brush rabbit consists of 38 vegetation associations within the valley/foothill riparian natural community and adjacent grasslands. The vegetation associations were selected based on a review of understory and overstory composition from Hickson and Keeler-Wolf (2007) and species habitat requirements.

Just until recently, the only known naturally occurring populations of riparian brush rabbits were confined to Caswell Memorial State Park (MSP), a 258-acre park supporting riparian oak woodland on the Stanislaus River immediately southeast of the study area, and in the south Delta southwest of Lathrop, which is within the study area (Williams and Basey 1986; Williams et al. 2002) (Figure 12-46). On October 11, 2012 a single female riparian brush rabbit was captured near Durham Ferry Road in riparian habitat along the San Joaquin River between Caswell MSP and Lathrop (Bradbury pers. comm.). This is only the 2nd naturally occurring population documented outside of Caswell MSP. Factors considered in assessing the value of adversely affected habitat for riparian brush rabbit, to the extent information was available, included size and degree of isolation of habitat patches, proximity to recorded species occurrences, and adjacency to conserved lands.

Alternative 4A would result in both temporary and permanent losses of riparian brush rabbit modeled habitat as indicated in Table 12-4A-54. Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the riparian brush rabbit.

- Increase the size and connectivity of the reserve system by acquiring lands adjacent to and between existing conservation lands (Resource Restoration and Performance Principle L1).
- Of the 103 acres of protected valley/foothill riparian natural community, protect and maintain 19 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Environmental Commitment 3 and Resource Restoration and Performance Principle RBR1).
- Of the 251 acres of restored valley/foothill riparian natural community, restore and maintain 19 acres of early- to mid-successional riparian habitat that meets the ecological requirements of the riparian brush rabbit and that is within or adjacent to or that facilitates connectivity with existing occupied or potentially occupied habitat (Environmental Commitment 7 and Resource Restoration and Performance Principle RBR2).
- Create and maintain high-water refugia in the 19 acres of restored riparian brush rabbit habitat and the 19 acres of protected riparian brush rabbit habitat, through the retention, construction and/or restoration of high-ground habitat on mounds, berms, or levees, so that refugia are no further apart than 66 feet (Resource Restoration and Performance Principle RBR3).
- In protected riparian areas that are occupied by riparian brush rabbit, monitor for and control nonnative predators that are known to prey on riparian brush rabbit (Resource Restoration and Performance Principle RBR4).
- Of the 1,060 acres of grasslands protected, protect 227 acres of grasslands on the landward side of levees adjacent to restored floodplain to provide flood refugia and foraging habitat for riparian brush rabbit (Resource Restoration and Performance Principle RBR5).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on riparian brush rabbit would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-54. Changes in Riparian Brush Rabbit Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Riparian	15	4
	Grassland	170	57
Total Impacts Water Conveyance Facilities		**185**	**61**
Environmental Commitments 4, 6–7, 9–11[a]	Riparian	0	0
	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**185**	**61**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-152: Loss or Conversion of Habitat for and Direct Mortality of Riparian Brush Rabbit

Alternative 4A would result in the permanent and temporary loss of up to 19 acres of riparian habitat and 227 acres of associated grassland habitat for the riparian brush rabbit in the study area

(Table 12-4A-54). Environmental commitments that would result in these losses are conveyance facilities construction and geotechnical investigation. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Development of Alternative 4A water conveyance facilities would result in the permanent removal of approximately 15 acres of riparian habitat and 170 acres of associated grassland habitat and in the temporary removal of 4 acre of riparian habitat and 57 acres of grassland habitat for riparian brush rabbit in CZ 8 (Table 12-4A-54). There are no riparian brush rabbit occurrences in the water conveyance facilities construction footprint. The riparian habitat that would be removed is of low value for the riparian brush rabbit as it consists of several small, isolated patches surrounded by agricultural lands northeast of Clifton Court Forebay. The associated grasslands are also of low value for the species: They consist of long, linear strips that abut riparian habitat, but extend several miles from the riparian habitat and, therefore, provide few if any opportunities for adjacent cover. Trapping efforts conducted for the riparian brush rabbit in this area were negative (see Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*, in the Draft BDCP). Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Protection of 227 acres of grassland and 19 acres of riparian habitat, as well as restoration of 19 acres of riparian habitat would benefit riparian brush rabbit (Table 12-4A-54). A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values in protected habitats may result in localized ground disturbances that could temporarily remove small amounts of riparian brush rabbit habitat. Enhancement and management actions in riparian brush rabbit habitat within the reserve system may include invasive plant removal, planting and maintaining vegetation to improve and sustain habitat characteristics for the species, and creating and maintaining flood refugia. These activities are expected to have minor adverse effects on available riparian brush rabbit habitat and are expected to result in overall improvements to and maintenance of riparian brush rabbit habitat values over time. These effects cannot be quantified, but are expected to be minimal and would be avoided and minimized through the AMMs listed below.

  Passive recreation in the reserve system could result in disturbance of individual riparian brush rabbits foraging in the ecotone between riparian and adjacent open habitats. However, *AMM37 Recreation* limits trail development adjacent to riparian corridors within the range of the riparian brush rabbit. With this minimization measure in place, recreation related effects on the riparian brush rabbit are expected to be minimal.

- Operations and maintenance: Ongoing maintenance of project facilities are not expected to adversely affect the riparian brush rabbit because the species is not expected to occur in the vicinity of proposed facilities.

- Injury and direct mortality: Water conveyance facility construction is not is not likely to result in injury or mortality of individual riparian brush rabbit because the species is not likely to be present in the areas that would be affected by this activity, based on live trapping results (see Appendix 3.E, *Conservation Principles for the Riparian Brush Rabbit and Riparian Woodrat*, in the

Draft BDCP). Valley foothill/riparian natural communities restoration would not result in injury or mortality of the riparian brush rabbit because restoration projects would be designed to avoid occupied riparian brush rabbit habitat and, if that is not possible, rabbits would be trapped and relocated as described in AMM25 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS).

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and AMMs that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are 6,012 acres of modeled riparian brush rabbit habitat in the study area, consisting of 2,909 acres of riparian habitat and 3,103 acres of associated grassland habitat. Alternative 4A would result in permanent and temporary effects combined on 19 acres of modeled riparian habitat (less than 1% of the habitat in the study area) and 227 acres of modeled grassland habitat (less than 1% of habitat in the study area) for riparian brush rabbit in CZ 6, CZ 7, and CZ 8.

These effects would result from the construction of the water conveyance facilities. The habitat would be lost in the valley/foothill riparian and grassland natural communities. Most of the loss of riparian brush rabbit habitat would be in an area unlikely to be occupied by the species in CZ 8. Habitat loss in CZ 7, in areas known or likely to be occupied, would also occur. Riparian restoration would be phased to minimize temporal habitat loss. Alternative 4A includes a commitment to protect 227 acres of grassland and 19 acres of riparian habitat, and to restore 19 acres of riparian habitat for riparian brush rabbit. The conserved habitat would also be part of a larger, more contiguous, and less patchy area of protected and restored riparian natural community than what currently exists in CZ 7 and would be contiguous with existing modeled riparian brush rabbit habitat. The conserved habitat would also provide more specific ecological requirements of riparian brush rabbit, including large patches of dense riparian brush; ecotonal edges that transition from brush species to grasses and forbs, scaffolding plants to support vines that grow above flood levels; a tree canopy that is open, if present; and high-ground refugia from flooding.

The project would also protect grasslands adjacent to suitable riparian vegetation in areas outside the floodplain levees. These grasslands are expected to provide additional foraging opportunities for the riparian brush rabbit and upland refugia during flood events. Grasslands on the landward side of levees adjacent to restored floodplain will be restored or protected as needed to provide flood refugia and foraging habitat for riparian brush rabbit.

Additionally, nonnative predators that are known to prey on riparian brush rabbit (e.g., feral dogs and cats) would be monitored in protected and restored riparian and grassland areas that are occupied by riparian brush rabbit and controlled as needed (Environmental Commitment 11).

Typical NEPA and CEQA project-level mitigation ratios for loss of riparian and grassland habitats affected by water conveyance facilities would be 1:1 for restoration and protection of the valley/foothill riparian natural community, and 1:1 for protection of grassland for riparian brush rabbit. Using these ratios would indicate that 19 acres of riparian habitat should be restored, 19 acres of riparian habitat should protected, and 227 acres of grassland should be protected for riparian brush rabbit to mitigate near-term losses.

The project also contains commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containment, and*

Countermeasure Plan, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 Barge Operations Plan, AMM10 Restoration of Temporarily Affected Natural Communities, AMM25 Riparian Woodrat and Riparian Brush Rabbit, and AMM37 Recreation. These AMMs contain elements that avoid or minimize the risk of project activities affecting habitats and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and updated versions of AMM2, AMM6, and AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The loss of riparian brush rabbit habitat and potential mortality under Alternative 4A would not be an adverse effect because there is little likelihood of riparian brush rabbits being present and because the project proponents have committed to protecting and restoring the acreage required to meet the typical mitigation ratios described above. This habitat protection, restoration, and enhancement would be guided by species-specific Resource Restoration and Performance Principles L1 and RBR1-RBR5, and by AMM1–AMM6, AMM10, AMM25, and AMM37, which would be in place throughout the period of construction and operations. Considering these commitments, the effects of Alternative 4A as a whole on riparian brush rabbit would not be an adverse effect.

CEQA Conclusion: Considering Alternative 4A's commitment to the protection, restoration, and management of riparian brush rabbit habitat, Resource Restoration and Performance Principles L1 and RBR1-RBR5, and with the implementation of AMM1–AMM7, AMM10, AMM25, and AMM37, the loss of habitat or direct mortality of riparian brush rabbit as a result of implementing Alternative 4A would not represent a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of the species. Therefore, the loss of habitat and potential mortality under this alternative would have a less-than-significant impact on riparian brush rabbit under CEQA.

Impact BIO-153: Indirect Effects of Alternative 4A on Riparian Brush Rabbit

Noise and visual disturbance adjacent to construction activities could indirectly affect the use of modeled riparian brush rabbit riparian habitat and of associated grassland habitat in the study area. These construction activities would include water conveyance, geotechnical investigation, and restoration activities. Water conveyance facilities construction would potentially affect acres of adjacent riparian habitat and of associated grassland habitat: this construction would occur in CZ 8 where there is suitable habitat for the species but surveys by ESRP did not indicate the species is present in this area; therefore, the potential for adverse noise and visual effects from conveyance facility construction would be minimal. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that would affect the riparian brush rabbit in adjacent habitat, if the species is present.

NEPA Effects: Implementation of AMM1–AMM7, AMM10, AMM25, and AMM37, as part of implementing Alternative 4A would avoid the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications or result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Therefore, indirect effects of Alternative 4A would not have an adverse effect on riparian brush rabbit.

CEQA Conclusion: Indirect effects from operations and maintenance as well as construction-related noise and visual disturbances could affect riparian brush rabbit in riparian and grassland habitats. The use of mechanical equipment during construction could cause the accidental release of petroleum or other contaminants that could affect riparian brush rabbit. The inadvertent discharge of sediment or excessive dust adjacent to riparian brush rabbit habitat could also have a negative effect on the species. With implementation of AMM1–AMM7, AMM10, AMM25, and AMM37 as part of Alternative 4A, the project would avoid and minimize the potential for substantial adverse effects on riparian brush rabbits, either indirectly or through habitat modifications and would not result in a substantial reduction in numbers or a restriction in the range of riparian brush rabbits. Indirect effects of Alternative 4A would have a less-than-significant impact on riparian brush rabbit.

Impact BIO-154: Periodic Effects of Inundation of Riparian Brush Rabbit Habitat as a Result of Implementation of Alternative 4A

No Alternative 4A components would result in periodic effects on riparian brush rabbit.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Riparian Woodrat

The habitat model used to assess effects for the riparian woodrat consists of selected plant alliances from the valley/foothill riparian natural community, geographically constrained to the south Delta portion of the study area in CZ 7, south of State Route 4 and Old River Pipeline along the Stanislaus, San Joaquin, Old, and Middle Rivers. Valley/foothill riparian areas along smaller drainages (Paradise Cut, Tom Paine Slough), and some larger streams in the northern portion of CZ 7 were excluded from the riparian woodrat habitat model due to a lack of trees or riparian corridors that were too narrow. Factors considered in assessing the value of affected habitat for the riparian woodrat, to the extent that information is available, include habitat patch size and connectivity.

The riparian woodrat is not known to occur in the study area. The only verified extant population of riparian woodrats rangewide is 2 miles east of the southern end of the study area in Caswell Memorial State Park along the Stanislaus River (Williams 1986:1–112; Williams 1993). Riparian woodrat may occur in small patches of valley oak riparian forest along the San Joaquin River from the southern tip of the study area north to approximately the Interstate 5 overcrossing near Lathrop (Figure 12-47).

Alternative 4A would not result in losses of riparian woodrat modeled habitat as indicated in Table 12-4A-55. There is no modeled habitat for the species in either the water conveyance facilities or Environmental Commitment 4 (tidal restoration) footprint.

Table 12-4A-55. Changes in Riparian Woodrat Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11	0	0
TOTAL IMPACTS	**0**	**0**

Impact BIO-155: Loss or Conversion of Habitat for and Direct Mortality of Riparian Woodrat

No habitat would be lost or converted and there would be no direct mortality of riparian woodrat under Alternative 4A.

NEPA Effects**:** No effect.

CEQA Conclusion: No Impact.

Impact BIO-156: Indirect Effects of Alternative 4A on Riparian Woodrat

There would be no indirect effects on riparian woodrat from Alternative 4A.

NEPA Effects**:** No effect.

CEQA Conclusion: No Impact.

Impact BIO-157: Periodic Effects of Inundation of Riparian Woodrat Habitat as a Result of Implementation of Alternative 4A

There would be no periodic inundation effects on riparian woodrat from Alternative 4A.

NEPA Effects**:** No effect.

CEQA Conclusion: No Impact.

Salt Marsh Harvest Mouse

The habitat model used to assess effects for the salt marsh harvest mouse includes six habitat types: primary tidal marsh habitat, secondary tidal marsh habitat (low marsh), secondary upland habitat adjacent to tidal marsh habitat, primary habitat within managed wetlands, secondary habitat within managed wetlands (dominated by plants characteristic of low marsh), and upland habitats within managed wetland boundaries. The tidal and managed wetland habitats were discriminated recognizing that regardless of habitat value, managed wetlands are at high risk of catastrophic flooding and have lower long-term conservation value than tidal wetlands.

Alternative 4A would not result in effects on modeled salt marsh harvest mouse habitat as indicated Table 12-4A-56. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh, which is the extent of known salt marsh harvest mouse habitat in the study area.

Table 12-4A-56. Changes in Salt Marsh Harvest Mouse Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	0	0
TOTAL IMPACTS	**0**	**0**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-158: Loss or Conversion of Habitat for and Direct Mortality of Salt Marsh Harvest Mouse

No habitat would be lost or converted and there would be no direct mortality of salt marsh harvest mouse under Alternative 4A. As noted above, water conveyance facilities and Environmental

Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

Impact BIO-159: Indirect Effects of Alternative 4A on Salt Marsh Harvest Mouse

No indirect effects on salt marsh harvest mouse were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

***CEQA Conclusion*:** No impact.

Suisun Shrew

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on the Suisun shrew. Primary Suisun shrew habitat consists of all *Salicornia*-dominated natural seasonal wetlands and certain *Scirpus* and *Typha* communities found within Suisun Marsh only. Low marsh dominated by *Schoenoplectus acutus* and *S. californicus* and upland transitional zones within 150 feet of the tidal wetland edge were classified separately as secondary habitat because they are used seasonally (Hays and Lidicker 2000). All managed wetlands were excluded from the habitat model.

Alternative 4A would not result in effects on modeled Suisun shrew habitat as indicated in Table 12-4A-57. There is no modeled habitat for the species in the water conveyance facilities footprint and tidal restoration under Alternative 4A would not take place in Suisun Marsh.

Table 12-4A-57. Changes in Suisun Shrew Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Permanent	Temporary
Total Impacts Water Conveyance Facilities	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]	0	0
TOTAL IMPACTS	**0**	**0**
[a] See discussion below for a description of applicable environmental commitments.		

Impact BIO-160: Loss or Conversion of Habitat for and Direct Mortality of Suisun Shrew

No habitat would be lost or converted and there would be no direct mortality of Suisun shrew under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

CEQA Conclusion: No Impact.

Impact BIO-161: Indirect Effects of Alternative 4A on Suisun Shrew

No indirect effects on Suisun shrew were identified under Alternative 4A. As noted above, water conveyance facilities and Environmental Commitment 4 activities would not be implemented within or adjacent to Suisun Marsh, which is the only portion of the study area where the species is known to occur.

***NEPA Effects*:** No effect.

CEQA Conclusion: No impact.

San Joaquin Kit Fox and American Badger

Within the study area, the modeled habitat for the San Joaquin kit fox and potential habitat for the American badger is restricted to 5,327 acres of grassland habitat west of Clifton Court Forebay along the study area's southwestern edge, in CZ 7–CZ 10. The study area represents the extreme northeastern corner of the San Joaquin kit fox's range in California, which extends westward and southward from the study area border. The northern range of the San Joaquin kit fox (including the study area) was most likely marginal habitat historically and has been further degraded due to development pressures, habitat loss, and fragmentation (Clark et al. 2007). CNDDB (California Department of Fish and Wildlife 2013) reports twelve occurrences of San Joaquin kit foxes along the extreme western edge of the project area within CZ 8, south of Brentwood (Figure 12-49). However, Clark et al. (2007) provide evidence that a number of CNDDB occurrences in the northern portion of the species' range may be coyote pups misidentified as San Joaquin kit foxes. Smith et al. (2006) suggest that the northern range may possibly be a population sink for the San Joaquin kit fox. There are five American badger records in the study area (California Department of Fish and Wildlife 2013). Two are from 1938 and no longer extant. The remaining three are all located in CZ 8, west of Clifton Court Forebay.

Alternative 4A would result in both temporary and permanent losses of San Joaquin kit and American badger habitat (Table 12-4A-58). Grassland restoration, and protection and management of natural communities could affect modeled San Joaquin San Joaquin kit fox habitat and potential American badger habitat. Alternative 4A would include the following environmental commitments and associated Resource Restoration and Performance Principles to benefit the San Joaquin kit fox which would also benefit American badger which uses similar habitat (see Chapter 3, *Conservation Strategy*, of the Draft BDCP). The conservation strategy for the San Joaquin kit fox involves protecting and enhancing habitat in the northern extent of the species' range to increase the likelihood that San Joaquin kit fox may reside and breed in the project area; and providing connectivity to habitat outside the project area.

- Protect and improve habitat linkages that allow terrestrial covered and other native species to move between protected habitats within and adjacent to the project area (Resource Restoration and Performance Principle L2).
- Protect 647 acres of grassland in the Byron Hills area (Environmental Commitment 3 and Resource Restoration and Performance Principle G10).

- Protect 150 acres and restore 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills including associated grasslands (Environmental Commitments 3 and 9, and Resource Restoration and Performance Principle VP/AW1).
- Increase burrow availability for burrow-dependent species in grasslands including grasslands surrounding restored and protected vernal pool and alkali seasonal wetland complexes (Resource Restoration and Performance Principle VP/AW6).
- Increase prey abundance and accessibility, especially small mammals and insects, for grassland-foraging species in grasslands and within restored and protected vernal pool and alkali seasonal wetland complex (Resource Restoration and Performance Principle VP/AW7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to the AMMs to reduce potential effects, impacts on San Joaquin kit fox and American badger would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-58. Changes in San Joaquin Kit Fox Modeled Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Grassland	267	56
Total Impacts Water Conveyance Facilities		**267**	**56**
Environmental Commitments 4, 6–7, 9–11[a]	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**267**	**56**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-162: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Kit Fox and American Badger

Alternative 4A conveyance facilities construction would result in the permanent and temporary loss combined of 323 acres of grassland habitat for the San Joaquin kit fox in the study area (Table 12-4A-58). Because American badger uses grasslands for denning and foraging and may occupy the same range as the San Joaquin kit fox in the project area, effects are anticipated to be the same as those described for San Joaquin kit fox. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA effects and a CEQA conclusion follow the individual activity discussions.

- *Water Facilities and Operation*: Construction of the conveyance facilities would result in the permanent loss of approximately 267 acres and the temporary loss of 56 acres of modeled San Joaquin kit fox and American badger habitat. This habitat is located in areas of naturalized grassland in a highly disturbed or modified setting on lands immediately adjacent to Clifton Court Forebay, in CZ 8. There are 3 San Joaquin kit fox and no American badger occurrences that overlap with the water conveyance facilities footprint.
- Environmental Commitment 11 Natural Communities Enhancement and Management: Protection of 647 acres of grassland would benefit San Joaquin kit fox and American badger

individuals present in the area. A variety of habitat management actions included in Environmental Commitment 11 that are designed to enhance wildlife values on protected lands may result in localized ground disturbances that could temporarily remove small amounts of San Joaquin kit fox and American badger habitat near Clifton Court Forebay, in CZ 8. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, are expected to have minor effects on available habitat and are expected to result in overall improvements to and maintenance of San Joaquin kit fox and badger habitat values. However, management activities could result in injury or mortality of San Joaquin kit fox or American badger if individuals were present in work sites or if dens were located in the vicinity of habitat management work sites. *AMM24 San Joaquin Kit Fox* and Mitigation Measure BIO-162: *Conduct Preconstruction Survey for American Badger* would be implemented to ensure that San Joaquin kit fox and American badger dens are avoided. AMM24 is described in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP.

Passive recreation in the reserve system could also result in disturbance of San Joaquin kit foxes and American badger at their den sites. Natal and pupping dens would be particularly vulnerable to human disturbance. Additionally, disease could be transmitted from domestic dogs that enter the reserve system with recreational users. However, *AMM37 Recreation* and Mitigation Measure BIO-162 would prohibit construction of new trails within 250 feet of active San Joaquin kit fox and American badger dens. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active San Joaquin kit fox or American badger populations. Rodent control would be prohibited even on grazed or equestrian access areas with San Joaquin kit fox and American badger populations to improve rodent prey availability. AMM37 measures to protect San Joaquin kit fox would also benefit American badger if present. With these restrictions, recreation-related effects on San Joaquin kit fox and American badger are expected to be minimal.

- Operations and maintenance: Ongoing maintenance of project facilities would be expected to have little if any adverse effect on San Joaquin kit fox or American badger. Postconstruction operations and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect either species' use of the surrounding habitat near Clifton Court Forebay, in CZ 8. Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of AMM1–AMM6, AMM10, and AMM24 and with preconstruction surveys for the American badger, as required by Mitigation Measure BIO-162, Conduct Preconstruction Survey for American Badger.

- Injury and direct mortality: Construction vehicle activity may cause injury to or mortality of either species. If San Joaquin kit fox or American badger reside where activities take place (most likely in the vicinity of Clifton Court Forebay, in CZ 8), the operation of equipment for land clearing, construction, operations and maintenance, and restoration, enhancement, and management activities could result in injury to or mortality of either species. Measures would be implemented to avoid and minimize injury to or mortality of these species as described in AMM1–AMM6, AMM10, AMM24, and AMM37 (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS) and Mitigation Measure BIO-162.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments and associated Resource Restoration and Performance Principles that offset or avoid these effects. NEPA effects and a CEQA conclusion are also included.

There are 5,327 acres of modeled San Joaquin kit fox habitat in the study area. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 323 acres of associated grassland habitat for San Joaquin kit fox and potential habitat for American badger, representing 6% of the modeled habitat. These effects would result from construction of the water conveyance facilities.

With full implementation of Alternative 4A, at least 647 acres of grassland would be protected in CZ 8, where the San Joaquin kit fox and American badger are most likely to occur in the study area. In addition, San Joaquin kit fox and American badger would benefit from the protection of 150 acres and restoration of 34 acres of existing vernal pool/alkali seasonal wetlands complexes in the greater Byron Hills. Because San Joaquin kit fox home ranges are large (varying from approximately 1 to 12 square miles; see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP), habitat connectivity is key to the conservation of the species. Grasslands would be acquired for protection in locations that provide connectivity to existing protected breeding habitats in CZ 8 and to other adjoining San Joaquin kit fox and American badger habitat within and adjacent to the project area. Connectivity to occupied habitat adjacent to the project area would help ensure the movement of San Joaquin kit foxes and American badger, if present, to larger habitat patches outside of the project area in Contra Costa County. Grassland protection would focus in particular on acquiring the largest remaining contiguous patches of unprotected grassland habitat, which are located south of SR 4 in CZ 8 (see Appendix 2.A, *Covered Species Accounts*, of the Draft BDCP). This area connects to more than 620 acres of existing habitat that was protected under the East Contra Costa County HCP/NCCP.

Grasslands in CZ 8 would also be managed and enhanced to increase prey availability and to increase mammal burrows, which could benefit the San Joaquin kit fox and American badger by increasing potential den sites, which are a limiting factor for the San Joaquin kit fox in the northern portion of its range. These management and enhancement actions are expected to benefit the San Joaquin kit fox as well as the American badger by increasing the habitat value of the protected grasslands.

CZ 8 supports 74% of the modeled San Joaquin kit fox grassland habitat in the study area, and the remainder of habitat consists of fragmented, isolated patches that are unlikely to support this species. The project's commitment to protect the largest remaining contiguous habitat patches (including grasslands and the grassland component of alkali seasonal wetland and vernal pool complexes) in CZ 8 and to maintain connectivity with the remainder of the satellite population in Contra Costa County would sufficiently offset the impacts resulting from water conveyance facilities construction.

Typical NEPA and CEQA project-level mitigation ratio for the natural community that would be affected would be 2:1 for protection of grassland. Using this ratio would indicate that 646 acres of grassland should be protected for San Joaquin kit fox and American badger to mitigate near-term losses.

Alternative 4A also includes commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged*

Material, *AMM10 Restoration of Temporarily Affected Natural Communities*, *AMM24 San Joaquin Kit Fox*, and *AMM37 Recreation.* These AMMs contain elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and updated versions of AMM2, AMM6, and AMM37 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. Remaining effects would be addressed by implementation of Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger.

NEPA Effects: In the absence of the proposed environmental commitments, the effects on San Joaquin kit fox and American badger habitat from Alternative 4A would represent an adverse effect as a result of habitat modification and potential direct mortality of special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, VP/AW1, VP/AW6, VP/AW7, and G10 and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the construction period and operations, and with implementation of Mitigation Measure BIO-162, the effects of Alternative 4A as a whole on San Joaquin kit fox and American badger would not be an adverse effect.

CEQA Conclusion: In the absence of the proposed environmental commitments, the effects on San Joaquin kit fox and American badger habitat from Alternative 4A would represent a significant impact as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection, restoration, management, and enhancement guided by Resource Restoration and Performance Principles L2, VP/AW1, VP/AW6, VP/AW7, and G10, and guided by AMM1–AMM6, AMM10, AMM24, and AMM37, which would be in place throughout the time period of construction and operations, and with implementation of Mitigation Measure BIO-162, the impact of Alternative 4A as a whole on San Joaquin kit fox and American badger would be less than significant.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

A qualified biologist provided by DWR will survey for American badger concurrent with the preconstruction survey for San Joaquin kit fox and burrowing owl. If badgers are detected, the biologist will passively relocate badgers out of the work area prior to construction if feasible. If an active den is detected within the work area, DWR will establish a suitable buffer distance and avoid the den until the qualified biologist determines the den is no longer active. Dens that are determined to be inactive by the qualified biologist will be collapsed by hand to prevent occupation of the den between the time of the survey and construction activities. In addition, the construction of new trails within 50 feet of active American badger dens would be prohibited. Existing trails would be closed within 250 feet of active natal/pupping dens until young have vacated, and within 50 feet of other active dens. No dogs would be allowed on reserve units with active American badger populations. Rodent control would be prohibited on areas with American badger populations to ensure rodent prey availability.

Impact BIO-163: Indirect Effects of Alternative 4A on San Joaquin Kit Fox and American Badger

Noise and visual disturbances outside the project footprint but within 250 feet of construction activities could temporarily affect modeled San Joaquin kit fox habitat and potential American badger. Water conveyance facilities operations and maintenance activities would include vegetation and weed control, rodent control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. Because operations and maintenance are covered activities rodent control would be prohibited in areas with San Joaquin kit fox or American badger populations to ensure rodent prey availability. While maintenance activities are not expected to remove San Joaquin kit fox and badger habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual foxes and badgers, if present. Given the remote likelihood of active San Joaquin kit fox or badger dens in the vicinity of the conveyance facility, the potential for this effect is small and would further be minimized with the implementation of seasonal no-disturbance buffers around occupied dens, if any, and other measures as described in AMM1–AMM6, AMM10, AMM24, AMM37, and Mitigation Measure BIO-162.

NEPA Effects**:** Implementation of AMM1–AMM6, AMM10, AMM24, and AMM37and Mitigation Measure BIO-162 *Conduct Preconstruction Survey for American Badger*, would avoid the potential for substantial adverse effects on San Joaquin kit fox or American badger, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin kit fox or American badger, or restrict either species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on San Joaquin kit fox or American badger.

CEQA Conclusion**:** Indirect effects from environmental commitment operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin kit fox and American badger. With implementation of AMM1–AMM6, AMM10, AMM24, and AMM37 as part of Alternative 4A construction, operation, and maintenance, the project would avoid the potential for significant adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of either species. In addition, Mitigation Measure BIO-162 as described above, would further reduce of the potential for indirect effects of Alternative 4A on American badger to a less-than-significant level.

Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger

Please see Mitigation Measure BIO-162 under Impact BIO-162.

San Joaquin Pocket Mouse

Habitat for San Joaquin pocket mouse consists of the grassland natural community throughout the study area. The species requires friable soils for burrowing. Alternative 4A would result in both temporary and permanent losses of San Joaquin pocket mouse habitat as indicated in Table 12-4A-59. Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles that would likely benefit San Joaquin pocket mouse.

- Protect 1,060 acres of grasslands (Environmental Commitment 3).
- Restore 1,070 acres of grasslands (Environmental Commitment 8).
- Sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes, with consideration of historical states (Resource Restoration and Performance Principle G3).

As explained below, with protection and management of this amounts of habitat, Alternative 4A's impacts on San Joaquin pocket mouse would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-59. Changes in San Joaquin Pocket Mouse Habitat Associated with Alternative 4A (acres)

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Grassland	506	151
Total Impacts Water Conveyance Facilities		**506**	**151**
Environmental Commitments 4, 6–7, 9–11[a]	Grassland	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**0**	**0**
TOTAL IMPACTS		**506**	**151**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-164: Loss or Conversion of Habitat for and Direct Mortality of San Joaquin Pocket Mouse

Alternative 4A would result in the combined permanent and temporary loss of up to 657 acres of habitat for San Joaquin pocket mouse, of which 506 acres would be a permanent loss and 151 acres would be a temporary loss of habitat (Table 12-4A-59). Project measures that would result in these losses are water conveyance facilities and transmission line construction, and establishment and use of RTM areas, and *Environmental Commitment 4 Tidal Natural Communities Restoration*. The majority of habitat loss would result from water conveyance facilities. Habitat enhancement and management activities (Environmental Commitment 11), which include ground disturbance or removal of nonnative vegetation, could result in local adverse habitat effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities could degrade or eliminate San Joaquin pocket mouse habitat. Each of these individual activities is described below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the combined permanent and temporary loss of up to 657 acres of potential San Joaquin pocket mouse habitat (506 acres of permanent loss, 151 acres of temporary loss) in CZ 3–CZ 6 and CZ 8. The majority of grassland that would be removed would be in CZ 8, from the modifications to Clifton Court Forebay. Refer to the Terrestrial Biology Mapbook in Appendix A of this RDEIR/SDEIS for a detailed view of Alternative 4A construction locations. Construction of the forebay would affect the area where there is a record of San Joaquin pocket mouse (California Department of Fish and Game 2012).
- *Environmental Commitment 11 Natural Communities Enhancement and Management:* The creation of recreational trails and recreational staging areas would result in the disturbance of grasslands and minor losses in habitat. The protection of 1,060 acres of grassland for covered species is expected to benefit San Joaquin pocket mouse by protecting existing habitats from potential loss or degradation that otherwise could occur with future changes in existing land use. Habitat management and enhancement-related activities could cause disturbance or direct mortality to San Joaquin pocket mouse if they are present near work areas.

- A variety of habitat management actions included in *Environmental Commitment 11 Natural Communities Enhancement and Management* that are designed to enhance wildlife values in restored or protected habitats could result in localized ground disturbances that could temporarily remove small amounts of San Joaquin pocket mouse habitat. Ground-disturbing activities, such as removal of nonnative vegetation and road and other infrastructure maintenance activities, would be expected to have minor adverse effects on habitat and would be expected to result in overall improvements to and maintenance of habitat values. Noise and visual disturbance from management-related equipment operation could temporarily displace individuals or alter the behavior of the species if adjacent to work areas. Alternative 4A enhancement and management actions designed for western burrowing owl would also be expected to benefit San Joaquin pocket mouse.
- Operations and Maintenance: Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect San Joaquin pocket mouse use of the surrounding habitat. Maintenance activities would include vegetation management, levee and structure repair, and re-grading of roads and permanent work areas. These effects, however, would be reduced by AMMs and environmental commitments as described below.
- Injury and Direct Mortality: Construction could result in direct mortality of San Joaquin pocket mouse if present in construction areas.

The following paragraphs summarize the combined effects discussed above and describe other environmental commitments that offset or avoid these effects. NEPA and CEQA impact conclusions are also included.

The habitat model indicates that the study area supports approximately 78,047 acres of potential habitat for San Joaquin pocket mouse. Alternative 4A as a whole would result in the permanent loss of and temporary effects on 657 acres of grasslands that could be suitable for San Joaquin pocket mouse (1% of the habitat in the study area). These effects would result from the construction of the water conveyance facilities. Alternative 4A includes a commitment to protect 1,060 acres of grassland (Environmental Commitment 3) and restore 1,070 acres of grassland (Environmental Commitment 8). Alternative 4A's commitment to sustain a mosaic of grassland vegetation alliances, reflecting localized water availability, soil chemistry, soil texture, topography, and disturbance regimes would protect a diversity of habitats that San Joaquin pocket mouse could use. All protected habitat would be managed under *Environmental Commitment 11 Natural Communities Enhancement and Management*.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities affected by the project would be 2:1 protection of grassland habitat. Using these typical ratios would indicate that 1,314 acres of grassland natural communities should be protected to mitigate the loss of 657 acres of grassland.

The project also includes commitments to implement *AMM1 Worker Awareness Training, AMM2 Construction Best Management Practices and Monitoring, AMM3 Stormwater Pollution Prevention Plan, AMM4 Erosion and Sediment Control Plan, AMM5 Spill Prevention, Containments and Countermeasure Plan, and AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM10 Restoration of Temporarily Affected Natural Communities*. All of these AMMs include elements that avoid or minimize the risk of affecting habitats and species adjacent to work areas and RTM storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and*

Minimization Measures, of the Draft BDCP and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

***NEPA Effects*:** In the absence of the environmental commitments, the effects on San Joaquin pocket mouse habitat and potential mortality of a special-status species resulting from Alternative 4A would represent an adverse effect. However, project proponents have committed to habitat protection and management associated with Environmental Commitment 3 and Environmental Commitment 11. This habitat protection and management would be guided by Resource Restoration and Performance Principle G3, and by AMM1–AMM6 and AMM10, which would be in place during construction. Considering these commitments, losses of San Joaquin pocket mouse and potential mortality under Alternative 4A would not be an adverse effect.

***CEQA Conclusion*:** Considering Alternative 4A's commitment to the protection and management of grasslands and with the implementation of Resource Restoration and Performance Principle G3 and AMM1–AMM6 and AMM10, the loss of habitat or direct mortality through implementation of Alternative 4A would not result in a substantial adverse effect through habitat modifications and would not substantially reduce the number or restrict the range of San Joaquin pocket mouse. Therefore, the loss of habitat or potential mortality under this alternative would have a less-than-significant impact on San Joaquin pocket mouse under CEQA.

Impact BIO-165: Indirect Effects of Alternative 4A on San Joaquin Pocket Mouse

Construction activities associated with water conveyance facilities, environmental commitments, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on San Joaquin kit pocket mouse and its habitat. These potential effects would be minimized and avoided through AMM1–AMM6, and AMM10, which would be in effect throughout the construction phase.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove pocket mouse habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in injury or mortality of individual pocket mice, if present.

***NEPA Effects*:** Implementation of the AMMs listed above would avoid the potential for substantial adverse effects on San Joaquin pocket mouse, either indirectly or through habitat modifications. These measures would also avoid and minimize effects that could substantially reduce the number of San Joaquin pocket mouse, or restrict the species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on San Joaquin pocket mouse.

***CEQA Conclusion*:** Indirect effects from environmental commitment operations and maintenance as well as construction-related noise and visual disturbances could impact San Joaquin pocket mouse. With implementation of AMM1–AMM6, and AMM10, as part of Alternative 4A construction, operation, and maintenance, Alternative 4A would avoid the potential for adverse effects on either species, either indirectly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of the species. Therefore, the indirect effects under this alternative would have a less-than-significant impact on San Joaquin pocket mouse under CEQA.

Special-Status Bat Species

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. The habitat types used to assess effects for special-status bats roosting habitat includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

There is potential for at least thirteen different bat species to be present in the study area (Figure 12-51), including four California species of special concern and nine species ranked from low to moderate priority by the Western Bat Working Group (see Draft EIR/EIS Appendix 12A, *Special-Status Species with Potential to Occur in the Study Area*, Table 12A-2). In 2009, DHCCP conducted a large-scale effort that involved habitat assessments, bridge surveys, and passive acoustic monitoring surveys for bats (see Appendix 12C, *2009 to 2011 Bay Delta Conservation Plan EIR/EIS Environmental Data Report*, in the Draft EIR/EIS for details on methods and results, and Table 12A-2 in Appendix 12A). The majority of the parcels assessed during field surveys contained bat foraging and roosting features and were considered highly suitable habitat. At the time of the 2009 field surveys, DWR biologists initially identified 145 bridges in their survey area. Eleven of the 145 bridges were not accessible and thirteen were determined to not be suitable for bats. Evidence of bat presence was observed at six of the bridges and bat sign (guano, urine staining, odor, or vocalizations) was observed at 26 of the bridges. Biologists observed Mexican free-tailed bats at four of the bridges and unidentified species at the remaining two bridges. One of these bridges, over the Yolo Causeway, was used by approximately 10,000 Mexican free-tailed bats, indicating a maternity roost. A second roost site of about 50 individuals was observed under a bridge in eastern Solano County.

The remaining 89 bridges contained structural features that were considered conducive to maternity, solitary, day and/or night roosting. Night roosts may have crevices and cracks but more often have box beams or other less protected roosting spots where bats rest temporarily while feeding. Day roosts are commonly found in bridges with expansion joints, crevices, or cracks where bats are protected from predators and weather. Seventeen bridges in the survey area had no potential for roosting because they lacked surface features from which bats could hang and offered no protection from weather or predators.

Alternative 4A would result in both temporary and permanent losses of foraging and roosting habitat for special-status bats as indicated in Table 12-4A-60. Protection and restoration for special-status bat species focuses on habitats and does not include manmade structures such as bridges. Alternative 4A would include the following conservation and Resource Restoration and Performance Principles to benefit special-status bats.

- Protect 13,302 acres and restore 2,246 acres of high-value natural communities. This objective involves protecting and restoring a variety of habitat types described below that would also benefit special-status bats (see Table 4.1-3 in Section 4.1.2, *Description of Alternative 4A*, in the RDEIR/SDEIS).
    - Protect 1,060 acres and restore 1,070 acres of grassland (Environmental Commitments 3 and Environmental Commitment 8).
    - Protect 11,870 acres of cultivated lands (Environmental Commitment 3).

- Restore 34 acres and protect 150 acres of vernal pool/alkali seasonal wetland complex (Environmental Commitment 3 and Environmental Commitment 9).
- Protect 119 acres and restore up to 832 acres of nontidal marsh (Environmental Commitment 3 and Environmental Commitment 10).
- Protect 6 acres of ponds (Resource Restoration and Performance Principle G2).
- Restore 59 acres of tidal natural communities (Environmental Commitment 4).
- Restore 251 acres and protect 103 acres of valley/foothill riparian natural community (Environmental Commitment 3 and Environmental Commitment 7).

As explained below, with the restoration and protection of these amounts of habitat, in addition to mitigation measures to reduce potential effects, impacts on special-status bats would not be adverse for NEPA purposes and would be less than significant for CEQA purposes.

Table 12-4A-60. Changes in Special-Status Bat Roosting and Foraging Habitat Associated with Alternative 4A

Project Component	Habitat Type	Permanent	Temporary
Water Conveyance Facilities	Roosting	194	61
	Foraging	4,744	3,731
Total Impacts Water Conveyance Facilities		**4,938**	**3,792**
Environmental Commitments 4, 6–7, 9–11[a]	Roosting	5	0
	Foraging	0	0
Total Impacts Environmental Commitments 4, 6–7, 9–11[a]		**5**	**0**
TOTAL IMPACTS		**4,943**	**3,792**

[a] See discussion below for a description of applicable environmental commitments.

Impact BIO-166: Loss or Conversion of Habitat for and Direct Mortality of Special-Status Bats

Alternative 4A would result in the permanent and temporary loss combined of up to 260 acres of roosting habitat and 8,475 acres of foraging habitat for special-status bats from water conveyance facilities construction and from tidal restoration (Environmental Commitment 4). Foraging habitat effects for water conveyance facilities and Environmental Commitment 4 were not considered adverse as they reflect a conversion from one foraging habitat type (mostly cultivated lands) to another foraging habitat (wetlands). Habitat enhancement and management activities (Environmental Commitment 11) could result in local adverse effects. In addition, maintenance activities associated with the long-term operation of the water conveyance facilities and other project facilities could affect special-status bat roosting habitat. A summary of combined impacts and NEPA effects and a CEQA conclusion follows the individual activity discussions.

- *Water Facilities and Operation*: Construction of Alternative 4A conveyance facilities would result in the permanent loss of approximately 194 acres of roosting habitat and 4,744 acres of foraging habitat in the study area. Development of the water conveyance facilities would also result in the temporary removal of up to 61 acres of roosting habitat and up to 3,731 acres of foraging habitat for special-status bats in the study area (Table 12-4A-60). DWR identified two bridges with potential night roosting habitat in the forebay embankment area and tunnel muck area that could be permanently affected by construction for water conveyance facilities. Additional roosting habitat affected by construction and operations includes valley/foothill riparian natural community, developed lands and landscaped trees, including eucalyptus, palms and orchards.

- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration site preparation and inundation would result in the loss of approximately 5 acres of roosting habitat. The roosting habitat that would be removed consists of relatively small and isolated patches along canals and irrigation ditches surrounded by cultivated lands in the Union Island and Roberts Island areas, and several small patches along the San Joaquin River. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, requires that tidal natural communities restoration avoid effects on roosting special-status bats.

- *Environmental Commitment 11 Natural Communities Enhancement and Management*: Implementation of Alternative 4A would result in an overall benefit to special-status bats within the study area through protection and restoration of their foraging and roosting habitats. The majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands. Restored foraging habitats primarily would replace agricultural lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats. Noise and visual disturbances during implementation of riparian habitat management actions could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. This effect would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*.

- Operations and maintenance: Ongoing facilities operation and maintenance is expected to have little if any adverse effect on special-status bats. Postconstruction operation and maintenance of the above-ground water conveyance facilities and restoration infrastructure could result in ongoing but periodic disturbances that could affect special-status bat use of the surrounding habitat in the Cache Slough area, and the north and south Delta (CZ 1, CZ 2, CZ 4, CZ 5, CZ 6, CZ 7, and CZ 8). Maintenance activities would include vegetation management, levee and structure repair, and regrading of roads and permanent work areas. These effects, however, would be minimized with implementation of the mitigation measures described below.

- Injury and direct mortality: In addition, to habitat loss and conversion, construction activities, such as grading, the movement of construction vehicles or heavy equipment, and the installation of water conveyance facilities components and new transmission lines, may result in the direct mortality, injury, or harassment of roosting special-status bats. Construction activities related to the environmental commitments could have similar affects. Preconstruction surveys would be conducted and if roosting or maternity sites are detected, seasonal restrictions would be placed while bats are present, as described below in the mitigation measures.

The following paragraphs summarize the combined effects discussed above and describe other Alternative 4A activities that offset or avoid these effects. NEPA effects and CEQA conclusions are also included.

Because the majority of affected acres would convert agricultural land to natural communities with higher potential foraging and roosting value, such as riparian, tidal and nontidal wetlands, and periodically inundated lands this analysis focuses only on losses to roosting habitat resulting from water conveyance facilities and Environmental Commitment 4.

Alternative 4A would permanently or temporarily affect 260 acres of roosting habitat for special-status bats in the near-term as a result of implementing water conveyance facilities (255 acres roosting habitat) and Environmental Commitment 4 (5 acres roosting habitat). Most of the roosting habitat losses would occur in valley/foothill riparian habitat.

Alternative 4A would restore up to 251 acres and protect 103 acres of valley/foothill riparian roosting habitat and 15,194 acres of additional foraging habitat in natural communities and developed lands. Restored foraging habitats would replace primarily cultivated lands. Restored habitats are expected to be of higher function because the production of flying insect prey species is expected to be greater in restored wetlands and uplands on which application of pesticides would be reduced relative to affected agricultural habitats.

Implementation of Alternative 4A would result in an overall benefit to special-status bats within the study area through protection and restoration of approximately 15,548 acres of their foraging and roosting habitats. The target for total protected and restored acreage is based on the sum of all natural community acreage targets. Achieving this is intended to protect and restore natural communities, species-specific habitat elements, and species diversity on a landscape-scale. Achieving this is also intended to conserve representative natural and seminatural landscapes in order to maintain the ecological integrity of large habitat blocks, including desired ecosystem function, and biological diversity.

Should any of the special-status bat species be detected roosting in the study area, construction of water conveyance facilities and restoration activities would have an adverse effect on roosting special-status bats. Noise and visual disturbances and the potential for injury or mortality of individuals associated within implementation of the restoration activities on active roosts would be minimized with implementation of Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*. Environmental commitments would sufficiently offset the adverse effects resulting from late long-term effects from water conveyance facilities and Environmental Commitment 4.

Typical NEPA and CEQA project-level mitigation ratios for those natural communities that would be affected for roosting habitat would be 1:1 for restoration and protection of the valley/foothill riparian natural community. Using these ratios would indicate that 260 acres of riparian habitat should be restored and 260 acres of riparian habitat should be protected.

The project also contains commitments to implement *AMM1 Worker Awareness Training*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM3 Stormwater Pollution Prevention Plan*, *AMM4 Erosion and Sediment Control Plan*, *AMM5 Spill Prevention, Containment, and Countermeasure Plan*, *AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material*, and *AMM10 Restoration of Temporarily Affected Natural Communities.* These AMMs include elements that avoid or minimize the risk of construction activity affecting habitat and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: The losses of roosting habitat for special-status bats associated with implementing Alternative 4A are not expected to result in substantial adverse effects on special-status bats, either directly or through habitat modifications, and would not result in a substantial reduction in numbers or a restriction in the range of special-status bats because the project proponents have committed to protecting the acreage required to meet the typical mitigation ratios described above. The losses of roosting habitat for special-status bats, in the absence of the environmental commitments, would represent an adverse effect as a result of habitat modification and potential direct mortality of a special-status species. However, with habitat protection and restoration associated with the environmental commitments, Resource Restoration and Performance Principle G2, the implementation of AMM1–AMM6, and AMM10, and with implementation of Mitigation Measure BIO-166, the effects of Alternative 4A as a whole on special-status bats would not be adverse.

CEQA Conclusion: The permanent loss of roosting habitat from Alternative 4A would be mitigated through implementation of Mitigation Measure BIO-166, which would ensure there is no significant impact under CEQA on roosting special-status bats, either directly or through habitat modifications and no substantial reduction in numbers or a restriction in the range of special-status bats. The project also contains commitments to implement Resource Restoration and Performance Principle G2 and AMM1–6 and AMM10. These AMMs include elements that avoid or minimize the risk of project activities affecting habitat and species adjacent to work areas and storage sites. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and updated versions of AMM2 and AMM6 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

The following measure was designed to avoid and minimize adverse effects on special-status bats. However, baseline data are not available or are limited on how bats use the study area, and on individual numbers of bats and how they vary seasonally. Therefore, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by DWR and will include these components.

- Identification of potential roosting habitat within project area.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional on-site night surveys as needed following passive acoustic detection of special status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).

- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridges and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of four nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1–2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures would be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence survey of the source habitat feature, from a half hour before sunset to 1–2 hours after sunset for a minimum of two nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge/structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures may be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures will be determined in coordination with CDFW and may include measures listed below.

- Disturbance of the bridge will be avoided between April 15 and September 15 (the maternity period) to avoid impacts on reproductively active females and dependent young.
- Installation of exclusion devices from March 1 through April 14 or September 15 through October 30 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- All tree removal will be conducted between September 15 and October 30, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young. If weather conditions remain conducive to regular bat activity beyond October 30th, later tree removal may be considered in consultation with CDFW.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in consultation with CDFW until September 15 or until a qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided and an appropriate buffer established in consultation with CDFW. Every effort should be made to avoid the roost, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction would be attempted and procedures designed in consultation with CDFW to reduce the likelihood of mortality of evicted bats. In all cases:
    - Eviction will not occur before September 15th and will match the timeframe for tree removal approved by CDFW.
    - Qualified biologists will carry out or oversee the eviction tasks and monitor the tree trimming/removal.
    - Eviction will take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
    - Eviction will take place during weather and temperature conditions conducive to bat activity.
    - Special-status bat roosts would not be disturbed.

  Eviction procedures may include but are not limited to:

- Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.
- Structural changes may be made to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
- Noninjurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.

- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation at a 1:1 ratio for the loss of roosting habitat would be accomplished by the restoration of 251 acres and protection of 103 acres of valley/foothill riparian habitat. Compensation may include the construction and installation of suitable replacement roosting habitat onsite as described below. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, "bat bark," planting cottonwood trees, leaving palm thatch in place rather than trimming). The creation of natural habitat onsite is generally preferable to artificial.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. "Bat bark" has been successfully used by Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012: 765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2012: 39). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Impact BIO-167: Indirect Effects of Alternative 4A on Special-Status Bats

Construction activities associated with water conveyance facilities, restoration activities, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities, could result in ongoing periodic postconstruction disturbances and noise with localized effects on special-status bats and their roosting habitat.

Water conveyance facilities operations and maintenance activities would include vegetation and weed control, ground squirrel control, canal maintenance, infrastructure and road maintenance, levee maintenance, and maintenance and upgrade of electrical systems. While maintenance activities are not expected to remove special-status bat habitat, operation of equipment could disturb small areas of vegetation around maintained structures and could result in disturbances to roosting bats, if present. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, is available to address these adverse effects.

Increased exposure to methylmercury associated with tidal natural communities restoration would potentially indirectly affect special-status bat species. *Environmental Commitment 12 Methylmercury Management* describes the process by which tidal natural communities restoration may increase methyl mercury levels in wetlands in the study area. Mercury has been found in high concentrations in some bat species, such as the Indiana bat. Many bat species forage heavily on aquatic insects, which might result in rapid bioaccumulation (Evers et al. 2012). Measures described in *Environmental Commitment 12 Methylmercury Management* are expected to reduce the effects of methylmercury on special-status bat species resulting from tidal natural communities restoration.

***NEPA Effects*:** Implementation of the Mitigation Measure BIO-166 for special-status bats would avoid the potential for substantial adverse effects on roosting special-status bats, either indirectly or through habitat modifications. This mitigation measure and *Environmental Commitment 12 Methylmercury Management* would also avoid and minimize effects that could substantially reduce the number of special-status bats, or restrict species' range. Therefore, the indirect effects of Alternative 4A would not have an adverse effect on special-status bats.

***CEQA Conclusion*:** Indirect effects from environmental commitments, operations and maintenance as well as construction-related noise and visual disturbances could have a significant impact on special-status bat species, either indirectly or through habitat modifications. Mitigation Measure BIO-166, *Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures*, and *Environmental Commitment 12 Methylmercury Management* would reduce this impact to a less-than-significant level by reducing the likelihood for impacts to occur to roosting bats and would ensure Alternative 4A would not result in a substantial reduction in numbers or a restriction in the range of species.

Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures

See Mitigation Measure BIO-166 under Impact BIO-166.

Impact BIO-168: Periodic Effects of Inundation of Special-Status Bat Habitat as a Result of Implementation of Alternative 4A

There would be no periodic effects of inundation on special-status bats or their habitat.

***NEPA Effects*:** No effects.

***CEQA Conclusion*:** No impacts.

4.3.1.1 Plant Species

Vernal Pool Species

Seventeen special-status plant species occur in vernal pools in the study area (Tables 12-2 and 12-3, summarized in Table 12-4A-61). The vernal pool habitat model used for the impact analysis on vernal pool species was developed for the BDCP and was based on vegetation types and associations from various data sets. The model was used to create maps showing the distribution of vernal pool habitat in the study area according to three habitat types in which these species are known to occur, including vernal pool complex, degraded vernal pool complex, and alkali seasonal wetland habitat. Vernal pool complex habitat consists of vernal pools and uplands that display characteristic vernal pool and swale visual signatures that have not been significantly impacted by agricultural or development practices. Degraded vernal pool complex habitat consists of habitat that ranges from areas with vernal pool and swale visual signatures that display clear evidence of significant disturbance due to plowing, discing, or leveling to areas with clearly artificial basins such as shallow agricultural ditches, depressions in fallow fields, and areas of compacted soils in pastures. Because wetlands in the degraded vernal pool complex are inundated during the wet season and may have historically been located in or near areas with natural vernal pool complex, they may support individuals or small populations of species that are found in vernal pools and swales. However, they do not possess the full complement of ecosystem and community characteristics of natural vernal pools, swales and their associated uplands and they are generally ephemeral features that are eliminated during the course of normal agricultural practices. A small amount of alkali seasonal wetland habitat was included in the model because alkaline vernal pools are also present in some areas mapped as alkali seasonal wetland.

Because each of the vernal pool species addressed in this EIR/EIS have specific microhabitat affinities, and because vernal pool habitat within the study area is highly heterogeneous with respect to habitat parameters such as soil type and pool depth, the vernal pool habitat model greatly overestimates the extent of habitat in the study area occupied by each species. However, the vernal pool habitat model is likely to encompass all or most of the potential area within which special-status vernal pool plant species would occur. Therefore, it is not likely to underestimate the extent of occupied habitat or to underestimate the effects of Alternative 4A.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principle VPS1 would include the following conservation commitment to benefit special-status vernal pool plant species

- Protect at least two currently unprotected occurrences of alkali milk-vetch in the Altamont Hills or Jepson Prairie core recovery areas (Resource Restoration and Performance Principle VPS1).

The construction activities proposed under Alternative 4A could have impacts on special-status vernal pool plant species. Modeled habitat is within the proposed footprint for the Alternative 4A water conveyance facilities. One known occurrence of a special-status plant species is within the proposed footprint for the Alternative 4A water conveyance facilities. Table 12-4A-61 summarizes the acreage of modeled vernal pool habitat in the study area and the number of occurrences of each special-status vernal pool species in the study area.

Table 12-4A-61. Summary of Impacts on Vernal Pool Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Vernal pool complex	9,557	23	—	—	Habitat loss from construction of the water conveyance facilities
Degraded vernal pool complex	2,576	7	—	—	Habitat loss from construction of the water conveyance facilities
Alkali Seasonal Wetland	188	2	—	—	Habitat loss from construction of the water conveyance facilities
Total	12,321	32	—	—	Habitat loss from construction of the water conveyance facilities and tidal wetland restoration
Species					
Alkali milk-vetch	—	—	16	1	Population loss from construction of the water conveyance facilities
Dwarf downingia	—	—	12	0	None
Boggs Lake hedge-hyssop	—	—	1	0	None
Legenere	—	—	8	0	None
Heckard’s peppergrass	—	—	4[a]	0	None
Ferris’ milk-vetch	—	—	6	0	None
Vernal pool smallscale	—	—	2	0	None
Hogwallow starfish	—	—	0	0	None
Ferris’ goldfields	—	—	4	0	None
Contra Costa goldfields	—	—	7	0	None
Cotula-leaf navarretia	—	—	5	0	None
Baker’s navarretia	—	—	3	0	None
Colusa grass	—	—	1	0	None
Bearded popcorn-flower	—	—	4	0	None
Delta woolly marbles	—	—	3	0	None
Saline clover	—	—	9	0	None
Solano grass	—	—	1	0	None

[a] One additional occurrence is in alkali seasonal wetlands.

Impact BIO-169: Effects on Habitat and Populations of Vernal Pool Plants

Under Alternative 4A, construction of the water conveyance facilities would affect habitat for special-status vernal pool species and one occurrence of a special-status vernal pool species.

- *Water Facilities and Operations*: Thirty acres of modeled vernal pool habitat, 19.4 acres of critical habitat for Contra Costa goldfields, and one known occurrence of the 17 vernal pool species are within the proposed footprint for the Alternative 4A water conveyance facilities. One occurrence of alkali milk-vetch in CZ 8 would be crossed by an electric transmission line. Under Alternative 4A, construction and operation of the water conveyance facilities could affect undiscovered occurrences of the seventeen special-status plant species.

- The east-west transmission line would not affect four special-status vernal pool species that occur in the study area. One occurrence each of dwarf downingia, legenere, Heckard's peppergrass, and Boggs Lake hedge-hyssop are within the east-west transmission line study area. However, the transmission line would not cross any of the occurrences.
- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A proposes to benefit special-status vernal pool plants by protecting 67 acres of vernal pool complex. The protected vernal pool habitat would be managed and enhanced to sustain populations of native vernal pool species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration would not affect special-status vernal pool plant species. No known occurrences of special-status vernal pool species would be affected by tidal restoration.
- *Environmental Commitment 6 Channel Margin Enhancement*: No vernal pool habitat or occurrences of special-status vernal pool plant species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status vernal pool species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No vernal pool habitat or occurrences of special-status vernal pool plant species are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status vernal pool species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: If, through unforeseen circumstances, construction of the water conveyance facilities results in the net loss of vernal pool habitat, environmental commitments would be implemented to compensate for that loss. Because vernal pool complex restoration would focus on habitat that had been cleared and leveled but maintained an intact duripan or claypan, the likelihood of affecting any special-status vernal pool plant species would be low. However, vernal pool restoration could adversely affect remnant populations of special-status vernal pool species or affect vernal pool habitat adjacent to the restoration areas.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid vernal pool habitat and would have no impacts on special-status vernal pool plant species.
- *Avoidance and Minimization Measures*: Effects on special-status vernal pool plant species potentially resulting from implementation of Alternative 4A would be avoided or minimized though *AMM11 Covered Plant Species*, *AMM2 Construction Best Management Practices and Monitoring*, *AMM12 Vernal Pool Crustaceans, and AMM30 Transmission Line Design and Alignment Guidelines.* AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools. In addition, AMM11 specifies that individual projects be designed to avoid critical habitat for listed plant and wildlife vernal pool species. AMM12 limits the direct removal of vernal pool crustacean habitat to no more than 10 wetted acres and the indirect effect to no more than 20 wetted acres. AMM12 also requires that that tidal natural communities restoration or other ground-disturbing covered activities in Conservation Zones 1 and 11 will not result in the adverse modification of primary constituent elements of critical

habitat for vernal pool fairy shrimp, conservancy fairy shrimp, and vernal pool tadpole shrimp. These protections would also apply to critical habitat for Contra Costa goldfields, where it overlaps with critical habitat for these vernal pool crustaceans. AMM30 specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM11 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

In addition, Environmental Commitment 3 includes Resource Restoration and Performance Principle VPS1 to protect two occurrences of alkali milk-vetch.

In summary, no adverse effects on special-status vernal pool plants would be expected from implementing Alternative 4A. Construction of the water conveyance facilities could affect one species, alkali milk-vetch, although adverse effects on this species would be avoided or minimized though implementation of AMM11 and AMM30. No other known occurrences of special-status vernal pool species would be affected under Alternative 4A. Beneficial effects on special-status vernal pool plants could occur by protecting 67 acres of vernal pool complex and by protecting occurrences of alkali milk-vetch.

The GIS analysis estimated that up to 32 acres of vernal pool habitat could be adversely affected by construction activities. However, the actual effect on habitat for special-status vernal pool plant species is expected to be much less than the estimated impact because Alternative 4A limits the total loss of wetted vernal pool habitat resulting from specific projects to 10 acres (approximately 67 acres of vernal pool complex) (AMM12). At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat for special-status vernal pool plants. This would be consistent with typical NEPA and CEQA project-level mitigation ratios for vernal pool impacts.

***NEPA Effects*:** The loss of modeled habitat for vernal pool plant species would be minimized by AMM12 and offset through the environmental commitments, and effects of constructing the water conveyance facilities on one occurrence of alkali milk-vetch would be avoided through AMM30. Therefore, Alternative 4A would not result in adverse effects on federally-listed vernal pool plant species.

***CEQA Conclusion*:** Because loss of modeled habitat for vernal pool plant species would be offset through restoration, and because impacts on occurrences of special-status vernal pool plant species would be avoided, implementation of Alternative 4A would not result in a reduction in the range or numbers of 17 special-status vernal pool plant species in the study area. Therefore, impacts on special-status vernal pool plant species would be less than significant. No mitigation is required.

Alkali Seasonal Wetland Species

Eight special-status plant species occur in alkali seasonal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-62). Alkali seasonal wetland habitat was modeled separately for four plant species occurring in seasonal alkali wetlands. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the four alkali seasonal wetland species not proposed for coverage under the BDCP.

The San Joaquin spearscale habitat model approximated the distribution of suitable San Joaquin spearscale habitat in the study area according to the species' preferred habitat types, intersected with soil series and slope position. Historical and current records of San Joaquin spearscale in the study area indicate that its current distribution is limited to alkaline soil areas with shallow basin or swale microtopography along the western border of the study area. The vegetation cover of the alkaline soils is typically a combination of alkaline soil-adapted species and annual grasses, including annual ryegrass and Mediterranean barley. Habitat types used for the model included alkali seasonal wetlands, vernal pool complex, and grasslands. Soil series used in the model consisted of either clays or clay loams with alkaline horizons. San Joaquin spearscale typically occurs in swales or in level terrain but occasionally occurs on the lower slopes adjacent to streams or swales or where seeps are present. Because some of the soil series with which San Joaquin spearscale is associated can occur on hillsides, slope was used to limit the extent of the model to the toe of the slope where these soils occur by excluding areas with slope greater than 1%. Land uses that are incompatible with the species' habitat requirements, such as modeled habitat polygons falling on leveled or developed lands, were removed from the model.

Modeled habitat for brittlescale was mapped as hydrologic features such as stream corridors and playa pools located on alluvium associated with the Montezuma Block along the western boundary of the study area or on alluvium associated with tertiary formations located along the southwest boundary of the study area. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15.2 meters) on either side of their centerlines to capture the estimated maximum extent of alluvium deposits in proximity to the streams. Mapped habitat that was occupied by urban or intensive agricultural uses was removed from the model.

The habitat model for heartscale was based on the species distribution in the study area (Solano and Yolo Counties) and on the soil types and plant communities within which it occurs. Potential habitat was determined by intersecting the GIS coverage for three parameters: 1) Yolo and Solano County boundaries; 2) Solano, Pescadero, and Willows soils; and 3) grassland, alkali seasonal wetland, and vernal pool complex natural communities. The model excluded areas that have been developed or cultivated, i.e., where the topography, soils, and hydrology have been substantially altered.

Delta button-celery habitat was modeled as alkali seasonal wetland complex, vernal pool complex, other natural seasonal wetland, and grassland occurring on Brentwood, Grangerville, Marcuse, Solano, and Vernalis soil map units within the San Joaquin Basin (i.e., south of the mainstem San Joaquin River). For this species, land cover north of the Discovery Bay area where intensive agriculture was classified as annual grassland were manually deleted from the area of predicted habitat. Additionally, other areas of potential habitat that have been developed were also manually deleted.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principle ASWS1 would include environmental commitments to benefit special-status alkali seasonal wetland species.

- Protect two currently unprotected occurrences of San Joaquin spearscale in Conservation Zones 1, 8, or 11 (Resource Restoration and Performance Principle ASWS1).

Modeled habitat for Delta button-celery would be adversely affected by construction of the Alternative 4A water conveyance facilities. One population of crownscale also would be adversely affected by construction of the water conveyance facilities. No adverse effects on palmate-bracted bird's-beak or recurved larkspur would be expected. Table 12-4A-62 summarizes the acreage of modeled alkali seasonal wetland habitat in the study area and the number of occurrences of each special-status alkali seasonal wetland plant species in the study area.

Table 12-4A-62. Summary of Impacts on Seasonal Alkali Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
San Joaquin spearscale modeled habitat	14,933	78	—	—	Habitat loss from construction of water conveyance facilities
Brittlescale modeled habitat	451	0	—	—	
Heartscale modeled habitat	6,528	0	—	—	
Delta button-celery modeled habitat	3,361[a]	108	—	—	Habitat loss from construction of water conveyance facilities
Alkali seasonal wetlands	3,723	2	—	—	Habitat loss from construction of water conveyance facilities
Species					
San Joaquin spearscale	—	—	19	1	Population loss from construction of water conveyance facilities
Brittlescale	—	—	8	0	None
Heartscale	—	—	3	0	None
Delta button-celery	—	—	1[b]	0	None
Heckard's peppergrass	—	—	1[c]	0	
Crownscale	—	—	17	1	Population loss from construction of water conveyance facilities
Palmate-bracted bird's-beak	—	—	1	0	None
Recurved larkspur	—	—	4	0	None

[a] A portion of this acreage consists of riparian habitat.
[b] A second occurrence in study area is in riparian habitat.
[c] Four additional occurrences of Heckard's peppergrass are associated with vernal pools.

Impact BIO-170: Effects on Habitat and Populations of Alkali Seasonal Wetland Plants

Alternative 4A would have adverse effects on modeled habitat for San Joaquin spearscale and Delta button-celery. It would also have adverse effects on occurrences of San Joaquin spearscale and crownscale. Under Alternative 4A, construction of the Byron Tract Forebay would permanently remove 78 acres of modeled habitat for San Joaquin spearscale and 108 acres of modeled habitat for Delta button-celery. This could be an adverse effect, depending on whether or not the affected modeled habitat is actually occupied by the species. Modeled habitat is assumed to encompass all potential habitat for a species and may therefore overestimate the area actually occupied. One known occurrence of San Joaquin spearscale near the forebay would be affected by facilities construction. Delta button-celery is not known to occur in CZ 8; the nearest known occurrence, in CZ 9, would not be affected. Construction of the water conveyance facilities would permanently remove about 1.5 acre of habitat occupied by crownscale at the Byron Tract Forebay. All or most of the occurrence would be directly affected. Construction of the water conveyance facilities would not affect brittlescale, heartscale, Heckard's peppergrass, palmate-bracted bird's-beak, or recurved larkspur.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would benefit alkali seasonal wetland plants by including alkali seasonal wetland in vernal pool complex habitat that would be protected and restored. The protected alkali seasonal wetland habitat would be managed and enhanced to sustain populations of native plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: No tidal habitat restoration would be implemented in habitat for special-status plant species. Therefore, tidal habitat restoration would not affect special-status alkali seasonal wetland species.
- *Environmental Commitment 6 Channel Margin Enhancement*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status alkali seasonal wetland species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No alkali seasonal wetland habitat or occurrences of special-status alkali seasonal wetland plant species are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status alkali seasonal wetland species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Although some vernal pools are alkaline, alkali seasonal wetlands in the study area consist of alkali grassland, alkali meadow, or iodine bush scrub. Therefore, vernal pool restoration would avoid alkali seasonal wetland habitat and would have no impacts on special-status alkali seasonal wetland plants. In addition, the environmental commitments would compensate for the loss of alkali seasonal wetlands resulting from other environmental commitments by restoring vernal pool complex that includes alkali seasonal wetlands to achieve no net loss of this habitat.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid alkali seasonal wetland habitat and would have no impacts on special-status alkali seasonal wetland plant species.

Avoidance and Minimization Measures: Effects on special-status alkali seasonal wetland plants potentially resulting from implementation of the water conveyance facilities would be avoided or minimized through *AMM2 Construction Best Management Practices and Monitoring, AMM11 Covered Plant Species,* and *AMM30 Transmission Line Design and Alignment Guidelines*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though AMM2. In addition, AMM11 prohibits ground disturbance or hydrologic disturbance within 250 feet of existing vernal pools, which would protect those species with modeled habitat that includes vernal pool complex. Occurrences of special-status species in vernal pools near tidal wetlands would not be affected by tidal habitat restoration where critical habitat for vernal pool species is present and would be avoided under AMM11. AMM30 requires that transmission line construction avoid any losses of alkali seasonal wetland complex natural community. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization*

Measures, of the Draft BDCP, and updated versions of AMM2 and AMM11 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

In summary, only one known occurrence of a special-status alkali seasonal wetland species (crownscale) would be affected under Alternative 4A. AMM11 would be implemented to avoid an adverse effect on the San Joaquin spearscale occurrence.

The primary effect of Alternative 4A on special-status alkali seasonal wetland plant species would be the loss of potential (i.e., modeled) habitat for San Joaquin spearscale and Delta button-celery. Approximately 2 acres of this habitat loss would be alkali seasonal wetlands. The actual effect on modeled habitat for alkali seasonal wetland species is expected to be somewhat less than the estimated impact because some of this habitat is composed of vernal pool complex, and the total loss of wetted vernal pool habitat is limited to 10 acres (approximately 67 acres of vernal pool complex) (AMM12). Loss of modeled habitat would be compensated for by restoring or creating vernal pool complex, alkali seasonal wetlands, and grasslands, in proportion to the amount of each habitat removed. At the proposed restoration ratios of 1:1 (prior to impact) and 1.5:1 (concurrent with impact), between 67 and 100.5 acres of vernal pool complex restoration would be required to compensate for the loss of modeled habitat composed of vernal pool complex. Loss of modeled habitat composed of grasslands would be compensated for by restoring grassland habitat on a 1:1 basis. These compensation levels would be consistent with typical NEPA and CEQA project-level mitigation ratios for impacts on vernal pools, alkali seasonal wetlands, and grasslands.

Alternative 4A would have a small beneficial effect on special-status alkali seasonal wetland plants by protecting a small amount of alkali seasonal wetland habitat. The environmental commitments also include protecting 2 occurrences of San Joaquin spearscale.

NEPA Effects: Under Alternative 4A, loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration of grassland, vernal pool, and alkali seasonal wetland habitat (Environmental Commitment 8, Environmental Commitment 9), and impacts on one occurrence of San Joaquin spearscale would be avoided through AMM11. With avoidance and habitat restoration, these effects would not be adverse. The loss of one occurrence of crownscale, a non-listed species, would result in a reduction in the range and numbers of this species and would be an adverse effect. Adverse effects on crownscale could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Because loss of modeled habitat for alkali seasonal wetland plant species would be offset through restoration, and because impacts on occurrences of special-status alkali seasonal wetland species would be avoided, impacts on alkali seasonal wetlands as a result of implementing Alternative 4A would not result in substantially reducing the number or restricting the range of seven special-status alkali seasonal wetland plant species. However, environmental commitments that benefit or protect listed species do not apply to nonlisted species, and loss of the crownscale population at Byron Tract Forebay would be a significant impact. Implementation of Mitigation Measure BIO-170 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species

DWR will evaluate all projects for their impacts on special-status plant species, avoid or minimize impacts on species that occur on project sites, and compensate for impacts on species. All impacts on federally listed species, diamond-petaled California poppy, or caper-fruited tropidocarpum shall be avoided. Impacts on other special-status plant species shall be avoided to the extent feasible, and any unavoidable impacts shall be compensated for.

- DWR shall conduct surveys for special-status plant species within and adjacent to all project sites. Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual restoration projects to avoid adverse modification of habitat for specified plant species. The purpose of these surveys will be to verify that the locations of special-status species identified in previous record searches or surveys are extant, identify any new special-status plant species occurrences, and cover any portions of the project area not previously surveyed. The extent of mitigation of direct loss of or indirect effects on special-status plant species will be based on these survey results.
- All surveys shall be conducted by qualified biologists using the using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (U.S. Fish and Wildlife Service 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009) during the season that special-status plant species would be evident and identifiable, i.e., during their blooming season. Locations of special-status plant species in proposed construction areas will be recorded using a GPS unit and flagged.
- The construction monitoring plan for the protection of special-status fish, wildlife, and plant species, prepared by DWR before implementing an approved project, will provide for construction activity monitoring in areas identified during the planning stages and species/habitat surveys as having special-status plant species.
- Where surveys determine that a special-status plant species is present in or adjacent to a project site, direct and indirect impacts of the project on the species shall be avoided through the establishment of 250-foot activity exclusion zones surrounding the periphery of the occurrences, within which no ground-disturbing activities shall take place, including construction of new facilities, construction staging, or other temporary work areas. Activity exclusion zones for special-status plant species shall be according to a 250-foot buffer surrounding the periphery of each special-status plant species occurrence, the boundaries of which shall be clearly marked with standard orange plastic construction exclusion fencing or its equivalent. The establishment of activity exclusion zones shall not be required if no construction-related disturbances will occur within 250 feet of the occupied habitat site. The size of activity exclusion zones may be reduced through consultation with a qualified biologist and with concurrence from USFWS or CDFW based on project site-specific conditions.
- Where avoidance of impacts on a special-status plant species is infeasible, DWR will compensate for loss of individuals or occupied habitat of a special-status plant species through the acquisition, protection, and subsequent management in perpetuity of other existing occurrences at a 2:1 ratio (occurrences affected:occurrences preserved). DWR will provide detailed information to USFWS and CDFW on the location of the preserved occurrences, quality of the preserved habitat, feasibility of protecting and managing the areas in-perpetuity, responsible parties, and other pertinent information. If suitable occurrences of a special-status plant species are not available for preservation, then the project shall be redesigned to remove features that would result in impacts on that species.

Grassland Species

Twelve special-status plant species occur in grasslands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-63). The only modeled plant species occurring in grassland is Carquinez goldenbush. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the six grassland species not proposed for coverage under the BDCP.

Carquinez goldenbush modeled habitat included hydrological features such as stream corridors on alluvium derived from the Montezuma Formation. Stream corridors (intermittent and perennial) that intersected these geologic units were selected and truncated at the point at which they encountered the upper elevation of intertidal marsh. The corridors were buffered 50 feet (15 meters) on either side in an effort to capture the estimated maximum extent of alluvium deposits in close proximity to the actual rivers/streams.

Of 78,047 acres of grasslands in the study area, Alternative 4A would adversely affect 657 acres under Alternative 4A. No known occurrences of special-status grassland plant species would be affected. Table 12-4A-63 summarizes the acreage of grassland habitat in the study area and the number of occurrences of each special-status grassland species in the study area.

Table 12-4A-63. Summary of Impacts on Grassland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Carquinez goldenbush modeled habitat	1,346	0	—	—	
Grassland	78,047	657	—	—	Habitat loss from construction of water conveyance facilities
Species					
Carquinez goldenbush	—	—	10	0	None
Big tarplant	—	—	5	0	None
Round-leaved filaree	—	—	2	0	None
Pappose tarplant	—	—	7	0	None
Parry's rough tarplant	—	—	5	0	None
Small-flowered morning-glory	—	—	0	0	None
Diamond-petaled poppy	—	—	1	0	None
Stinkbells	—	—	1	0	None
Fragrant fritillary	—	—	4	0	None
Gairdner's yampah	—	—	0	0	None
Streamside daisy[a]	—	—	1	0	None
Caper-fruited tropidocarpum	—	—	8	0	None

[a] This species actually occurs in upland woodland, a habitat that has not been mapped or quantified for analysis of Alternative 4A.

Impact BIO-171: Effects on Habitat and Populations of Grassland Plants

Alternative 4A would have no expected effects on known occurrences of special-status plant species that occur in grasslands. However, the loss of 657 acres of grassland would have the potential to affect undocumented populations of special-status grassland species.

No modeled habitat for Carquinez goldenbush and no known occurrences of the 12 special-status grassland plant species are within the proposed footprint for the Alternative 4A water conveyance facilities. About 657 acres of grassland habitat would be affected by construction of the water conveyance facilities. However, this grassland habitat consists of small patches of herbaceous ruderal vegetation along levees that do not provide habitat for special-status grassland species. Therefore, under Alternative 4A, construction and operation of the water conveyance facilities would not affect the 12 special-status grassland species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would preserve 1,060 acres of grassland habitat. Protection of grassland habitat may also protect undiscovered occurrences of special-status plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration would not affect modeled habitat for Carquinez goldenbush. No other occurrences of special-status grassland plants are within portions of the study area potentially suitable for tidal restoration. Therefore, tidal restoration would have no impacts on known occurrences of special-status grassland plants.
- *Environmental Commitment 6 Channel Margin Enhancement*: No known occurrences of special-status grassland plants are present within areas proposed for channel margin habitat enhancement. Areas mapped as grassland along levees that would be affected by channel margin habitat enhancement are small patches of ruderal vegetation along levees that do not provide habitat for special-status grassland species and are not modeled habitat for Carquinez goldenbush. Therefore, channel margin habitat enhancement would have no impacts on special-status grassland plants.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No modeled habitat for Carquinez goldenbush or known occurrences of special-status grassland plants are present within areas proposed for riparian habitat enhancement. Therefore, riparian habitat enhancement would have no impacts on special-status grassland plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: Vernal pool complex includes vernal pools as well as the surrounding grassland matrix. Because the habitat to be restored would consist of areas of former vernal pool complex that have been leveled for cultivation, special-status grassland plant species would not be present. Therefore, vernal pool complex restoration would not affect special-status grassland plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid grassland habitat and would have no impacts on special-status grassland plant species.
- *Avoidance and Minimization Measures*: Potential effects on undiscovered populations of special-status grassland plants would be avoided or minimized though *AMM11 Covered Plant Species,* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or

subsequently minimized through AMM2. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM11 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

NEPA Effects: Implementation of Alternative 4A would result in no adverse effects on federally-listed grassland plant species.

CEQA Conclusion: Alternative 4A would have no impacts on special-status grassland species. No mitigation is required.

Valley/Foothill Riparian Species

Four special-status plant species occur in valley/foothill riparian habitat in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-64). Habitat modeling was done for two species, Delta button celery and slough thistle. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the two valley/foothill species not proposed for coverage under the BDCP.

The valley/foothill riparian habitat model for Delta button-celery and slough thistle was mapped as all of the study area along the flood plain of the San Joaquin River between the levees from the Mossdale Bridge to Vernalis. Whether or not this modeled habitat is actually occupied by Delta button-celery and slough thistle is unknown; all known occurrences of these species within the area of modeled habitat are believed to be extirpated.

Of 17,966 acres of valley/foothill riparian habitat in the study area, Alternative 4A would affect73 acres, none of which is modeled habitat for Delta button-celery and slough thistle. Table 12-4A-64 summarizes the acreage of modeled habitat for Delta button-celery and slough thistle and the number of occurrences of each special-status riparian species in the study area.

Table 12-4A-64. Summary of Impacts on Valley/Foothill Riparian Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta button-celery modeled habitat	3,361[a]	0	—	—	None
Slough thistle modeled habitat	1,834	0	—	—	None
Valley/foothill riparian habitat	17,966	73	—	—	Habitat loss from construction of water conveyance facilities
Species					
Delta button-celery	—	—	1[b]	0	None
Slough thistle	—	—	2	0	None
Northern California black walnut	—	—	1	0	None
Wright's trichocoronis	—	—	1	0	None

[a] A portion of this acreage consists of alkali seasonal wetland
[b] A second occurrence is in alkali seasonal wetland

Impact BIO-172: Effects on Habitat and Populations of Valley/Foothill Riparian Plants

No extant occurrences of Delta button-celery, slough thistle, Northern California black walnut, or Wright's trichocoronis are present in the study area. Therefore, no impacts on special-status valley/foothill riparian plant species are expected. Modeled habitat for Delta button-celery and slough thistle, which may support undocumented occurrences of these species, would not be affected by construction of the water conveyance facilities.

Construction of the water conveyance facilities would remove 73 acres of valley-foothill riparian habitat under Alternative 4A. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian species are within the proposed footprint for the Alternative 4A water conveyance facilities. Therefore, under Alternative 4A, construction and operation of the water conveyance facilities would not affect special-status valley/foothill riparian species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A would protect 103 acres of existing valley/foothill riparian forest in CZ 7. This action would have no substantial effects on special-status valley/foothill plants because no extant occurrences of special-status valley/foothill plants are present in the study area.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration would inundate 5 acres of valley/foothill riparian habitat. However, no modeled habitat and no known occurrences of the four special-status valley/foothill riparian plants are within the portions of the study area potentially suitable for tidal restoration. Therefore, tidal restoration would not affect the special-status valley/foothill riparian plants.
- *Environmental Commitment 6 Channel Margin Habitat Enhancement*: No modeled habitat or occurrences of special-status valley/foothill riparian plants are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on special-status valley/foothill riparian plant species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No extant occurrences of special-status valley/foothill riparian plant species are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on special-status valley/foothill riparian plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No occurrences of special-status valley/foothill riparian plant species are present within areas proposed for vernal pool and alkali seasonal wetland complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status valley/foothill riparian species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid valley/foothill riparian habitat and would have no impacts on special-status valley/foothill riparian plant species.
- *Avoidance and Minimization Measures*: Effects on Delta button-celery and slough thistle potentially resulting from implementation of Environmental Commitment 5 would be avoided or minimized though *AMM11 Covered Plant Species* and *AMM2 Construction Best Management Practices and Monitoring*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though

AMM2. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM11 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

Because no extant occurrences of special-status valley/foothill riparian plants are known to occur in the study area, Alternative 4A is not expected to adversely affect any special-status valley/foothill riparian plants. Modeled habitat for both Delta button-celery and slough thistle would be affected. Under AMM11, surveys for special-status plants would be performed during the planning phase for floodplain restoration. If Delta button-celery or slough thistle were found to be present in the floodplain restoration area, then the project would be designed to avoid impacts on the populations. Therefore, Alternative 4A would not have an adverse effect on these species.

NEPA Effects: Implementation of Alternative 4A would not have an adverse effect on federally-listed valley/foothill riparian plant species.

CEQA Conclusion: Alternative 4A would have no impact on special-status valley/foothill riparian plant species. No mitigation is required.

Tidal Wetland Species

Eight special-status plant species occur in tidal wetlands in the study area (Tables 12-2, 12-3, summarized in Table 12-4A-65). Five tidal wetland habitat models were developed for special-status plant species occurring in tidal wetland habitat. Because this analysis relies on the data developed for the BDCP, models were only available for species covered under the BDCP. Habitat models were not developed for the Bolander's water hemlock, which was not proposed for coverage under the BDCP.

Modeled habitat for Mason's lilaeopsis and Delta mudwort was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover type, which was obtained from the BDCP GIS vegetation data layer.

The side-flowering skullcap model mapped the distribution of suitable habitat in the study area according to the species' habitat association with woody riparian habitat. The model selected Delta riparian vegetation types providing the habitat characteristics that side-flowering skullcap seems to require, namely, woody substrate in freshwater tidal areas. The model included vegetation subunits of the BDCP Valley Riparian natural community characterized by California dogwood, white alder, and arroyo willow.

The modeled habitat for soft bird's-beak consisted of pickleweed- and saltgrass-dominated vegetation units located west of the Antioch Bridge. Modeled habitat for these two plant species was mapped as areas within 10 feet (3 meters) on either side of the landward boundary of tidal perennial aquatic land cover types. The model used all Tidal Brackish Emergent Wetland polygons that were limited by specific vegetation units that are known to be closely associated with soft bird's-beak habitat.

Habitat for Delta tule pea and Suisun Marsh aster was modeled separately based on the salinity of the water. For the tidal freshwater emergent wetland BDCP land cover type, modeled habitat was mapped as the area within 10 feet (3 meters) of the landward side of the landward boundary, exclusively where this land cover type is adjacent to grassland, vernal pool complex, valley/foothill riparian, or cultivated land habitats cover types. For brackish water areas in and near Suisun Marsh, the model used all tidal brackish emergent wetland polygons within an elevation range of 7 to 10 feet (2 to 3 meters) to capture elevations 1 foot (30 centimeters) below intertidal to 2 feet (60 centimeters) above intertidal.

The modeled habitat for Suisun thistle in and near Suisun Marsh consists of all tidal brackish emergent wetland polygons with the appropriate vegetation. This included vegetation units dominated by saltscale, saltgrass, pickleweed, and broad-leaved peppergrass.

Full implementation of Alternative 4A and compliance with Resource Restoration and Performance Principles TWS1 and TWS2 would include the following environmental commitments to minimize impacts on tidal wetland species.

- No net loss of Mason's lilaeopsis and delta mudwort occurrences within restoration sites (Resource Restoration and Performance Principle TWS1).
- No net loss of Delta tule pea and Suisun Marsh aster occurrences within restoration sites (Resource Restoration and Performance Principle TWS2).

Of 17,357 acres of tidal wetlands in the study area, Alternative 4A would affect 18 acres, including areas that are modeled habitat for Mason's lilaeopsis, Delta mudwort, side-flowering skullcap, Delta tule pea, and Suisun Marsh aster. Known occurrences Mason's lilaeopsis, side-flowering skullcap, and Suisun Marsh aster would be affected. Table 12-4A-65 summarizes the acreage of modeled habitat for special-status tidal wetland species and the number of occurrences of each special-status tidal wetland plant species in the study area.

Table 12-4A-65. Summary of Impacts on Tidal Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Delta mudwort/ Mason's lilaeopsis modeled habitat	6,081	39	—	—	Habitat loss from construction of water conveyance facilities
Side-flowering skullcap modeled habitat	2,497	9	—	—	Habitat loss from construction of water conveyance facilities
Soft bird's-beak modeled habitat	1,228	0	—	—	None
Delta tule pea/Suisun Marsh aster modeled habitat	5,853	3	—	—	Habitat loss from construction of water conveyance facilities
Suisun thistle modeled habitat	1,281	0	—	—	None
Tidal brackish emergent wetland	8,501	0	—	—	None
Tidal freshwater emergent wetland	8,856	18	—	—	Habitat loss from construction of water conveyance facilities, tidal habitat restoration, Yolo Bypass fisheries enhancements, and floodplain restoration
Species					
Delta mudwort	—	—	58	0	None
Delta tule pea	—	—	106	0	
Mason's lilaeopsis	—	—	181	8	Occurrences affected by construction of water conveyance facilities
Side-flowering skullcap	—	—	12	1	Occurrence affected by construction of water conveyance facilities
Soft bird's-beak	—	—	13	0	None
Suisun Marsh aster	—	—	164	3	Occurrences affected by construction of water conveyance facilities
Suisun thistle	—	—	4	0	None
Bolander's water hemlock	—	—	8	0	None

Impact BIO-173: Effects on Habitat and Populations of Tidal Wetland Plants

Alternative 4A would have adverse effects on tidal marsh special-status plant species.

The individual effects of each relevant environmental commitment are addressed below. A summary statement of the combined impacts and NEPA and CEQA conclusions follows the individual activity discussions.

Water Facilities and Operations: Construction of the Alternative 4A water conveyance facilities would remove 39 acres of modeled habitat for delta mudwort and Mason's lilaeopsis, 9 acres of modeled habitat for side-flowering skullcap, and 3 acres of modeled habitat for Delta tule pea and Suisun Marsh aster. The extent to which modeled habitat is actually occupied by these species is not known; however, eight occurrences of Mason's lilaeopsis, three occurrences of Suisun Marsh aster, and one occurrence of side-flowering skullcap in the study area could be affected by construction impacts. No known occurrences of the other special-status tidal wetland species would be affected by construction of the water conveyance facilities.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: Alternative 4A does not specifically propose to protect any habitat or occurrences of tidal wetland plants nor does it propose active restoration of affected habitat or occurrences.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: Tidal habitat restoration would not affect modeled habitat for Mason's lilaeopsis and Delta mudwort or any occurrences of tidal wetland special-status plant species.
- *Environmental Commitment 6 Channel Margin Enhancement*: Effects of channel margin enhancement were not analyzed. Channel margin enhancement could have adverse effects on tidal wetland plants through direct removal and habitat modification. However, it would compensate for effects on these species by improving the habitat functions of the channel margins as a result of riprap removal and creation of floodplain benches. Side-flowering skullcap would benefit from installation of large woody material, which it appears to colonize.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian habitat restoration is not expected to adversely affect special-status tidal wetland plants. Preparatory work that involves habitat disturbance would occur during implementation of Environmental Commitment 4 and Environmental Commitment 5. Riparian plantings carried out for Environmental Commitment 7 would be placed in floodplain areas, not in tidal wetlands.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plants are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status tidal wetland plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No tidal wetlands or occurrences of special-status tidal wetland plant species are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status tidal wetland plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid tidal wetland habitat and would have no impacts on special-status tidal wetland plant species.

Avoidance and Minimization Measures: Effects on special-status tidal wetland plant species potentially resulting from construction of the water conveyance facilities would be avoided or minimized though *AMM11 Covered Plant Species, AMM2 Construction Best Management Practices and Monitoring,* and *AMM30 Transmission Line Design and Alignment Guidelines*. Under AMM11, surveys for special-status plant species would be performed during the planning phase of projects, and any impacts on populations of special-status species would be avoided through project design or subsequently minimized though AMM2. AMM30, which specifies that the alignment of proposed transmission lines will be designed to avoid sensitive terrestrial and aquatic habitats when siting poles and towers, to the maximum extent feasible, would avoid some impacts on Mason's lilaeopsis and side-flowering skullcap. The AMMs are described in detail in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP, and updated versions of AMM2 and AMM11 are described in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS.

In summary, the GIS analysis indicates that Alternative 4A would result in the loss of modeled habitat for five special-status species and result in adverse effects on known occurrences of three of the special-status species occurring in tidal wetlands.

Delta mudwort could lose 39 acres of modeled habitat, but no known occurrences would be affected. Channel margin enhancement (Environmental Commitment 6) and riparian natural community restoration (Environmental Commitment 7) will consider the potential for creating habitat for Delta mudwort; creation of suitable habitat under these measures could also help offset this habitat loss. Although active restoration of this species is not proposed, natural expansion of populations into the restored habitat may take place

Mason's lilaeopsis could lose 39 acres of modeled habitat), including all or part of eight occurrences. Tidal habitat restoration activities (Environmental Commitment 4) would increase the extent of habitat available for colonization by Mason's lilaeopsis, which could offset this habitat loss. Although active restoration of this species is not proposed, the natural expansion of populations into the restored habitat may take place. The environmental commitments include post-implementation monitoring of affected occurrences and occurrences in reserve lands to confirm that no net loss of occurrences has been achieved.

Both of these species (Delta mudwort, Mason's lilaeopsisr) are widespread in the study area with many occurrences. Habitat modification and loss are the primary stressors that are responsible for their decline and that currently limit their distribution and abundance. Therefore, restoring habitat and improving habitat functions for these species would provide a reasonable expectation that the distribution and abundance of these species would also improve. Because a relatively small amount of modeled habitat would be adversely affected, it is likely that the initial adverse effects of construction activities on these species would be offset and that the overall effect of Alternative 4A on these species would not be adverse.

Side-flowering skullcap could lose one occurrence. Under AMM11, this occurrence would be surveyed for, and because this is a tidal freshwater wetland species, avoidance of the habitat during project construction would be highly likely. No active restoration of this species is proposed, and no post-implementation monitoring of affected occurrences and occurrences in reserve lands would be done. Because impacts on occurrences of side-flowering skullcap would be avoided, the overall effect of Alternative 4A on this species would not be adverse.

***NEPA Effects*:** The loss of modeled and occupied habitat for special-status tidal wetland plants would be offset through tidal habitat restoration (Environmental Commitment 4). Therefore, implementation of Alternative 4A would result in no adverse effects on eight special-status tidal wetland plant species in the study area.

CEQA Conclusion**:** Because loss of occurrences and modeled habitat for special-status tidal habitat plant species would be offset through habitat restoration, impacts on special-status tidal wetland plants as a result of implementing Alternative 4A would not be significant.

Inland Dune Species

Five special-status plant species occur in inland dune habitat in the study area. No habitat models were prepared for inland dune habitat. Table 12-4A-66 summarizes the acreage of inland dune habitat in the study area and the number of occurrences for each special-status inland dune species in the study area.

Table 12-4A-66. Summary of Impacts on Inland Dune Plants under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Inland Dunes	19	0	—	—	None
Species					
Hoover's cryptantha	—	—	1	0	None
Antioch Dunes buckwheat	—	—	1	0	None
Mt. Diablo buckwheat	—	—	1	0	None
Contra Costa wallflower	—	—	3	0	None
Antioch Dunes evening-primrose	—	—	9	0	None

Impact BIO-174: Effects on Habitat and Populations of Inland Dune Plants

Alternative 4A would have no adverse effects on inland dune species (Table 12-4A-66). No construction activities would take place where the species occur. No specific actions to benefit inland dune species are proposed.

NEPA Effects**:** Implementation of Alternative 4A would not affect special-status inland dune species.

CEQA Conclusion**:** Implementation of Alternative 4A would have no impacts on inland dune species. No mitigation is required.

Nontidal Wetland Species

Six special-status plant species occur in nontidal wetlands in the study area. Table 12-4A-67 summarizes the acreage of nontidal wetland habitat in the study area and the number of occurrences of each special-status nontidal wetland species in the study area.

Table 12-4A-67. Summary of Impacts on Nontidal Wetland Plant Species under Alternative 4A

	Acres in Study Area	Acres Affected	Occurrences in Study Area	Occurrences Affected	Impacts
Habitat					
Nontidal freshwater aquatic	5,567	69	—	—	Loss of habitat from construction of water conveyance facilities
Nontidal freshwater perennial emergent wetland	1,509	8	—	—	Loss of habitat from construction of water conveyance facilities
Species					
Watershield	—	—	3	1	Loss of habitat from construction of water conveyance facilities
Bristly sedge	—	—	18	3	Loss of occurrences from construction of water conveyance facilities
Woolly rose-mallow[a]	—	—	121	14	Loss of occurrences from construction of water conveyance facilities
Eel grass pondweed	—	—	1	0	None
Sanford's arrowhead	—	—	23	1	Loss of occurrences from construction of water conveyance facilities
Marsh skullcap[a]	—	—	1	0	None

[a] Also occurs in valley/foothill riparian habitat.

Impact BIO-175: Effects on Habitat and Populations of Nontidal Wetland Plants

Under Alternative 4A, known occurrences watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead would be within the proposed footprint for the water conveyance facilities and could be adversely affected. Alternative 4A would have no adverse effects on eel-grass pondweed or marsh skullcap.

Construction of the Alternative 4A water conveyance facilities would adversely affect four special-status plant species occurring in nontidal wetlands. One of three watershield occurrences in CZ 5 on Bouldin Island could be affected by construction of the water conveyance facilities. This is a historical occurrence that has not been observed since 1893, and it may be extirpated (California Department of Fish and Wildlife 2013). Three occurrences of bristly sedge in CZ 4 and CZ 5, including approximately 1.54 acres of occupied habitat, would be affected by construction of the water conveyance facilities. Fourteen occurrences of woolly rose-mallow would be affected. Six occurrences in CZ 4 could be removed during construction of the intake facilities and disposal of RTM, and four occurrences in CZ 6 and four occurrences in CZ 8 could be affected by construction of other facilities and by geotechnical investigations. Construction of the water conveyance facilities could remove occupied habitat at one occurrence of Sanford's arrowhead in CZ 4. Under Alternative 4A, construction and operation of the water conveyance facilities could affect 77 acres of nontidal wetlands, which could have adverse effects on undiscovered occurrences of the six special-status nontidal wetland plant species.

- *Environmental Commitment 3 Natural Communities Protection and Restoration*: No specific natural communities protection is proposed for nontidal wetlands under Alternative 4A. Therefore, no occurrences of special-status nontidal plants are proposed for protection.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: No habitat or known occurrences of special-status nontidal wetland plants are present within areas proposed for tidal habitat restoration. Therefore, tidal habitat restoration would have no adverse effects on special-status nontidal wetland plants.
- *Environmental Commitment 6 Channel Margin Enhancement*: No known occurrences of special-status nontidal wetland plant species are present within areas proposed for channel margin habitat enhancement. Therefore, channel margin habitat enhancement would have no impacts on known occurrences of special-status nontidal wetland species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: No known occurrences of special-status nontidal wetland plant species are present within areas proposed for riparian habitat restoration. Therefore, riparian habitat restoration would have no impacts on known occurrences of special-status nontidal wetland species.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: No known occurrences of special-status nontidal wetland plant species are present within areas proposed for grassland communities restoration. Therefore, grassland communities restoration would have no impacts on special-status nontidal wetland species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: No known occurrences of special-status nontidal wetland plants are present within areas proposed for vernal pool complex restoration. Therefore, vernal pool complex restoration would have no impacts on special-status nontidal wetland plants.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration would take place through conversion of cultivated lands. Therefore, nontidal marsh restoration would avoid existing nontidal marsh and would have no adverse effects on special-status nontidal wetland plants. Alternative 4A may benefit nontidal wetland species by creating 832 acres of nontidal freshwater marsh, including components of nontidal perennial aquatic and nontidal freshwater perennial emergent wetland communities, and by maintaining and enhancing the habitat functions of protected and created nontidal wetland habitats for special-status and other native species. However, no specific actions to benefit special-status species are proposed.

Under Alternative 4A, 119 acres of nontidal marsh would be restored. However, these wetlands would be restored primarily as habitat for giant garter snake. These habitat restoration activities would be unlikely to expand the amount of habitat available to watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, and potential loss of habitat or occurrences resulting from construction activities would not be compensated for. Moreover, because special-status nontidal wetland plant species are not covered under environmental commitments, the species protections afforded to listed species under the AMMs do not apply to these species, and the effects of Alternative 4A on these species would be adverse. Implementation of Mitigation Measure BIO-170, *Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species*, would reduce these effects.

NEPA Effects: Implementation of Alternative 4A could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead, four nontidal wetland species, which would be an adverse effect. Adverse effects on these species could be avoided or offset through implementation of Mitigation Measure BIO-170.

CEQA Conclusion: Under Alternative 4A, construction of the water conveyance facilities could result in a reduction in the range and numbers of watershield, bristly sedge, woolly rose-mallow, and Sanford's arrowhead. These impacts would be significant. Implementation of Mitigation Measure BIO-170 would reduce these impacts to a less-than-significant level.

Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Special-Status Plant Species

Please see Mitigation Measure BIO-170 under Impact BIO-170.

4.3.1.2 General Terrestrial Biology

Wetlands and Other Waters of the United States

Alternative 4A actions would both permanently and temporarily remove or convert wetlands and open water that are regulated by USACE under Section 404 of the CWA. The 404 regulations and relevant information on mitigating the effects of impact on wetlands and other waters of the United States (waters of the U.S.) are described in Section 12.2.1.1 in Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, of this RDEIR/SDEIS. The methods used to conduct these analyses are described in Section 12.3.2.4 in Appendix A, *Draft EIR/EIS In-Text Chapter Revisions* of this RDEIR/SDEIS. Waters of the U.S. data used for this analysis is based on a verified wetland delineation from the USACE that was completed in early 2015. The waters of the U.S. were mapped at a finer scale than that which was done for the natural community mapping for the BDCP and therefore the acreages of these two datasets differ when compared to each other. The waters of the U.S. mapping identified numerous agricultural ditches and seasonal wetlands occurring within and associated with cultivated lands, which explains the majority of the difference.

Impact BIO-176: Effects of Constructing Water Conveyance Facilities on Wetlands and Other Waters of the United States

Alternative 4A proposes the construction, maintenance, and operation of water conveyance facilities within, or requiring the unavoidable fill of, waters of the U.S. The estimated fill of jurisdictional waters associated with this alternative is described in Table 12-4A-68 below. Based on the methodology used to conduct this analysis, the losses would occur at intake, tunnel, pipeline, canal, and RTM and borrow/spoil storage sites, transmission corridors, and multiple temporary work areas associated with the construction activity. The permanent waters of the U.S. losses would occur at various locations along the modified pipeline/tunnel alignment. The majority of the loss would occur due to the expansion of Clifton Court Forebay, new transmission lines, construction of Alternative 4A's three intake structures along the eastern bank of the Sacramento River between Clarksburg and Courtland in the north Delta, and at the RTM storage sites associated with tunnel construction at various locations between Lambert Road and Twin Cities Road, on Bouldin Island, and on Byron Tract, adjacent to Clifton Court Forebay.

The temporary effects on waters of the U.S. would also occur mainly at the three intake construction sites along the eastern bank of the Sacramento River, and at barge unloading facilities in the San

Joaquin River, Snodgrass Slough, Potato Slough, Connection Slough, Old River, and West Canal. An additional temporary effect would result from dredging of Clifton Court Forebay.

Table 12-4A-68. Estimated Fill of Waters of the U.S. Associated with the Construction of Water Conveyance Facilities under Alternative 4A

Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]
Agricultural Ditch	45.5	17.4	0	62.9
Alkaline Wetland	20.3	0.1	0	20.4
Clifton Court Forebay	258.0	0	1,931.0	258.0
Conveyance Channel	8.0	2.9	0	10.8
Depression	29.3	7.1	0	36.4
Emergent Wetland	57.2	31.5	0	88.8
Forest	8.3	8.6	0	16.9
Lake	23.2	0	0	23.2
Scrub-Shrub	12.8	5.4	0	18.1
Seasonal Wetland	114.6	25.1	0	139.7
Tidal Channel	19.2	80.7	0	99.9
Vernal Pool	0.3	0	0	0.3
Total	**597**	**179**	**1,931**	**775**

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.
[b] Temporary impacts are due to dredging Clifton Court Forebay.
[c] Total does not include temporary impacts on Clifton Court Forebay because these would just be temporary disturbance to open water, which typically do not require compensatory mitigation.

The majority of the impacts on wetlands and waters of U.S. are to wetlands found within cultivated lands (mostly agricultural ditches and seasonal wetlands) and waters associated with Clifton Court Forebay. The impacted seasonal wetlands mapped within the Conveyance Planning Area, as described in Section 12.3.2.4 in Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, of this RDEIR/SDEIS, all occur in the central Delta within plowed agricultural fields and would be mostly affected by the RTM storage sites and transmission line construction. The effects on Clifton Court Forebay would primarily result from the establishment of new embankments around and across the existing forebay. The forebay would be expanded to the south by an additional 450 acres of storage space resulting in a net gain of open water in the forebay.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water-quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the U.S. that will be temporarily or permanently impacted by this alternative vary greatly depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. With respect to Clifton Court Forebay, the facility is regularly maintained, but supports some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. The alkaline wetlands and vernal pools exist in non-native grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub, depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions will be considerably lower. All of the wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges. The areas mapped as lake are the dredged borrow ponds created during the construction of Interstate 5. Although relatively small, each lake is likely performing functions from all three categories.

A functional assessment of wetlands proposed for fill will be conducted during the development of the Conceptual Mitigation Plan as part of the Clean Water Act permitting process. The results of this assessment will be compared to the expected functions at the proposed mitigation site(s) such that it can be confirmed that the compensatory mitigation will in fact accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functional compensatory wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands will be significantly less than high function, the compensatory mitigation will result in a net increase in wetland function.

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The proposed project was designed to avoid waters of the U.S, to the maximum extent practicable. Each of the conveyance components has been located in upland areas where it was feasible to do so. Once construction begins, specific measures will be implemented, as described in the AMMs set out in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS (AMM2 and AMM6), to further avoid and minimize effects to waters of the U.S. as well as to special-status species. The AMMs will be implemented at all phases of a project, from siting through design, construction, and on to operations and maintenance. The AMMs that pertain specifically to waters of the United States are AMM1 *Worker Awareness Training,* AMM2 *Construction Best Management Practices and Monitoring*, AMM3 *Stormwater Pollution Prevention Plan*, AMM4 *Erosion and Sediment Control Plan*, AMM5 *Spill Prevention, Containment, and Countermeasure Plan*, AMM6 Disposal and Reuse of Spoils, Reusable Tunnel Material, and Dredged Material, AMM7 *Barge Operations Plan*, AMM10 *Restoration of Temporarily Affected Natural Communities*, AMM12 *Vernal Pool Crustaceans*, AMM30 *Transmission Line Design and Alignment Guidelines*, AMM34 *Construction Site Security*, and AMM36 *Notification of Activities in Waterways*.

The implementation of measures to avoid and minimize impacts on habitat for aquatic species and species which utilize aquatic habitats, such as California tiger salamander, giant garter snake, California red legged frog, western pond turtle, riparian woodrat, and riparian brush rabbit, will also result in further avoidance and minimization of effects to waters of the United States.

Aside from wetland habitats that would be created as a result of implementing Environmental Commitment 4–Environmental Commitment 10 described for Alternative 4A, some of which could serve the dual purpose of offsetting effects to species and mitigating impacts on waters of the U.S., more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing Alternative 4A pursuant to USACE's and U.S. EPA's Mitigation Rule (see Section 12.2.1.1 in Appendix A, *Draft EIR/EIS In-Text Chapter Revisions*, of this RDEIR/SDEIS). Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.* would be available to address adverse impacts on waters of the U.S.

NEPA Effects: The permanent and temporary loss of wetlands and waters of the U.S. as a result of constructing Alternative 4A water conveyance facilities would be a substantial effect if not compensated by wetland restoration and protection. This loss would represent a fill of water of the U.S. as defined by Section 404 of the CWA. The project proponents will implement AMMs 1–7, 10, 12, 30, 34, and 36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. However, specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the U.S. and thus that the affect is not adverse. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be available to reduce these effects such that they are not adverse.

CEQA Conclusion: The permanent and temporary loss of wetlands and waters of the U.S. as a result of constructing Alternative 4A water conveyance facilities would be a significant impact. Specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the U.S. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be available to reduce the impact to a less-than-significant level. Additionally, Alternative 4A would restore up to 896 acres of wetlands as part of the proposed project, which would include 59 acres of tidal marsh restoration (Environmental Commitment 4), 5 acres of vernal pool/alkali seasonal wetlands (Environmental Commitment 9; 34 acres of vernal pool complex assuming a wetland density of 15%), and 832 acres of nontidal marsh restoration (Environmental Commitment 10). In addition, Alternative 4A would restore 251 acres of riparian habitat (Environmental Commitment 7), some portion of which may also qualify as forested or scrub-shrub wetland. In addition, 4.6 miles of levees will have channel margin enhancement conducted on them (Environmental Commitment 6), which would include improving channel geometry and restoring riparian, marsh, and mudflat habitats on the water side of levees.

The success in implementing these Environmental Commitments would be assured through effectiveness monitoring, which includes success criteria, and adaptive management as outlined in the *Adaptive Management and Monitoring* sections of the Draft BDCP for tidal marsh restoration (Draft BDCP Section 3.4.4.4), channel margin enhancement (Draft BDCP Section 3.4.6.4), valley/foothill riparian restoration (Draft BDCP Section 3.4.7.4), vernal pool and alkali seasonal wetland complex restoration (Draft BDCP Section 3.4.9.4), and nontidal marsh restoration (Draft BDCP Section 3.4.10.3). All restored areas will be secured in fee-title or through conservation easements.

Alternative 4A would also protect and manage the following natural communities that contain wetlands: 103 acres of valley/foothill riparian, 150 acres of vernal pool complex, and 119 of nontidal marsh. In addition, 1,060 acres of grasslands and 11,870 acres of cultivated lands will be protected and managed, which would likely include areas of seasonal wetlands, ponds, and agricultural ditches.

Alternative 4A also includes the following Resource Restoration and Performance Principles (see Table 4.1-8 in this RDEIR/SDEIS) to further guide the Environmental Commitments that would also contribute to establishing and maintaining the functions and values of restored and protected waters of the U.S.

- Restore or create vernal pool and alkali seasonal wetland complex to achieve no net loss of wetted acres (Resource Restoration and Performance Principle VP/AW2).
- Provide appropriate seasonal flooding characteristics for supporting and sustaining vernal pool and alkali seasonal wetland complex species (Resource Restoration and Performance Principle VP/AW4).
- In grasslands surrounding protected and created vernal pools and alkali seasonal wetlands complex, increase the extent, distribution, and density of native perennial grasses intermingled with other native species, including annual grasses, geophytes, and other forbs (Resource Restoration and Performance Principle VP/AW6).
- Increase the size and connectivity of protected vernal pool and alkali seasonal wetland complex in the greater Byron Hill area (Resource Restoration and Performance Principle VP/AW3).
- Protect up to six acres of stock ponds and other aquatic features within protected grasslands to provide aquatic breeding habitat for native amphibians and aquatic reptiles (Resource Restoration and Performance Principle G2).
- Maintain and enhance aquatic features in grasslands to provide suitable inundation depth and duration and suitable composition of vegetative cover to support breeding for covered amphibian and aquatic reptile species (Resource Restoration and Performance Principle G7).
- Maintain and protect the small patches of important wildlife habitats associated with cultivated lands that occur in cultivated lands within the reserve system, including isolated valley oak

trees, trees and shrubs along field borders and roadsides, remnant groves, riparian corridors, water conveyance channels, grasslands, ponds, and wetlands (Resource Restoration and Performance Principle CL1).

- Create and protect nontidal marsh consisting of a mosaic of nontidal perennial aquatic and nontidal freshwater emergent wetland natural communities, which will include suitable habitat characteristics for western pond turtle (Resource Restoration and Performance Principle WPT1).
- Create aquatic habitat for the giant garter snake will be connected to the protected rice land or equivalent-value habitat (Resource Restoration and Performance Principle GGS1).
- Protect, restore, and/or create rice land or equivalent-value habitat (e.g., perennial wetland) for the giant garter snake in Conservation Zones 4 and/or 5 (Resource Restoration and Performance Principle GGS3).
- Create at least 320 acres of managed wetlands (part of the nontidal wetland restoration acreage) in minimum patch sizes of 40 acres within the Greater Sandhill Crane Winter Use Area in CZs 3, 4, 5, or 6, with consideration of sea level rise and local seasonal flood events. The wetlands will be located within 2 miles of existing permanent roost sites and protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of 2:1 upland to wetland to provide buffers around the wetlands (Resource Restoration and Performance Principle GSC2).
- Create at least two 90-acre wetland complexes within the Stone Lakes National Wildlife Refuge project boundary. The complexes will be no more than 2 miles apart and will help provide connectivity between the Stone Lakes and Cosumnes River Preserve greater sandhill crane populations. Each complex will consist of at least three wetlands totaling at least 90 acres of greater sandhill crane roosting habitat, and will be protected in association with other protected natural community types (excluding nonhabitat cultivated lands) at a ratio of at least 2:1 uplands to wetlands (i.e., two sites with at least 90 acres of wetlands each). One of the 90-acre wetland complexes may be replaced by 180 acres of cultivated lands (e.g., cornfields) that are flooded following harvest to support roosting cranes and provide highest-value foraging habitat, provided such substitution is consistent with the long-term conservation goals of Stone Lakes National Wildlife Refuge for greater sandhill crane (Resource Restoration and Performance Principle GSC3).

The project proponents will also implement AMMs 1–7, 10,12, 30, 34, and 36, which would avoid and minimize fill of wetlands and waters and any indirect effects to wetlands and waters. As stated above, specific mitigation would be required to ensure that Alternative 4A does not result in a loss of functions and values of waters of the U.S. Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be available to reduce the impact to a less-than-significant level.

Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the U.S.

All mitigation proposed as compensatory mitigation would be subject to specific success criteria, success monitoring, long-term preservation, and long-term maintenance and monitoring pursuant to the requirements of the Mitigation Rule. All compensatory mitigation shall fully replace lost function through the mechanisms discussed below which will result in restoration and/or creation of habitat with at least as much function and value as those of the impacted habitat. In some cases, the mitigation habitat will afford significantly higher function and value than that of impacted habitat.

Compensation ratios are driven by type, condition, and location of replacement habitat as compared to type, condition and location of impacted habitat. Compensatory mitigation usually includes restoration, creation, or rehabilitation of aquatic habitat. The USACE does not typically accept preservation as the only form of mitigation; use of preservation as mitigation typically requires a very high ratio of replacement to impact. It is anticipated that ratios will be a minimum of 1:1, depending on the factors listed above.

Compensatory mitigation will consist of restoration, creation, and/or rehabilitation of aquatic habitat. Typically, impacted habitat will be replaced in-kind, although impacts on some habitat types such as agricultural ditches, conveyance channels, and Clifton Court Forebay, will be mitigated out-of-kind with higher functioning habitat types such as riparian wetland, marsh, and/or seasonal wetland. Compensatory mitigation shall be accomplished by one, or a combination of the following methods:

- Purchase credits for restored/created/rehabilitated habitat at an approved wetland mitigation bank;
- On-site (adjacent to the project footprint) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- On-site (adjacent to the project footprint) creation of aquatic habitat;
- Off-site (within the Delta) restoration or rehabilitation of wetlands converted to uplands due to past land use activities (such as agriculture) or functionally degraded by such activities;
- Off-site (within the Delta) creation of aquatic habitat; and/or
- Payment into the Corps' Fee-in-Lieu program.

Purchase of Credits or Payment into Fee-in-Lieu Program

It is envisioned that purchase of bank credits and/or payment into a fee-in-lieu program will be utilized for habitat types that would be difficult to restore or create within the Delta. Examples are vernal pool habitat, which requires an intact hardpan or other impervious layer and very specific soil types, and alkali seasonal wetland, which requires a specific set of chemical soil parameters. It is anticipated that only a small amount of compensatory mitigation will fall into these categories.

On-Site Restoration, Rehabilitation and/or Creation

Much of the Delta consists of degraded or converted habitat that is more or less functioning as upland. Opportunities will be sought where on-site restoration, rehabilitation, and/or creation could occur immediately adjacent to the project footprint. It is anticipated that some of the compensatory mitigation will fall into this category.

Off-Site Restoration, Rehabilitation and/or Creation

There exists, within the immediate vicinity of the project area, Delta land which has been subject to agricultural practices or other land uses which have degraded or even converted wetlands that existed historically. Sites within the Delta will be evaluated for their restoration, rehabilitation, and/or creation potential. It is anticipated that most of the compensatory mitigation will fall into this category.

Compensatory mitigation will result in no net loss of acreage of Waters of the U.S. and will accomplish full functional replacement of impacted wetlands. All impacted wetlands will be replaced with fully functioning wetland habitat demonstrating high levels of habitat, water quality, and hydrologic/hydraulic function. Since many impacted wetlands are likely to function at significantly less than high levels, the compensatory mitigation will result in a significant net increase in wetland function.

Impact BIO-177: Effects of Implementing Environmental commitments (Environmental Commitment 4 - Environmental Commitment 10) on Wetlands and Other Waters of the United States

The habitat protection and restoration activities associated with Alternative 4A's environmental commitments (Environmental Commitment 4–Environmental Commitment 10) could alter the acreages and functions and values of wetlands and waters of the United States in the study area. Because these environmental commitments have not been defined to the level of site-specific footprints, it is not possible to specifically delineate and quantify these effects on wetlands and waters; however the project would conduct tidal restoration (Environmental Commitment 4), riparian restoration (Environmental Commitment 7), grasslands restoration (Environmental Commitment 8), and nontidal marsh restoration (Environmental Commitment 10) within 2,207 acres of cultivated lands that likely contain agricultural ditches and seasonal wetlands (as was identified during the delineation for the Conveyance Planning Area). In addition, 5 acres of valley/foothill riparian would be affected by tidal restoration (Environmental Commitment 4). The proportion of these areas that actually contain waters and wetlands is expected to be low; however for the purposes of this analysis a conservative estimate of 10% was applied to estimate the amount of wetlands and waters that may be affected within these areas, which would be 221 acres.

Alternative 4A would result in the restoration of 896 acres of wetlands and waters, as well the protection and management of 269 acres of wetland natural communities (vernal pool complex and nontidal marsh) and 13,033 acres of other natural communities that likely contain some degree of wetlands and waters (valley/foothill riparian, grasslands, and cultivated lands). As discussed above, Alternative 4A would also implement AMMs, Resource Restoration and Performance Principles, and adaptive management and monitoring together with these environmental commitments. The Environmental Commitments and associated measures could serve the dual purpose of offsetting effects to species and mitigation impacts on waters of the U.S.; however, more specific mitigation is required to ensure that there is no net loss of wetland functions and values as a result of implementing these Environmental Commitments under Alternative 4A pursuant to USACE's and U.S. EPA's Mitigation Rule. Mitigation Measure BIO-176, Compensatory Mitigation for Fill of Waters of the U.S. would be available to address adverse impacts on waters of the U.S.

NEPA Effects: The implementation of Environmental Commitment 4–Environmental Commitment 10 for Alternative 4A would potentially result in the conversion of wetlands and waters in cultivated lands and along the margins of Delta channels. These wetlands and waters would likely be converted to tidal and nontidal wetlands, including some open water, and possibly grasslands through implementation of Environmental Commitment 4, Environmental Commitment 8, and Environmental Commitment 10. Although, the increase in wetland acreage and wetland functions from these Environmental Commitments could offset the effects on waters of the U.S. occurring in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be required to ensure that these effects are not adverse.

***CEQA Conclusion*:** The implementation of Environmental Commitment 4–Environmental Commitment 10 for Alternative 4A would potentially result in the conversion of wetlands and waters in cultivated lands and along the margins of Delta channels. These wetlands and waters would likely be converted to tidal and nontidal wetlands, including some open water, and possibly grasslands through implementation of Environmental Commitment 4, Environmental Commitment 8, and Environmental Commitment 10. Although, the increase in wetland acreage and wetland functions from these Environmental Commitments could offset the effects on waters of the U.S. occurring in these areas, implementation of Mitigation Measure BIO-176, *Compensatory Mitigation for Fill of Waters of the U.S.*, would be required to ensure that the impacts are reduced to a less-than-significant level.

Shorebirds and Waterfowl

This section describes the effects of Alternative 4A, including water conveyance facilities construction and implementation of the environmental commitments, on shorebirds and waterfowl. Managed wetlands, tidal natural communities, and cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands) provide freshwater nesting, feeding, and resting habitat for a large number of Pacific flyway waterfowl and shorebirds.

Alternative 4A would result in both temporary and permanent losses of shorebird and waterfowl habitat. Full implementation of Alternative 4A would also include the following environmental commitments and associated Resource Restoration and Performance Principles that would benefit shorebirds and waterfowl through habitat restoration and protection.

- Restore or create 37 acres of tidal wetlands in the north Delta (Environmental Commitment 4).
- Restore or create 22 acres of *Schoenoplectus* and *Typha*-dominated tidal and nontidal freshwater emergent wetland in patches greater than 0.55 acres in the south Delta (Environmental Commitment 10 and Resource Restoration and Performance Principle CBR1).
- Protect 119 acres of nontidal wetlands and create 832 acres of nontidal wetlands (Environmental Commitment 3 and Environmental Commitment 10).
- Protect 1,060 acres of grassland and 11,870 acres of cultivated lands (Environmental Commitment 3).

Impact BIO-178: Loss or Conversion of Habitat for Waterfowl and Shorebirds as a Result of Water Conveyance Facilities Construction

Development of the water conveyance facilities would result in the permanent removal of approximately 22 acres of managed wetland, 3 acres of tidal wetlands, 61 acres of nontidal wetlands, and 3,768 acres of suitable cultivated lands (including grain and hay crops, pasture, field crops, rice, and idle lands). In addition, 29 acres of managed wetland, 15 acres of tidal wetlands, 15 acres of nontidal wetlands and 1,339 acres of suitable cultivated lands would be temporarily impacted. No rice would be impacted as a result of constructing the water conveyance facilities. These losses of habitat would occur within the first 10–14 years of Alternative 4A implementation in the Delta.

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. In addition, 59 acres of tidal freshwater emergent wetland would be restored or created and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created in the Delta. The restored and protected acres described above would provide suitable nesting habitat for these species. These conservation actions would be associated with the aforementioned environmental commitments and would occur in the same timeframe as the construction losses. Construction activities could have an adverse effect on nesting shorebirds or waterfowl if they were present in or adjacent to work areas and could result in destruction of nests or disturbance of nesting and foraging behaviors. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***NEPA Effects*:** Habitat loss from construction of the Alternative 4A water conveyance facilities would not result in an adverse effect on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be an adverse effect on nesting shorebirds and waterfowl. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on nesting birds.

***CEQA Conclusion*:** Habitat loss from construction of the Alternative 4A water conveyance facilities would have a less-than-significant impact on shorebirds and waterfowl because of the acres of natural communities and cultivated lands that would be restored and protected in the near-term timeframe. If waterfowl were present in or adjacent to work areas, construction activities could result in destruction of nests or disturbance of nesting and foraging behaviors, which would be a significant impact. Implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, which would identify birds prior to disturbance and would allow for avoidance measures, would reduce this impact on nesting birds to a less-than-significant level.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Impact BIO-179: Loss or Conversion of Habitat for Wintering Waterfowl as a Result of Implementation of Alternative 4A

The implementation of Environmental Commitments would result in the permanent loss or conversion of 2,212 acres of cultivated lands.

- *Environmental Commitment 4 Tidal Natural Communities Restoration:* Tidal habitat restoration site preparation and inundation would permanently remove an estimated 54 acres of cultivated lands.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: Riparian restoration would permanently remove approximately 251 acres of cultivated lands.
- *Environmental Commitment 8 Grassland Natural Community Restoration*: Grassland restoration would convert approximately 1,070 acres of cultivated lands into grasslands.

- *Environmental Commitment 10 Nontidal Marsh Restoration*: Restoration and creation of nontidal freshwater marsh would result in the permanent removal of 832 acres of cultivated lands

A total of 1,060 acres of grassland and 11,870 acres of cultivated lands would be protected through Alternative 4A. In addition, 59 acres of tidal freshwater emergent wetland would be restored or created and 119 acres of nontidal wetlands would be protected, and 832 acres of nontidal wetlands would be created in the Delta. Some portion of these wetlands would be expected to provide suitable habitat for wintering waterfowl. The restored and protected acres described above would provide foraging habitat for wintering waterfowl and the acres of cultivated lands protected would provide adequate food sources and resting habitat for waterfowl species. Restoration and protection acres would be associated with Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 8 and Environmental Commitment 10 and would occur in the same timeframe as the construction and early restoration losses. Environmental Commitment 11 would be implemented to guide management of cultivated lands and wetlands for shorebird and waterfowl species.

***NEPA Effects*:** The loss or conversion of 2,212 acres of cultivated lands would not be adverse under NEPA because project proponents have committed to restoring and protecting an acreage that exceeds the typical mitigation ratios for cultivated lands (1:1 protection). This habitat protection and restoration would be guided by Resource Restoration and Performance Principle CBR1 described above and would not be expected to substantially alter food productivity for wintering waterfowl in the Delta. Therefore the implementation of Alternative 4A would not represent an adverse effect on wintering waterfowl.

***CEQA Conclusion*:** The loss or conversion of 2,212 acres of cultivated lands would not represent a substantial impact because project proponents have committed to restoring and protecting an acreage that exceeds the typical mitigation ratios for cultivated lands (1:1 protection). This habitat protection and restoration would be guided by Resource Restoration and Performance Principle CBR1 described above and would not be expected to substantially alter food productivity for wintering waterfowl in the Delta. Therefore the implementation of Alternative 4A would have a less-than-significant impact on wintering waterfowl.

Impact BIO-180: Loss or Conversion of Habitat for Breeding Waterfowl from Implementation of Alternative 4A

Implementation of Environmental Commitments under Alternative 4A would not be expected to reduce managed wetlands in the Delta. Alternative 4A would protect 119 acres and create 832 acres of nontidal marsh. In addition, 59 acres of tidal freshwater wetlands would be restored in the Delta which would be expected to contain water during the breeding period (March through July). Restoration and protection acres would be associated with Environmental Commitment 3, Environmental Commitment 4, and Environmental Commitment 10 and would occur in the same timeframe as the construction and early restoration losses. Environmental Commitment 11 would be implemented to guide management of wetlands for shorebird and waterfowl species.

***NEPA Effects*:** Implementation of environmental commitments under Alternative 4A would not reduce managed wetlands in the Delta, and would create nontidal and tidal wetlands. Therefore, Alternative 4A would not have an adverse effect on breeding waterfowl.

***CEQA Conclusion*:** Implementation of environmental commitments under Alternative 4A would not reduce managed wetlands in the Delta, and would create nontidal and tidal wetland habitat. Therefore, Alternative 4A would have a less-than-significant impact on breeding waterfowl.

Impact BIO-181: Loss or Conversion of Habitat for Shorebirds from the Implementation of Conservation Components

Shorebird use of the study area varies by species and fluctuates both geographically and by habitat type throughout the year. Shallow flooded agricultural fields and wetlands support large numbers of wintering and migrating shorebirds (Shuford et al. 1998), particularly least and western sandpipers, dunlin, greater yellowlegs and long-billed dowitcher. Rice lands of the Sacramento Valley provide important breeding habitat for shorebirds such as American avocet and black-necked stilt (Shuford et al. 2004) and have been designated as a Western Hemisphere Shorebird Reserve Network Site of International Importance (Hickey et al. 2003). Managed wetlands provide suitable foraging and roosting habitat for shorebirds; black-necked stilts, avocets, and yellowlegs use this habitat type almost exclusively. Water depth in all of these habitat types is an important habitat variable as the majority of shorebird species require water depths of approximately 10–20 cm for foraging (Isola et al. 2000, Hickey et al. 2003).

Managed Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for managed wetland habitat suitability (Table 1, ICF International 2013): black-necked stilt (*Himantopus mexicanus*), greater yellowlegs (*Tringa melanoleuca*), and long-billed dowitcher (*Limnodromus scolopaceus*). Dunlin (*Calidris alpine*), least sandpiper (*Calidris minutilla*), semipalmated plover (*Charadrius semipalmatus*), and western sandpiper (*Calidris mauri*), had a rank 2 for managed wetland habitat suitability. Black-bellied plover (*Pluvialis squatarola*) and whimbrel (*Numenius phaeopus*) both had rank 3 for managed wetland habitat suitability.

No managed wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, or Environmental Commitment 10. However, 832 acres of nontidal marsh would be created under Environmental Commitment 10.

Cultivated Lands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for cultivated lands habitat suitability (Table 1, ICF International 2013): killdeer (*Charadrius vociferous*), long-billed curlew, and whimbrel within pasture habitat and sandhill crane was ranked 1 for grain and hay crops. Long-billed dowitcher and killdeer both had a rank 2 for idle crop habitat suitability and black-bellied plover was ranked 2 for pasture habitat. Red-necked phalarope (*Phalaropus lobatus*) and Wilson's phalarope (*Phalaropus tricolor*) were both ranked 2 for grain and hay crops. Long-billed dowitcher, dunlin, least sandpiper, and long-billed curlew were all ranked 3 for rice habitat suitability and killdeer was ranked 3 for field crop habitat suitability.

Within the Delta, 54 acres of cultivated lands would be permanently converted to tidal wetlands as a result of tidal restoration (Environmental Commitment 4), 251 acres would be permanently lost as a result of riparian restoration (Environmental Commitment 7), 1,070 acres would be converted to grassland as a result of grassland restoration (Environmental Commitment 8), and 832 acres would be converted to nontidal wetlands as a result of nontidal marsh restoration (Environmental Commitment 10).

Tidal Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for tidal mudflat habitat suitability (Table 6, ICF International 2013): black-bellied plover, dunlin, least sandpiper, marbled godwit (*Limosa fedoa*), semipalmated plover, short-billed dowitcher (*Limnodromus griseus*), western sandpiper, and willet (*Tringa semipalmata*). Long-billed curlew (*Numenius americanus*) and whimbrel both had a rank 2 for tidal mudflat habitat suitability. American avocet (*Recurvirostra americana*) was ranked 3 for tidal mudflat habitat suitability. For tidal brackish emergent wetland/tidal freshwater emergent wetland, willet was ranked 2 and long-billed curlew and whimbrel were both ranked 3 for habitat suitability.

No tidal wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, Environmental Commitment 8, or Environmental Commitment 10. However, 59 acres of tidal wetlands would be created under Environmental Commitment 4.

Nontidal Wetlands

According to Stralberg et al. 2011, the following species of shorebirds had a rank 1 designation for nontidal wetland habitat suitability (Table 6, ICF International 2013): red-necked phalarope and Wilson's phalarope for nontidal freshwater perennial emergent wetland and American avocet for alkali seasonal wetland complex. Greater yellowlegs had a rank 2 for vernal pool complex habitat suitability. Red-necked phalarope and western sandpiper were both ranked 3 for alkali seasonal wetland habitat suitability and greater yellowlegs was ranked 3 for nontidal freshwater perennial emergent wetland habitat suitability.

No nontidal wetlands would be converted or lost from the implementation of Environmental Commitment 4, Environmental Commitment 7, or Environmental Commitment 10. However, 832 acres of nontidal wetlands would be created under Environmental Commitment 10.

The protection and restoration of natural communities would also include management and enhancement actions under *Environmental Commitment 11 Natural Communities Enhancement and Management.* The following management activities to benefit shorebirds would be considered for implementation under Environmental Commitment 11 in areas where they would not conflict with other species management.

- Managed wetlands and Nontidal Wetlands:
    - Managed wetlands can be potentially manipulated to provide the optimum water depths for foraging shorebirds and islands for nesting (Hickey et al. 2003).
    - During fall and spring, stagger the timing and location of draining and flooding to optimize the extent of shallow-water habitat; varying depths within the wetland unit helps to create temporal variation in foraging opportunities. During warm, dry springs when wetland units dry quickly, wetland units can be re-supplied with water to extend habitat availability for shorebirds.
    - Provide open, shallow water habitat adjacent to minimally vegetated, shallowly sloped edges for nesting shorebirds between April and July.
    - Provide islands with little to no vegetation to increase the likelihood of shorebird roosting and nesting.

- Create low slopes on islands and levees; gradual angles (10–12:1) are better than steep angles.
- Limit levee maintenance during the nesting season (April through July). However, mowing the center of levees is fine.
- Potentially add material to levees or to islands to encourage nesting for some species.

- Cultivated Lands:
  - Maintaining a mosaic of dry and flooded crop types, and varying water depths will promote a diverse community of waterbirds, including shorebirds, during fall migration and winter (Shuford et al. 2013).
  - To provide wintering habitat for multiple waterbird guilds, including shorebirds, use a combination of flooding practices that include one-time water application and maintenance flooding while also providing unflooded habitat (Strum et al. *in review*).
  - The post-harvest flooding of winter wheat and potato fields in early fall (July- September) can provide substantial benefits to shorebirds at a time of very limited shallow-water habitat on the landscape (Shuford et al. 2013).
  - Stagger the drawdown of flooded rice and other winter-flooded agricultural fields to prolong the availability of flooded habitat (Iglecia et al. 2012). Be aware of soil type because this practice may not be as effective on soils that drain quickly.
  - Remove as much stubble as possible in rice and other agricultural fields after harvest to increase the potential shorebird habitat on intentionally flooded or unflooded fields that may passively gather rain water (Iglecia et al. 2012).
  - Shallowly flood available agricultural fields during July, August, and September to provide early fall migration habitat for shorebirds. Fields should be free of vegetation prior to flooding, have minimal micro-topography (e.g., no large clods), and should remain flooded for up to three week periods (after three weeks, vegetation encroachment reduces habitat value for shorebirds; ICF International 2013).
  - Manage levee habitats to have minimal vegetation but do not spray herbicide directly or drive on levees during the nesting season (April–July, Iglecia et al. 2012).
  - Maintain a minimum top-width of 30 inches for levees, based on increased avocet use of wider levees (Iglecia et al. 2012).
  - When possible, flood fields with nesting habitat (modified levees and islands) in late April to provide nesting habitat for American avocets (Iglecia et al. 2012).
  - Finer grained substrate (clods smaller than a fist) in rice and other agricultural fields may be more appealing for nesting shorebirds (Iglecia et al. 2012).
  - Maintain gently sloping levees and island sides (10–12:1; Iglecia et al. 2012).
  - Islands should be disked along with the rest of the field after harvest to help inhibit vegetation growth (Iglecia et al. 2012).

***NEPA Effects*:** Alternative 4A implementation would result in the conversion of cultivated lands in the Delta to tidal and nontidal wetlands. The result would be a loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While losses of cultivated lands would be incurred, protection, enhancement, and management of 11,870 acres of cultivated lands would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by Swainson's hawk, giant garter snake, and greater sandhill crane, they would also benefit shorebirds with the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*. Habitat conversion would not be expected to result in an adverse effect on shorebird populations in the study area.

CEQA Conclusion: Alternative 4A implementation would result in the conversion of cultivated lands in the Delta to tidal and nontidal wetlands. The result would be a loss of the primary habitat of black-necked stilt, American avocet, greater yellowlegs, and long-billed dowitcher and a gain in the primary habitat of black-bellied plover, dunlin, least sandpiper, marbled godwit, semipalmated plover, short-billed dowitcher, western sandpiper, and willet. While losses of cultivated lands would be incurred, protection, enhancement, and management of 11,870 acres of cultivated lands would likely have substantial benefits for select species of wintering and breeding shorebirds. This is because impacts on crop types would be distributed across all crop types, while protection would focus primarily on pasture lands, grain and hay, corn, and rice types. While the protection, enhancement, and management of these crop types are being driven by Swainson's hawk, giant garter snake, and greater sandhill crane, they would also benefit shorebirds with the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*. Habitat conversion would not be expected to adversely affect shorebird populations in the study area. With the protection and restoration of acres in the Delta watershed, in addition to the implementation of the management actions outlined in *Environmental Commitment 11 Natural Communities Enhancement and Management*, habitat conversion would be expected to have a less-than-significant impact on shorebird populations in the study area.

Impact BIO-182: Effects on Shorebirds and Waterfowl Associated with Electrical Transmission Facilities

New transmission lines installed in the study area would increase the risk for bird-power line strikes, which could result in injury or mortality of shorebirds and waterfowl. The existing network of power lines in the study currently poses a risk for shorebirds and waterfowl in the Delta. New transmission lines would increase this risk and have an adverse effect on shorebird and waterfowl species in the absence of other avoidance and minimization measures. The implementation of *AMM20 Greater Sandhill Crane* would reduce potential effects through the installation of flight-diverters on new transmission lines, and selected existing transmission lines in the study area.

NEPA Effects: New transmission lines would increase the risk for shorebird and waterfowl power line strikes which could have a substantial adverse effect as a result of direct mortality. This impact would be significant. With the implementation of *AMM20 Greater Sandhill Crane*, the potential effect of the construction of new transmission lines on shorebird and waterfowl would not be adverse.

CEQA Conclusion: New transmission lines would increase the risk for shorebird and waterfowl power line strikes which could have a substantial adverse effect as a result of direct mortality. This impact would be significant. The implementation of *AMM20 Greater Sandhill Crane* would reduce the potential impact of powerline strikes from the construction of new transmission lines on shorebirds and waterfowl to a less-than-significant level.

Impact BIO-183: Indirect Effects of Plan Implementation on Shorebirds and Waterfowl

Indirect construction- and operation-related effects: Noise and visual disturbances associated with construction-related activities could result in temporary disturbances that affect shorebird and waterfowl use of modeled habitat. Indirect effects associated with construction include noise, dust, and visual disturbance caused by grading, filling, contouring, and other ground-disturbing operations. Construction-related noise and visual disturbances could disrupt nesting and foraging behaviors, and reduce the functions of suitable habitat which could result in an adverse effect on these species. Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to minimize adverse effects on active nests. The use of mechanical equipment during water conveyance construction could cause the accidental release of petroleum or other contaminants that could affect shorebirds and waterfowl or their prey in the surrounding habitat. AMM1–AMM7, including *AMM2 Construction Best Management Practices and Monitoring*, would minimize the likelihood of such spills from occurring. The inadvertent discharge of sediment or excessive dust adjacent to shorebirds and waterfowl in the study area could also have a negative effect on these species. AMM1–AMM7 would ensure that measures were in place to prevent runoff from the construction area and the negative effects of dust on wildlife adjacent to work areas.

Methylmercury Exposure: Covered activities have the potential to exacerbate bioaccumulation of mercury in shorebird and waterfowl species. Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains (Alpers et al. 2008). Bioaccumulation of methylmercury varies by species as there are taxonomic differences in rates of detoxification within the liver (Eagles-Smith et al. 2009). Organisms feeding within pelagic-based (algal) food webs have been found to have higher concentrations of methylmercury than those in benthic or epibenthic food webs; this has been attributed to food chain length and dietary segregation (Grimaldo et al. 2009). That is, the pelagic food chain tends to be longer than the benthic food chain, which allows for greater biomagnification of methylmercury in top predators. Also, there is less prey diversity at the top of the pelagic food chain than in the benthic food chain; pelagic top predators eat smaller fish and little else, while benthic top predators consume a variety of organisms, many of which are lower in the food chain than fishes and thus have less potential for methylmercury biomagnification. Shorebirds and waterfowl that forage on invertebrates and bivalves, may therefore have lower concentrations of methylmercury than diving ducks that forage on fish. A detailed review of the methylmercury issues associated with implementation of Alternative 4A are contained in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS. The review includes an overview of the project-related mechanisms that could result in increased mercury in the food web, and how exposure to individual species may occur based on feeding habits and where their habitat overlaps with the areas where mercury bioavailability could increase.

Largemouth bass was used as a surrogate species for analysis and the modeled effects of mercury concentrations from changes in water operations under water conveyance facilities on largemouth bass did not differ substantially from existing conditions (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS); therefore, results also indicate that shorebird and waterfowl mercury tissue concentrations would not measurably increase as a result of water conveyance facilities implementation.

Mercury is transformed into the more bioavailable form of methylmercury in aquatic systems, especially areas subjected to regular wetting and drying such as tidal marshes and flood plains. Thus, Alternative 4A restoration activities that create newly inundated areas (Environmental Commitment 4 and Environmental Commitment 5) could increase bioavailability of mercury. In general, the highest methylation rates are associated with high tidal marshes that experience intermittent wetting and drying and associated anoxic conditions (Alpers et al. 2008). Mercury is generally elevated throughout the Delta, and restoration of the lower potential areas in total may result in generalized, very low level increases of mercury. Given that some species have elevated mercury tissue levels without the project, these low level increases could result in some level of effects. Restoration in Suisun Marsh would convert managed wetlands to tidal wetlands, which would be expected to result in an overall reduction in mercury methylation.

Due to the complex and very site-specific factors that will determine if mercury becomes mobilized into the foodweb, Environmental Commitment 12, is included to provide for site-specific evaluation for each restoration project. On a project-specific basis, where high potential for methylmercury production is identified that restoration design and adaptive management cannot fully address while also meeting restoration objectives, alternate restoration areas will be considered. Environmental Commitment 12 will be implemented in coordination with other similar efforts to address mercury in the Delta, and specifically with the DWR Mercury Monitoring and Analysis Section. This environmental commitment will include the following actions.

- Assess pre-restoration conditions to determine the risk that the project could result in increased mercury methylation and bioavailability
- Define design elements that minimize conditions conducive to generation of methylmercury in restored areas.
- Define adaptive management strategies that can be implemented to monitor and minimize actual postrestoration creation and mobilization of methylmercury.

Selenium Exposure: Selenium is an essential nutrient for avian species and has a beneficial effect in low doses. However, higher concentrations can be toxic (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and can lead to deformities in developing embryos, chicks, and adults, and can also result in embryo mortality (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009). The effect of selenium toxicity differs widely between species and also between age and sex classes within a species. In addition, the effect of selenium on a species can be confounded by interactions with the effects of other contaminants such as mercury (Ackerman and Eagles-Smith 2009).

The primary source of selenium bioaccumulation in birds is through their diet (Ackerman and Eagles-Smith 2009, Ohlendorf and Heinz 2009) and selenium concentration in species differs by the trophic level at which they feed (Ackerman and Eagles-Smith 2009, Stewart et al. 2004). At Kesterson Reservoir in the San Joaquin Valley, selenium concentrations in invertebrates have been found to be two to six times the levels in rooted plants. Furthermore, bivalves sampled in the San Francisco Bay contained much higher selenium levels than crustaceans such as copepods (Stewart et al. 2004). Studies conducted at the Grasslands in Merced County recorded higher selenium levels in black-necked stilts which feed on aquatic invertebrates than in mallards and pintails, which are primarily herbivores (Paveglio and Kilbride 2007). Diving ducks in the San Francisco Bay (which forage on bivalves) have much higher levels of selenium levels than shorebirds that prey on aquatic invertebrates (Ackerman and Eagles-Smith 2009). Therefore, birds that consume prey with high levels of selenium have a higher risk of selenium toxicity.

Selenium toxicity in avian species can result from the mobilization of naturally high concentrations of selenium in soils (Ohlendorf and Heinz 2009) and covered activities have the potential to exacerbate bioaccumulation of selenium in avian species, including shorebird and waterfowl species. Marsh (tidal and nontidal) and floodplain restoration have the potential to mobilize selenium, and therefore increase avian exposure from ingestion of prey items with elevated selenium levels. Thus, Alternative 4A restoration activities that create newly inundated areas could increase bioavailability of selenium (see Chapter 3, *Conservation Strategy*, of the Draft BDCP for details of restoration). Changes in selenium concentrations were analyzed in Chapter 8, *Water Quality*, of the Draft EIR/EIS and it was determined that, relative to Existing Conditions and the No Action Alternative, water conveyance facilities would not result in substantial, long-term increases in selenium concentrations in water in the Delta under any alternative. However, it is difficult to determine whether the effects of potential increases in selenium bioavailability associated with restoration-related environmental commitments (Environmental Commitment 4 and Environmental Commitment 5) would lead to adverse effects on shorebirds and waterfowl species.

Because of the uncertainty that exists at this programmatic level of review, there could be a substantial effect on shorebirds and waterfowl from increases in selenium associated with restoration activities. This effect would be addressed through the implementation of *AMM27 Selenium Management,* which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats, (see Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS). Furthermore, the effectiveness of selenium management to reduce selenium concentrations and/or bioaccumulation would be evaluated separately for each restoration effort as part of design and implementation. This avoidance and minimization measure would be implemented as part of the tidal habitat restoration design schedule.

***NEPA Effects*:** Noise and visual disturbances from the construction of Alternative 4A water conveyance facilities could reduce shorebird and waterfowl use of modeled habitat adjacent to work areas. Moreover, operation and maintenance of the water conveyance facilities, including the transmission facilities, could result in ongoing but periodic postconstruction disturbances that could affect shorebird and waterfowl use of the surrounding habitat. AMM1–AMM7 would minimize these effects, and Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would be available to address adverse effects on nesting individuals.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats. Therefore, the indirect effects associated with noise and visual disturbances, and increased exposure to selenium from Alternative 4A implementation would not have an adverse effect on shorebirds and waterfowl.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on shorebirds and waterfowl.

CEQA Conclusion: Indirect effects that include noise and visual disturbance, potential hazardous spills, increased dust and sedimentation, and increased methylmercury and selenium exposure as a result of Alternative 4A water conveyance facilities construction and operation and maintenance would represent an adverse effect as a result of habitat modification and potential for direct mortality of shorebirds and waterfowl in the absence of the environmental commitments and AMMs. This would be a significant impact.

AMM1–AMM7, and implementation of Mitigation Measure BIO-75, *Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds*, would reduce potential adverse effects of noise, visual disturbance and potential for spills, dust, and sedimentation.

Tidal habitat restoration could result in increased exposure of shorebirds and waterfowl to selenium. This effect would be addressed through the implementation of *AMM27 Selenium Management*, which would provide specific tidal habitat restoration design elements to reduce the potential for bioaccumulation of selenium and its bioavailability in tidal habitats.

Changes in water operations under water conveyance facilities would not be expected to result in increased mercury bioavailability or exposures to Delta foodwebs. Tidal habitat restoration could result in increased exposure of California least tern to methylmercury. There is potential for increased exposure of the foodwebs to methylmercury in these areas, with the level of exposure dependent on the amounts of mercury available in the soils and the biogeochemical conditions. This could result in a significant impact. However, the concentrations of methylmercury that are harmful varies by species, and the potential for increased exposure varies substantially within the study area. Implementation of Environmental Commitment 12 which contains measures to assess the amount of mercury before project development, followed by appropriate design and adaptation management, would minimize the potential for increased methylmercury exposure, and would result in no adverse effect on shorebirds and waterfowl.

Therefore, with AMM1–7, AMM27, and Environmental Commitment 12 in place, in addition to the implementation of Mitigation Measure BIO-75, the indirect effects of Alternative 4A implementation would not result in a substantial adverse effect through habitat modification or potential mortality. Therefore, the indirect effects of Alternative 4A implementation would have a less-than-significant impact on shorebirds and waterfowl.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

See Mitigation Measure BIO-75 under Impact BIO-75.

Common Wildlife and Plants

Common wildlife and plants are widespread, often abundant, species that are not all covered under laws or regulations that address conservation or protection of individual species. Common wildlife do have some level of protection under California Fish and Game Code and most bird species have protections under the Migratory Bird Treaty Act. Examples of common wildlife and plants occurring in the study area are provided within the discussion for each natural community type in Section 12.1.2.2, *Special-Status and Other Natural Communities*, of the Draft EIR/EIS. Impacts on common wildlife and plants would occur through the same mechanisms discussed for natural communities and special-status wildlife and plants for each alternative.

Impact BIO-184: Effects on Habitat and Populations of Common Wildlife and Plants

Effects on habitat of common wildlife and plants, including habitat removal and conversion, are discussed in the analysis of Alternative 4A effects on natural communities (Impacts BIO-1 through BIO-21. In general, effects on habitat of common wildlife and plants would not be adverse. Through the course of implementing the project over a 15-year time period, several natural communities and land cover types would be reduced in size, primarily from construction of the water conveyance facility, but also from restoration of other natural communities. Grassland, managed wetland and cultivated lands would be reduced in acreage, so the common species that occupy these habitats would be affected. However, the losses in acreage and value of these habitats would be offset by protection, restoration, enhancement, and management actions under Alternative 4A, including *Environmental Commitment 3 Natural Communities Protection and Restoration*, *Environmental Commitment 4 Tidal Natural Communities Restoration*, *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 7 Riparian Natural Community Restoration*, *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*, *Environmental Commitment 10 Nontidal Marsh Restoration*, and *Environmental Commitment 11 Natural Communities Enhancement and Management*. In addition, the AMMs contained in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and in Appendix D, *Substantive BDCP Revisions*, of this RDEIR/SDEIS would be in place to reduce or eliminate the potential to adversely affect both special-status and common wildlife and plants.

Direct effects on common wildlife and plants from constructing water conveyance facilities and implementing environmental commitments would include construction or inundation-related disturbances that result in injury or mortality of wildlife or plants and the immediate displacement of wildlife. Indirect effects include project-related disturbances to nearby wildlife and plants during construction (e.g., disruption of breeding and foraging behaviors from noise and human activity, habitat degradation from fugitive dust and runoff) and effects occurring later in time (e.g., collisions of birds with transmission lines, habitat fragmentation, vegetation management). Indirect effects could result both from construction and from operations and maintenance (e.g., ground disturbances could result in the spread and establishment of invasive plants).

NEPA Effects: The direct and indirect effects associated with implementing the environmental commitments of Alternative 4A would not be adverse because the environmental commitments and AMMs also expand and protect natural communities, avoid or minimize effects on special-status species, prevent the introduction and spread of invasive species, and enhance natural communities. These actions would result in avoiding and minimizing effects on common wildlife and plants as well.

CEQA Conclusion: Construction and operation of the water conveyance facilities and habitat restoration activities would have impacts on common wildlife and plants in the study area through habitat loss and through direct or indirect loss or injury of individuals. The loss of habitat would not be substantial, because habitat restoration would increase the amount and extent of habitat available for use by most common wildlife and plant species. Environmental commitments to avoid or minimize effects on special-status species, and to enhance natural communities also would result in avoiding and minimizing effects on common wildlife and plants. Consequently, implementation of Alternative 4A is not expected to cause any populations of common wildlife or plants to drop below self-sustaining levels, and this impact would be less than significant. No mitigation would be required.

Wildlife Corridors

Essential Connectivity Areas (ECAs) are lands likely to be important to wildlife movement between large, mostly natural areas at the state wide level. The ECAs form a functional network of wildlands that are considered important to the continued support of California's diverse natural communities. Four general areas were identified within the study area that contain ECAs (Figure 12-2). The BDCP also identified important landscape linkages in the Plan Area to guide reserve design, which can also be seen on Figure 12-2.

Impact BIO-185: Effects of Alternative 4A on Wildlife Corridors

Alternative 4A water conveyance facilities would cross two of the ECAs identified during the analysis, the Stone Lake-Yolo Bypass ECA and the Mandeville Island-Staten Island ECA.

The construction of Intakes 2 and 3, the rerouting of Hwy 160, temporary tunnel work areas, and RTM areas j would occur within the Stone Lake-Yolo Bypass ECA. These activities would result in the permanent loss of narrow strips of riparian vegetation along the Sacramento River and the permanent and temporary loss of cultivated lands. Alternative 4A would not substantially increase impediments to movement of any nonavian wildlife that could move from Stone Lakes to Yolo Bypass because the Sacramento River and Sacramento River Deep Water Ship Channel already create a barrier to dispersal for nonavian species. However, the conversion of riparian and cultivated lands and the presence of the intakes would locally constrict the north-south movement of nonavian terrestrial species in the area between the Sacramento River and the Southern Pacific Dredger Cut west of Stone Lakes, as well as the east-west movement between Stone Lakes and the east bank of the Sacramento River. No records of wildlife species were identified within these construction footprints, though there are several records for Swainson's hawk in the vicinity. Though there would be losses in Swainson's hawk foraging habitat and potential nesting habitat in these areas, these loses would not substantially impede the movements of Swainson's hawks in the area. The loss in habitat is addressed in the Swainson's hawk effects analysis.

The addition of temporary transmission lines within the Stone Lake-Yolo Bypass ECA, which would be in place for approximately 7 years, could adversely affect birds during periods of low visibility. Sandhill cranes that are known to roost at Stones Lakes could particularly be adversely affected by the addition of the north-south running transmission line to the west of Stone Lakes and by the east-west transmission line between Stone Lakes and the Cosumnes Preserve; however this line would generally parallel an existing transmission line. Because the proposed east-west transmission line parallels an existing line and would only be in place for approximately 7 years it would not likely create a barrier to the future movement of cranes in this area (see impact discussions for greater and lesser sandhill cranes).

The Alternative 4A conveyance facilities would also pass through the Mandeville Island-Staten Island ECA, which also has several know roost locations for greater sandhill crane. Within this ECA, Alternative 4A would result in the construction of a large RTM disposal area on Bouldin Island, permanent access roads on Bouldin and Mandeville Islands, and temporary transmission lines across most of the ECA. As discussed above, the temporary transmission lines could adversely affect the movement of cranes and other bird species during periods of low visibility. The RTM disposal area may create a physical barrier to movement for some species and could make this area unusable as wildlife habitat for close to 10 years during the tunnel construction. The access roads are mostly located on existing dirt and paved roads and would therefore not create any new physical barriers but could temporarily increase road mortality during periods of construction. The conveyance alignment at this location would be within the tunnel and thus not create a barrier to wildlife movement.

Alternative 4A conveyance facilities would create some localized disruption in wildlife movement and the temporary and permanent transmission lines would create additional barriers to movement for avian species during periods of low visibility. However, overall the Alternative 4A alignment would not create substantial barriers to movement between ECAs because the majority of the alignment consists of a tunnel that would be beneath riparian corridors, which are the most likely dispersal routes for terrestrial animals in the majority of the study area, and because the large surface impacts (the intakes) are in areas that already have barriers to movement for nonavian terrestrial species (Sacramento River and Sacramento River Deep Water Ship Channel).

Restoration activities may occur in some of the ECAs. These activities would generally improve the movement of wildlife within and outside of the study area. In addition, the preservation of restored lands (Environmental Commitment 3) and the enhancement and management of these areas (Environmental Commitment 11) would improve and maintain wildlife corridors within the study area.

NEPA Effects: Alternative 4A conveyance facilities would create local barriers to dispersal but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4A would not adversely affect wildlife corridors.

CEQA Conclusion: Alternative 4A conveyance facilities would create local barriers to dispersal and create barriers to safe movement of avian species during periods of low visibility but overall the restoration activities would improve opportunities for wildlife dispersal within the study area and between areas outside of the study area and therefore overall Alternative 4A would result in less-than-significant impacts on wildlife corridors.

Invasive Plant Species

The invasive plant species that primarily affect each natural community in the study area, which include water hyacinth, perennial pepperweed, giant reed, and Brazilian waterweed, are discussed in Section 12.1.4, *Invasive and Noxious Plant Species*, of the Draft EIR/EIS. Invasive species compete with native species for resources and can alter natural communities by altering fire regimes, hydrology (e.g., sedimentation and erosion), light availability, nutrient cycling, and soil chemistry but also have the potential to harm human health and the economy by adversely affecting natural ecosystems, water delivery, flood protection systems, recreation, agricultural lands, and developed areas (Randall and Hoshovsky 2000). The construction and restoration activities associated with Alternative 4A could result in the introduction or spread of invasive plant species by creating temporary ground disturbance that provides opportunities for colonization by invasive plants in the study area.

The primary mechanisms for the introduction of invasive plants as the result of implementation of Alternative 4A are listed here.

- Grading, excavation, grubbing, and placement of fill material.
- Breaching, modification, or removal of existing levees and construction of new levees.
- Modification, demolition, and removal of existing infrastructure (e.g., buildings, roads, fences, electric transmission and gas lines, irrigation infrastructure).
- Maintenance of infrastructure.
- Removal of existing vegetation and planting/seeding of vegetation.
- Maintaining vegetation and vegetation structure (e.g., grazing, mowing, burning, trimming).
- Dredging waterways.

Clearing operations and the movement of vehicles, equipment, and construction materials in the study area would facilitate the introduction and spread of invasive plants by bringing in or moving seeds and other propagules. These effects would result from four activities.

- Spreading chipped vegetative material from clearing operations over topsoil after earthwork operations are complete.
- Importing, distributing, storing, or disposing of fill, RTM, borrow, spoil, or dredge material.
- Traffic from construction vehicles (e.g., water and cement trucks) and personal vehicles of construction staff.
- Transport of construction materials and equipment within the study area and to/from the study area.

Table 12-4A-69 lists the acreages of temporary disturbance in each natural community in the study area that would result from implementation of Alternative 4A.

Table 12-4A-69. Summary of Temporary Disturbance in Natural Communities under Alternative 4A

Natural Community	Temporary Impacts (acres)
Tidal perennial aquatic	2,098
Tidal brackish emergent wetland	0
Tidal freshwater emergent wetland	15
Valley foothill riparian	31
Grassland	151
Inland dune scrub	0
Alkali seasonal wetland complex	0
Vernal pool complex	3
Other natural seasonal wetland	0
Nontidal freshwater perennial emergent wetland	6
Nontidal perennial aquatic	10
Managed wetlands	29
Cultivated lands	1,309
Total	**3,652**

Impact BIO-186: Adverse Effects on Natural Communities Resulting from the Introduction and Spread of Invasive Plant Species

Alternative 4A would have adverse effects on natural communities as a result of the introduction and spread of invasive plant species through implementation of water conveyance facilities, Environmental Commitment 3, Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, Environmental Commitment 9, Environmental Commitment 10 and AMM6. No adverse effects are expected from implementation of other project-related environmental commitments.

- *Water Facilities and Operations*: Construction of the Alternative 4A water conveyance facilities would result in the temporary disturbance of 3,652 acres that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 3 Natural Communities Protection and Restoration*: The restoration activities in the natural communities located in planned conservation areas would result in the temporary disturbance of restoration areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 4 Tidal Natural Communities Restoration*: The activities associated with the restoration of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland in ROAs would result in the temporary disturbance of tidal areas that would provide opportunities for colonization by invasive plant species. These adverse effects would be reduced by designing restoration projects to minimize the establishment of nonnative submerged aquatic vegetation, and early restoration projects would be monitored to assess the response of nonnative species to restoration designs and local environmental conditions. If indicated by monitoring results, the project proponents would implement invasive plant control measures in restored natural communities to help ensure the establishment of native marsh plain plant species. Additionally, the project proponents would actively remove submerged and floating aquatic vegetation in subtidal portions of tidal natural community restoration sites.
- *Environmental Commitment 6 Channel Margin Enhancement*: The temporary effects of channel margin enhancement were not estimated because specific locations for this activity and their areal extent have not been developed. Channel margin enhancement (Sacramento River between Freeport and Walnut Grove, San Joaquin River between Vernalis and Mossdale, Steamboat and Sutter Sloughs, and salmonid migration channels in the interior Delta) would result in the temporary disturbance of channel areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 7 Riparian Natural Community Restoration*: The restoration of valley/foothill riparian habitat would result in the temporary disturbance of riparian areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*: The restoration of vernal pool and alkali seasonal wetland complexes, primarily in CZ 8, would result in the temporary disturbance of grassland areas that would provide opportunities for colonization by invasive plant species.
- *Environmental Commitment 10 Nontidal Marsh Restoration*: Nontidal marsh restoration, which would take place through conversion of agricultural lands primarily in CZ 4, would result in the temporary disturbance of fallow agricultural areas that would provide opportunities for

colonization by invasive plant species. These adverse effects would be reduced by monitoring the development of marsh vegetation to determine if nonnative vegetation needs to be controlled to facilitate the establishment of native marsh vegetation or if restoration success could be improved with supplemental plantings of native species. If indicated by monitoring, nonnative vegetation control measures and supplemental plantings would be implemented.

- *Avoidance and Minimization Measures*: *AMM6 Spoils, Reusable Tunnel Material, and Dredged Material Disposal Plan* would have adverse effects if spoils, RTM, dredged material, or chipped vegetative materials containing viable invasive plant propagules are used as topsoil in uninfested areas.

The adverse effects that would result from the introduction and spread of invasive plants through colonization of temporarily disturbed areas would be minimized by implementation of Environmental Commitment 11, AMM4, AMM10, and AMM11.

Environmental Commitment 11 Natural Communities Enhancement and Management would reduce these adverse effects by implementing invasive plant control within the Alternative 4A restoration areas to reduce competition on native species, thereby improving conditions for special-status species, ecosystem function, and native biodiversity. The invasive plant control efforts would target new infestations that are relatively easy to control or the most ecologically damaging nonnative plants for which effective suppression techniques are available. In aquatic and emergent wetland communities, Brazilian waterweed, perennial pepperweed, barbgrass, and rabbitsfoot grass would be controlled (and tidal mudflats would be maintained). In riparian areas, invasive plant control would focus on reducing or eliminating species such as Himalayan blackberry, giant reed, and perennial pepperweed. In grassland areas, techniques such as grazing and prescribed burning may be used to decrease the cover of invasive plant species.

Implementation of AMM4, AMM10, and AMM11 would also reduce the adverse effects that could result from construction activities. The AMMs provide methods to minimize ground disturbance, guidance for developing restoration and monitoring plans for temporary construction effects, and measures to minimize the introduction and spread of invasive plants. AMM4 would involve the preparation and implementation of an erosion and sediment control plan that would control erosion and sedimentation and restore soils and vegetation in affected areas. The restoration and monitoring plans for implementation of AMM10 would involve methods for stockpiling, storing, and restoring topsoil, revegetating disturbed areas, monitoring and maintenance schedules, adaptive management strategies, reporting requirements, and success criteria. AMM10 would also include planting native species appropriate for the natural community being restored, with the exception of some borrow sites in cultivated lands that would be restored as grasslands.

AMM11 specifies that the project proponent would retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared do contain invasive plants, then chipped vegetation material from those areas would not be used for erosion control but would be disposed ~~of~~ to minimize the spread of invasive plant propagules (e.g., burning, composting). During construction of the water conveyance facilities and construction activities associated with the environmental commitments, construction vehicles and construction machinery would be cleaned prior to entering construction sites that are in or adjacent natural communities other than cultivated lands and prior to entering any Alternative 4A restoration sites or conservation lands other than cultivated lands. Vehicles working in or travelling off paved roads through areas with infestations of invasive plant species would be cleaned before travelling to other parts of the study area. Cleaning stations would be established at the perimeter of Alternative 4A activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring would include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species would be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.

***NEPA Effects*:** The implementation of AMM4, AMM10, and AMM11, and Environmental Commitment 11 would reduce the potential for the introduction and spread of invasive plants and avoid or minimize the potential effects on natural communities and special-status species; therefore, these effects would not be adverse.

***CEQA Conclusion*:** Under Alternative 4A, impacts on natural communities from the introduction or spread of invasive plants as a result of implementing Alternative 4A would not result in the long-term degradation of a sensitive natural community due to substantial alteration of site conditions and would, therefore, be considered less than significant. No mitigation would be required.

Compatibility with Plans and Policies

Impact BIO-187: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Laws, Plans, Policies, or Executive Orders Addressing Terrestrial Biological Resources in the Study Area

Constructing the water conveyance facilities and implementing associated environmental commitments for Alternative 4A have the potential for being incompatible with plans and policies related to managing and protecting terrestrial biological resources of the study area. A number of laws, plans, policies, programs, and executive orders that are relevant to actions in the study area provide guidance for terrestrial biological resource issues as overviewed in Section 12.2, *Regulatory Setting*, of the Draft EIR/EIS. This overview of plan and policy compatibility evaluates whether Alternative 4A would be compatible or incompatible with such enactments, rather than whether impacts would be adverse or not adverse, or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or executive order adopted to avoid or mitigate terrestrial biological resource effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 4A on terrestrial biological resources are addressed in the impacts on natural communities and species. The following is a summary of compatibility evaluations related to terrestrial biological resources for laws, plans, policies, and executive orders relevant to the project.

Federal and State Legislation

- The federal Clean Water Act, Endangered Species Act, Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, Rivers and Harbors Act and Marine Mammal Protection Act all contain legal guidance that either directly or indirectly promotes or stipulates the protection and conservation of terrestrial biological resources in the process of undertaking activities that involve federal decisionmaking. The goals and objectives contained in Alternative 4A that provide the major guidance for implementing the various project elements of Alternative 4A are all designed to promote the long-term viability of the natural communities, special-status species, and common species that inhabit the study area. While some of the environmental commitments of the alternative involve permanent and temporary loss of natural communities and associated habitats during facilities construction and expansion of certain natural communities, the long-term implementation of the project would provide for the long-term viability and expansion of the habitats and special-status species populations in the study area. Alternative 4A environmental commitments would be compatible with the policies and directives for terrestrial biological resources contained in these federal laws.

- The California Endangered Species Act, California Native Plant Protection Act, Porter-Cologne Water Quality Control Act, and Natural Communities Conservation Planning Act are state laws that have relevance to the management and protection of terrestrial biological resources in the study area. Each of these laws promotes consideration of wildlife and native vegetation either through comprehensive planning or through regulation of activities that may have an adverse effect on the terrestrial and aquatic natural resources of the state. Alternative 4A contains goals and objectives that have been developed to promote the species protection and natural resource conservation that are directed by these state laws. Alternative 4A environmental commitments would be compatible with the policies and directives contained in these laws.
- The *Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992* (*Delta Protection Act*) and the *Sacramento-San Joaquin Delta Reform Act*, which updated the Delta Protection Act, promote the maintenance and protection of natural resources and the protection of agricultural land uses in the Delta's primary zone through the goals and policies contained in the 2009 updated Land Use and Resources Management Plan (LURMP). While nothing in the LURMP is binding on state agencies that are project proponents, the LURMP does promote restoration and enhancement of habitats for the terrestrial and aquatic species of the Delta on public land. The project's goals and objectives would be compatible with these LURMP goals (Delta Protection Commission 2010).
- The *Suisun Marsh Preservation Act* of 1974 was designed to protect the Suisun Marsh for long-term use as wildlife habitat, with a goal of preserving and enhancing the quality and diversity of the Marsh's aquatic and wildlife habitats. Alternative 4A would not affect Suisun Marsh; therefore, it would be compatible with the intent of the Suisun Marsh Preservation Act.

Plans, Programs, and Policies

- *The Delta Plan*, which was developed by the Delta Stewardship Council in compliance with the 2009 Sacramento-San Joaquin Delta Reform Act, is mandated to achieve two co-equal goals: provide for a more reliable water supply for California and protect, restore, and enhance the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. The project is intended to contain water management and environmental commitments consistent with the Delta Plan. The Delta Stewardship Council will determine whether the project is compatible with the goals and objectives of the Delta Plan prior to its approval. The compatibility of the project with the Delta Plan is considered in detail in Section 13.2.2.2, *The Delta Plan*, of the Draft EIR/EIS.
- *California Wetlands Conservation Policy*, which was adopted by Executive Order in 1993, promotes a long-term gain in the quantity, quality and permanence of wetlands acreages and values in California. The project's environmental commitments that provide for an expansion of wetland acreage and quality in the Delta are compatible with the intent of the California Wetlands Conservation Policy.
- *The North American Waterfowl Management Plan* (*NAWMP*) and *Central Valley Joint Venture* (*CVJV*) strive to maintain and expand wetlands and uplands for waterfowl and shorebirds in the major basins of California's Central Valley. The NAWMP is a management plan jointly approved

by the United States and Canada in 1986. It contains general guidance from the principal wildlife management agencies of the two countries for sustaining abundant waterfowl populations by conserving landscapes through self-directed partnerships (joint ventures) that are guided by sound science. The CVJV is the joint venture established for overseeing NAWMP implementation in the Central Valley. The CVJV is made up of 21 conservation organizations, state and federal government agencies, and one corporation that have formed a partnership to improve the habitat conditions for breeding and nonbreeding waterfowl, breeding and nonbreeding shorebirds, waterbirds, and riparian-dependent songbirds in the Central Valley. The CVJV's 2006 Implementation Plan (Central Valley Joint Venture 2006) establishes conservation objectives and priorities for these bird groups within the basins of the Central Valley. The project study area includes all or portions of three Implementation Plan basins— the Delta, Yolo and Suisun basins. The 2006 Implementation Plan contains basin-specific objectives for wetland restoration, protection of existing wetland habitats, wetland enhancement, adequate power and water supplies for wetland management, agricultural land enhancement, farmland easements that maintain waterfowl food resources on agricultural land, and farmland easements that buffer existing wetlands from urban and residential growth.

Implementation of the Alternative 4A environmental commitments would result in reductions in cultivated land and managed wetland acreage in the Delta only; however, increases in tidal and nontidal wetlands in this basin would be another result. The project also contains a significant commitment to long-term protection of agricultural land (over 9,000 acres) for waterfowl, shorebirds and other sensitive wildlife species. The sum of these actions would be consistent with the objectives of the Implementation Plan.

- Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan, Cosumnes River Preserve Management Plan, Brannan Island and Franks Tract State Recreation Areas General Plan, and the Lower Sherman Island Wildlife Area Land Management Plan are primarily designed to preserve and enhance the natural resource and recreation qualities of these areas. Implementing Alternative 4A, especially construction of water conveyance facilities, and land modification associated with Environmental Commitment 4 restoration activities, could create temporary disruptions to the terrestrial biological resource management activities in these management areas. The ultimate goals of aquatic and terrestrial habitat enhancement and restoration contained in the project would be compatible with the long-term management goals of these areas. Proposed restoration areas in the Delta would be designed to be compatible with and to complement the current management direction for these areas and would be required to adapt restoration proposals to meet current policy established for managing these areas.
- *Suisun Marsh Preservation Agreement* and *Suisun Marsh Plan* are the most recent efforts by the state and federal agencies responsible for Suisun Marsh (the Marsh) to maintain its long-term viability as managed wetlands and wildlife habitat, consistent with the Suisun Marsh Preservation Act. Alternative 4A would not directly or indirectly affect the Suisun Marsh and its natural habitats; therefore, it would be consistent with the Plan's management goals.
- *California Aquatic Invasive Species Management Plan* does not address terrestrial invasive species. Implementation of the project's habitat management objectives affect terrestrial species that utilize study area aquatic habitats. These effects are positive in that the project's objectives are to control and remove invasive aquatic species that are detrimental to native aquatic and terrestrial species. Implementation of project's environmental commitments would be undertaken with the goal of avoiding any further spread of aquatic invasive species. Alternative

4A would, therefore, be compatible with the objectives of the California Aquatic Invasive Species Management Plan.

- *Habitat Conservation Plans and Natural Community Conservation Plans* are the subject of a detailed analysis in Section 12.3.3.18, *Effects on Other Conservation Plans*, in the Draft EIR/EIS. The analysis considers the compatibility of the alternatives with all HCPs and NCCPs that share planning area with the study area. The Alternative 4A study area overlaps geographically with six conservation plans. The water conveyance facilities construction actions would still overlap with the South Sacramento, San Joaquin, East Contra Costa and East Alameda County planning areas, but there would be little effect on implementation of the HCP/NCCPs for these areas. The environmental commitments associated with Alternative 4A would remove relatively small acreages of primarily cultivated land in all six of the overlapping plan areas (Yolo, Solano, South Sacramento, East Contra Costa, East Alameda and San Joaquin County HCP/NCCPs). The consistency analysis below indicates that the degree to which the competition for conservation lands would impact the conservation goals of other plans is limited. Alternative 4A would have much less risk from competition for conservation lands. In most cases, because of the flexibility for acquisition targets incorporated into Alternative 4A and other plans, the potential conflict would be manageable, and significant conflicts with the implementation of overlapping plans could be avoided. In certain cases, especially pertaining to similar restoration objectives, perceived conflicts may also represent opportunities for collaboration to jointly achieve similar conservation goals. Because implementing Alternative 4A would not result in a conflict with the provisions of an adopted HCP, NCCP or other approved local, regional or state habitat conservation plan, there would be a less-than-significant impact.

Executive Orders

- *Executive Order 11990: Protection of Wetlands* requires all federal agencies to consider wetland protection in their policies and actions. The project proposes to protect, enhance and expand the wetlands of the study area, and, therefore, would be compatible with Executive Order 11990.

- *Executive Order 13112: Invasive Species* directs federal agencies to prevent and control the introduction and spread of invasive species in a cost-effective and environmentally sound manner. Alternative 4A construction and restoration actions have the potential to both introduce and spread invasive species in the study area. Implementation of AMM11 described in this in Appendix D, *Substantive BDCP Revisions* of this RDEIR/SDEIS could make Alternative 4A implementation compatible with Executive Order 13112.

- *Executive Order 113443: Facilitation of Hunting Heritage and Wildlife Conservation* directs federal agencies whose activities affect public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities, and the management of game species and their habitat. Alternative 4A environmental commitments that involve conversion of cultivated land and managed wetland to tidal and nontidal wetlands and other natural communities would conflict with the hunting expansion and enhancement aspects of this executive order. Refer to Chapter 15, *Recreation*, of the Draft EIR/EIS for a detailed analysis of the effects of alternatives on hunting opportunities. The habitat protection and expansion environmental commitments of Alternative 4A would be compatible with the executive order's goal of facilitating the management of habitats for some game species.

NEPA Effects: The potential plan and policy incompatibilities of implementing Alternative 4A identified in the analysis above indicate the potential for a physical consequence to the environment.

The primary physical consequence of concern is the conversion of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the Shorebirds and Waterfowl analysis above, and no additional NEPA effects determination is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2, *Regulatory Setting*, of the Draft EIR/EIS for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

CEQA Conclusion: The potential plan and policy incompatibilities of implementing Alternative 4A identified in the analysis above indicate the potential for a physical consequence to the environment. The primary physical consequence of concern is the conversion of cultivated land and managed wetland to natural wetland and riparian habitat in the study area. The physical effects are discussed in the Shorebirds and Waterfowl analysis above, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices. The reader is referred to Section 13.2, *Regulatory Setting*, of the Draft EIR/EIS for a further discussion of the responsibilities of state and federal agencies to comply with local regulations, and a discussion of the relationship between plan and policy consistency and physical consequences to the environment.

4.3.9 Land Use

Impact LU-1: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: Incompatibility with land use regulations stemming from the construction of water conveyance structures under Alternative 4A would be identical to those described for Alternative 4.

Like Alternative 4, Alternative 4A would place temporary and permanent structures on lands designated for other uses by the general plans of Sacramento, San Joaquin, Contra Costa, and Alameda Counties. As described in Table 13-11 in Chapter 13, *Land Use*, of the Draft EIR/EIS, this would include 15 acres in Alameda County; almost 4,302 acres in Contra Costa County; 2,112 acres in Sacramento County; and 2,815 acres in San Joaquin County. The construction of the water conveyance facilities would require land use activities that would be incompatible with land use designations, goals and policies ascribed to the study area and for the purposes of reducing environmental impacts. To the extent that constructing Alternative 4A would result in incompatibilities with land use designations, goals and policies designed to avoid or reduce environmental effects, these potential incompatibilities are described in Chapter 13, *Land Use*, Section 13.3.3.9, Impact LU-1 in Appendix A of this RDEIR/SDEIS. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, to the extent that alternatives are incompatible with such land use designations, goals, and policies, any related environmental effects are discussed in other chapters.

CEQA Conclusion: These incompatibilities indicate the potential for a physical consequence to the environment. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, the physical effects they suggest are discussed in other chapters throughout this document. The relationship between plans, policies, and regulations and impacts on the physical environment is discussed in Section 13.3.1, *Methods for Analysis*, of the Draft EIR/EIS.

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: Effects related to conflicts with existing land uses under Alternative 4A would be identical to those described for Alternative 4. As for Alternative 4, construction and operation of physical facilities for water conveyance would create temporary or permanent conflicts with existing land uses (including displacement of existing structures and residences) because of the construction of permanent features of the facility. As described in Table 13-12 of Chapter 13, *Land Use*, 85 structures would be displaced, including 19 residential, 7 recreational, 50 storage/support, and 9 other structures (such as power/utility structures and bridges). Indirect impacts would primarily happen as a result of incompatibility with adjacent land uses or the loss or increased difficultly of access to parcels. Table 13-12 in Appendix A of this RDEIR/SDEIS, summarizes the estimated number of structures affected across structure type and alternative and Mapbook Figure M13-4 in the Mapbook Volume of the Draft EIR/EIS shows the distribution of these effects across the Modified Pipeline/Tunnel conveyance alignment.

The removal of a substantial number of existing permanent structures as a result of constructing the water conveyance facility would be considered a direct, adverse socioeconomic effect of this alternative under NEPA. When required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative, which would reduce the severity of economic effects related to this physical impact, but would not reduce the severity of the physical impact itself. Project conflicts with existing public structures under Alternative 4A are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential adverse effects on the environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential adverse effects on traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS.

CEQA Conclusion: Construction of the proposed water conveyance facility would necessitate the removal of a substantial number of existing permanent structures. The removal of existing structures is not, in itself, considered a significant environmental impact, though removal might entail economic impacts. Significant environmental impacts would only result if the structures qualified as "historical resources" or the removal of structures led to significant physical effects on certain other resources. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, such effects are discussed in other sections throughout the document. Project conflicts with existing public structures under Alternative 4A are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential impacts on the public and environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in Section 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential impacts on "historical resources" (including qualifying structures) and traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS. Where applicable, project proponents will provide compensation to property owners for losses due to implementation of Alternative 4A. This compensation would not constitute mitigation for any related physical impact; however, it would reduce the severity of economic effects.

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: Effects related to any potential division of an existing community as a result of the construction of water conveyance facilities under Alternative 4A would be identical to those described for Alternative 4. Construction of permanent facilities and associated work areas would be located around the community of Hood. A tunnel carrying water south from Intakes 2 and 3 to the intermediate forebay would be placed under the community. The tunnel would be constructed below the surface and would not interfere with the existing community; therefore, the alignment would not create a physical structure adjacent to or through the existing community. A temporary power line would be constructed around the northern, eastern, and southern sections of the community, which would provide power to the intake work areas during construction. Additionally, a temporary work area associated with construction of the conveyance facilities would be built adjacent to Hood on the southern side of the community, and would serve as a staging area during the construction phase. It would consist of facilities such as parking areas, offices, and construction equipment storage. Construction and the long-term placement of Intakes 3 and 5, although not adjacent to Hood, would be built about one-quarter mile north and one-half mile south of Hood, respectively, and would substantially alter the lands to the north and south of the community. While permanent physical structures adjacent to or through Hood are not anticipated to result from this alternative, activities associated with their construction could make it difficult to travel within and around Hood in certain areas for a limited period of time. Mitigation Measures TRANS-1a and TRANS-1b are available to address this effect. Additionally, the lasting placement of the intake facilities would represent physical structures that would substantially alter the setting of the community's surroundings, constituting an adverse effect.

CEQA Conclusion: During the construction of the tunnels between Intakes 3 and 5 and the intermediate forebay, construction activities would occur to the north and south of the community of Hood, and a proposed temporary power line would cross through portions of the community. Even though access to and from the community would be maintained over the long-term, the nearby construction of the temporary work area would substantially alter the setting of the community in the near term. Similarly, the nearby construction of Intakes 3 and 5, although not adjacent to Hood, would create permanent physical structures approximately one-quarter mile north and one-half mile south of Hood that would substantially alter the community's surroundings. These structures would therefore result in a significant and unavoidable impact. Implementation of Mitigation Measures TRANS-1a and TRANS-1b would reduce the severity of this impact by supporting continued access to and from the community on transportation routes; however, permanent structures in the community's vicinity would remain, and the impact would be significant and unavoidable.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in the Draft EIR/EIS.

Impact LU-4: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 4A related to incompatibility with applicable land use designations, goals, and policies resulting from implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar in mechanism to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would protect and restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6-10, as compared with 83,800 acres under Alternative 4. Up to 4.6 miles of channel margin habitat would be enhanced under Alternative 4A with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 4A would likely be substantially smaller than those associated with Alternative 4. Because Alternative 4A doesn't include those Conservation Measures, the BDCP will be treated as a covered activity under the Delta Plan. The consistency between this alternative and the Delta Plan is discussed in detail in Appendix G of this RDEIR/SDEIS.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land use designations, goals, and policies.

However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, local designations, goals, and policies related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations for the implementation of many of these land-intensive actions are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-5: Conflicts with Existing Land Uses as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects related to conflicts with existing land uses under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS and under Impact LU-4, above). While the location of each restoration and/or enhancement action is not known at this time, it is possible that implementing these measures may result in temporary (e.g., construction activities that may conflict with land designated as open space) or permanent (e.g., displacement of existing residents and removal of existing structures) physical conflicts with existing land uses in or immediately adjacent to the study area.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with land uses within and adjacent to the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, land uses related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations and types of restoration to be implemented are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would conflict with existing land uses or result in the permanent conversion of land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapters 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to conflict with existing land uses. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-6: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Effects related to the physical division of an existing community under Alternative 4A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS and under Impact LU-4, above). Because the locations for the implementation of these habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is not anticipated to be adverse.

CEQA Conclusion: Because the locations for the implementation of habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is anticipated to be less than significant.

4.3.10 Agricultural Resources

Impact AG-1: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The temporary and short-term conversion and permanent conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses would be identical to those described under Alternative 4 (as described in Chapter 14, *Agricultural Resources,* Section 14.3.3.9 in Appendix A of this RDEIR/SDEIS) and would constitute an adverse effect on the physical environment. Alternative 4A would result in the temporary or short-term conversion of approximately 1,495 acres of Important Farmland and 1,132 acres of land subject to Williamson Act contracts to other uses. Permanent features associated with this alternative could convert approximately 3,909 acres of Important Farmland and 2,035 acres of land subject to Williamson Act contracts to other uses. Mapbook Figure M14-7 in the Mapbook Volume of the Draft EIR/EIS shows all of the construction features (including temporary work areas) associated with this proposed water conveyance facility alignment along with Important Farmland. Disposal and reuse of RTM (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), along with Mitigation Measure AG-1, would be available to reduce these effects.

CEQA Conclusion: Construction of physical structures associated with the water conveyance facility proposed under this alternative would occupy Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones, directly precluding agricultural use for the duration of construction. Temporary and short-term construction of facilities would convert approximately 1,495 acres of Important Farmland and 1,132 acres of land subject to Williamson Act contracts or in Farmland Security Zones to other uses. Physical structures would also permanently convert approximately 3,909 acres of Important Farmland and 2,035 acres of land subject to Williamson Act contracts or in Farmland Security Zones to other uses. As described above and in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, it is anticipated that the RTM and dredged material would be removed from RTM storage areas (which represent a substantial portion of the permanent impact areas) and reused, as appropriate, as bulking material for levee maintenance, as fill material for habitat restoration projects, or other beneficial means of reuse identified for the material. Because these activities would convert a substantial amount of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses, however, they are considered significant impacts on the environment. Implementation of Mitigation Measure AG-1 would reduce these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4. For further discussion of potential incompatibilities with land use designations, see Section 4.3.9, *Land Use*, in this RDEIR/SDEIS.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in the Draft EIR/EIS.

Impact AG-2: Other Effects on Agriculture as a Result of Constructing and Operating the Proposed Water Conveyance Facility

Effects associated with construction and operation of the water conveyance facility under this alternative would be identical to those described under Alternative 4 in terms of effects related to seepage from the operation of forebays and from disruption of drainage and irrigation facilities during construction of water conveyance facilities. The conveyance alignment constructed under this alternative would cross or interfere with approximately 43 miles of agricultural delivery canals and drainage ditches. These activities could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas adjacent to forebays and through disruption of drainage and irrigation facilities.

Under Alternative 4A, Operational Scenarios H3 and H4, the operation of new physical facilities combined with hydrodynamic effects of habitat restoration activities could indirectly affect agriculture by causing changes to the quality of irrigation water in parts of the study area. Relative to Existing Conditions, Alternative 4A would result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and in the San Joaquin River at San Andreas Landing (Table EC-1 in Appendix B of this RDEIR/SDEIS). The percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions to 17–18% and the percent of days out of compliance would increase from 11% under Existing Conditions to 26–28%, depending on the operations scenario. The percent of days the San Andreas Landing EC objective would be exceeded would increase from 1% to 2% under Operational Scenario H3, and would decrease to 0% under Operational Scenario H4. The percent of days out of compliance with the EC objective for San Andreas Landing would increase from 1% to 4% for Operational Scenario H3, and would decrease to 0% under Operational Scenario H4.

As discussed in Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS, sensitivity analyses suggest that many of these modeled exceedances are a result of modeling artifacts or a result of operating rules used by the CALSIM II model under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements. In these cases, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions, as suggested by modeling results. In the case of San Andreas Landing, the small number of modeled exceedances not attributable to modeling artifacts would be small in magnitude, last only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, *Water Quality,* Section 8.3.1.1, in Appendix A of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). However, the results at Emmaton indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects on agricultural beneficial uses.

Average EC levels at the western and southern Delta compliance locations would decrease, except at Emmaton during the drought period, from 3–38% for the entire period modeled (1976–1991) and 3–32% during the drought period modeled (1987–1991) (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). At Emmaton, there would be an increase in average EC for the drought period of 4–5%, and a decrease of 5–7% for the entire period modeled. There would be increases in average EC at two interior Delta locations: the S. Fork Mokelumne River at Terminous average EC would increase 5% for the entire period modeled and 4% during the drought period modeled; and San Joaquin River at San Andreas Landing average EC would decrease 6% for the entire period modeled, but increase 1–3% during the drought period modeled. The geographic extent and magnitude of EC increases relative to Existing Conditions would be smaller than those described for Alternative 4 in Chapter 8, *Water Quality*, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS.

Relative to the No Action Alternative (ELT), the percent of days exceeding EC objectives or percent of days out of compliance would increase at the Sacramento River at Emmaton, San Joaquin River at San Andreas Landing, and Old River near Middle River and at Tracy Bridge (Table EC-1 in Appendix B of this RDEIR/SDEIS). The increase in percent of days exceeding the EC objective would be 5% or less at these locations, depending on the operational scenario (i.e., H3 or H4). The increase in percent of days out of compliance would be 7% or less at these locations, depending on the operational scenario.

In general, the changes in frequency of exceedances of EC objectives relative to the No Action Alternative (ELT) would be similar to those discussed above relative to Existing Conditions, and thus the conclusions of the sensitivity analyses discussed above extend to the comparison to the No Action Alternative (ELT). For the entire period and drought period modeled, average EC levels would increase at interior and southern Delta locations: the average EC increase would be 5% for the S. Fork Mokelumne River at Terminous and 1% or less in Old River at Middle River and Tracy Bridge (Tables EC-8A and EC-8B in Appendix B of this RDEIR/SDEIS). The geographic extent and magnitude of EC increases relative to the No Action Alternative (ELT) would be smaller than those described for Alternative 4 in Chapter 8, *Water Quality*, Section 8.3.3.9, in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Considered together, construction and operation of the water conveyance facility under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Water quality modeling results indicate that it is unlikely that there would be increased frequency of exceedance of agricultural EC objectives in the western, interior, or southern Delta. However, there could be increased long-term and drought period average EC levels during the summer months in the Sacramento River at Emmaton under Alternative 4A relative to the No Action Alternative, which could adversely affect agricultural beneficial uses. Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 (including Mitigation Measure WQ-11a) will reduce the severity of these adverse effects.

CEQA Conclusion: Water conveyance facility construction and operation could create a significant impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Water quality modeling results indicate that average EC levels at Emmaton would increase by up to 5% relative to Existing Conditions during the summer months of the drought period, and more generally in dry and critical water year types. The increases during the drought period could cause substantial degradation of water quality and thereby impact the agricultural beneficial uses in the western Delta. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse. The comparison to Existing Conditions reflects changes in EC due to both Alternative 4A operations and climate change/sea level rise.

Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 (including Mitigation Measure WQ-11a) will reduce the severity of these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; monitoring changes in groundwater levels during construction; offsetting water supply losses attributable to construction dewatering activities; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. Implementation of Mitigation Measure WQ-11 (including Mitigation Measure WQ-11a) would be expected to reduce the water quality effects on agricultural resources to a less-than-significant level. However, the impact related to conversion of Important Farmland would remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure WQ-11: Avoid, Minimize, or Offset, as Feasible, Reduced Water Quality Conditions

Please see Mitigation Measure WQ-11 under Impact WQ-11 in the discussion of Alternative 1A in Chapter 8, *Water Quality*, of the Draft EIR/EIS. (Mitigation Measure WQ-11b does not apply to Alternative 4A).

Mitigation Measure WQ-11a: Adaptively Manage Diversions at the North and South Delta Intakes to Reduce or Eliminate Water Quality Degradation in Western Delta

Please see Mitigation Measure WQ-11a under Impact WQ-11 in the discussion of Alternative 4A in Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS.

Impact AG-3: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 4A related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to approximately 15,548 acres of habitat under Environmental Commitments 3, 4, 6–10 as compared with 83,800 acres under Alternative 4. Channel margin enhancement would be implemented on up to 4.6 levee miles compared to 20 miles under Alternative 4. Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Installation of nonphysical fish barriers at Georgiana Slough may require conversion of a small area of Important Farmland for potential construction of an access road and/or storage facility. Conservation Measures 2, 5, 13, 20, and 21 would not be implemented as part of this alternative. Considered together, the magnitude of effects under Alternative 4A would likely be substantially smaller than those associated with Alternative 4.

NEPA Effects: Because locations have not been selected for many of these habitat restoration and enhancement activities, the precise extent of this effect is unknown. However, based on the large proportion of land in the Conservation Zones designated as Important Farmland and/or subject to Williamson Act contracts or in Farmland Security Zones, it is anticipated that a substantial area of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones would be directly converted to habitat purposes under this alternative, resulting in an adverse effect on the environment. While conflicts with or cancellation of Williamson Act contracts would not—by itself—constitute an adverse effect on the quality of the human environment, the related conversion of the underlying agricultural resource would result in such an effect. Mitigation Measure AG-1 would be available to lessen the severity of these potential effects. Also, under the provisions of Government Code §51223, it may be feasible to rescind Williamson Act contracts for agricultural use, and enter into open space contracts under the Williamson Act, or open space easements pursuant to the Open Space Easement Act. To the extent this mechanism is used, it would eliminate the Williamson Act conflicts otherwise resulting from changes from agriculture to restoration and mitigation uses. For further discussion of potential incompatibilities with land use policies, see Section 4.3.9, *Land Use*, of this RDEIR/SDEIS.

CEQA Conclusion: This alternative would restore up to 1,400 acres under environmental commitments geared toward the restoration of various natural communities. Additionally, up to 4.6 linear miles of channel margin habitat would be enhanced. Implementation of restoration activities and other conservation actions could result in conversion of a substantial amount of Important Farmland and conflict with land subject to Williamson Act contracts or in Farmland Security Zones, resulting in a significant impact on agricultural resources in the study area. Implementation of Mitigation Measure AG-1 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Impact AG-4: Other Effects on Agriculture as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 4A related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction,* of this RDEIR/SDEIS, Alternative 4A would restore up to approximately 15,548 acres of habitat as compared with 83,800 acres under Alternative 4. Channel margin enhancement would be implemented on up to 4.6 levee miles compared to 20 miles under Alternative 4. Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 20, and 21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 4A would likely be substantially smaller than those associated with Alternative 4, and effects on agricultural activities related to increased frequency of floodplain inundation would not occur.

Increased frequency of inundation associated with proposed tidal habitat restoration and channel margin habitat enhancement would result in increased groundwater recharge, which could result in groundwater level rises and soil saturation on adjacent lands, as described under Chapter 7, *Groundwater*, Impact GW-6, in Appendix A of this RDEIR/SDEIS. These conditions could limit agricultural production in certain areas. Conversely, in areas where the project results in a larger vertical distance between the water table and crop roots, plants with shallow roots may not be able to extract enough water to maintain optimal growth without modifying irrigation or drainage infrastructure. While the geographic incidence and potential severity of these effects are unknown and would depend on existing localized groundwater levels in the vicinity of sites chosen for restoration, they would be anticipated to create an adverse effect on agricultural resources if they were to substantially restrict agricultural uses.

As discussed in Section 4.3.4, *Water Quality*, under Impact WQ-12 in this RDEIR/SDEIS, implementation of these conservation actions would not introduce new sources of EC into the study area. Therefore, as they relate to salinity of irrigation water, these measures would not be anticipated to restrict agricultural uses within the study area. Implementation of tidal wetland restoration would increase the exchange of tidal water in restoration areas; however, consideration of this measure and its potential effects on electrical conductivity in the Delta has been incorporated in the assessment of water conveyance facility operations under Impact AG-2.

Construction activities and the permanent footprints associated with land acquired for habitat restoration or enhancement could directly or indirectly disrupt existing agricultural irrigation and drainage facilities throughout the study area. Where irrigation or drainage infrastructure is disconnected from the farmland it serves, agricultural uses could be substantially restricted. However, the location and severity of this effect would depend on site-specific conditions.

Restoration implemented under Alternative 4A could result in substantial changes in land use patterns in parts of the study area, which could indirectly affect some farmlands by causing changes to the microclimates surrounding sensitive agricultural crops. For example, large areas of tidal habitat could create a localized climate that would be less supportive of yields of certain crops adjacent to the areas. However, this effect is speculative and its potential severity would depend on site-specific conditions.

The project proponents would acquire and protect up to approximately 10,100 acres of cultivated lands and manage them for specific habitat values corollary to agricultural use for species including Swainson's hawk, giant garter snake, greater sandhill crane, white-tailed kite, and tricolored blackbird. While acquisition of these lands would protect agricultural uses on the majority of these lands, specific management actions implemented could reduce crop yields, restrict crop choices, and convert small portions of cultivated lands to nonagricultural uses, as described under Alternative 4. Overall, these effects would not be anticipated to result in the substantial restriction of agricultural uses.

NEPA Effects: Implementation of conservation actions under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. However, implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these adverse effects.

CEQA Conclusion: Implementation of conservation actions under this alternative could create a significant impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. Implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

4.3.11 Recreation

Impact REC-1: Permanent Displacement of Existing Well-Established Public Use or Private Commercial Recreation Facility Available for Public Access as a Result of the Location of Proposed Water Conveyance Facilities

NEPA Effects: The extent of the permanent displacement of public use or private commercial recreation areas located within the Delta occurring under Alternative 4A would be the same as described for Alternative 4, as described in Chapter 15, *Recreation,* Section 15.3.3.9 in Appendix A of this RDEIR/SDEIS. The recreation areas that could be adversely affected are the Cosumnes River Preserve and Clifton Court Forebay. Recreation could be disrupted at the Cosumnes River Preserve by placing an RTM area to the north of the preserve, constructing an east-west permanent transmission line adjacent to the northern boundary of the preserve, and locating permanent tunnel shafts on the preserve. Modifications made to Clifton Court Forebay would disrupt recreation activities occurring on and near the forebay's south embankment. Other potential impacts along the alignment of the water conveyance facility include disruption of use of portions of Staten Island and use of DWR ponds currently used for water ski instruction and hound racing. As described in detail under Alternative 4, construction of the water conveyance facilities under Alternative 4A would not result in an adverse effect on public use or private commercial recreation facilities because none of these facilities would be permanently displaced.

CEQA Conclusion: The extent of permanent displacement of public use or private commercial recreation areas under Alternative 4A would be the same as discussed for Alternative 4 because the type and alignment of the water conveyance facilities are identical between the two alternatives. This includes placing permanent facilities on or disrupting access to the Cosumnes River Preserve, including public access to portions of Staten Island. Similarly, recreation use of the Clifton Court Forebay embankments would be disrupted during construction. Specifically, public access to the forebay's south embankment, which supports fishing and hunting, would be disrupted during construction. Alternative 4A would not result in the permanent displacement of well-established public use or private commercial recreation facilities available for public access. The impact on these facilities would be less than significant and no mitigation is required.

Impact REC-2: Result in Long-Term Reduction of Recreation Opportunities and Experiences as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction of recreation experiences within the Delta as a result of construction the water conveyance facilities under Alternative 4A would be the same as described for Alternative 4. Two recreation sites, Clifton Court Forebay and Cosumnes River Preserve, are within the construction footprint and six recreation sites or areas (Stone Lakes National Wildlife Refuge, Clarksburg Boat Launch, Wimpy's Marina, Delta Meadows, Bullfrog Landing Marina, and Lazy M Marina) are within the 1,200- to 1,400-foot indirect impact area. Potential indirect effects on recreation include loss of access, construction noise, and changes in the visual character of the area surrounding the recreation sites.

As discussed in detail under Alternative 4, impacts on recreation occurring within the Stone Lakes NWR would be attributable to noise and changes in visual character as a result of temporary work areas, RTM storage, geotechnical exploration, construction of Intakes 2 and 3, and construction of the temporary transmission lines. Recreation activities that could be adversely affected include wildlife and environmental education.

The Clarksburg Boat Launch is on the west bank of the Sacramento River across the river from the site of Intake 3. Although access to the boat launch would be maintained during the construction period, noise generated during construction and geotechnical testing could adversely affect use of the public access areas near the boat launch for fishing or other activities.

As discussed under Alternative 4, impacts on recreation opportunities occurring within the Cosumnes River Preserve would include disruption of wildlife viewing and docent-guided tours. Although no recreation opportunities would be permanently displaced, recreation opportunities occurring within portions of the preserve could be adversely affected during construction as result of the introduction of noise, light, and temporary facilities such as access roads, safe haven work sites, and tunnel shaft with temporary work areas.

Wimpy's Marina is a private boating facility located on the south fork of the Mokelumne River southeast of Walnut Grove. Geotechnical exploration would occur along the tunnel corridor for approximately 2.5 years and would introduce noise that would adversely affect recreation occurring at the marina.

As discussed in detail under Alternative 4, recreation occurring at Delta Meadows could be affected by geotechnical testing and construction and operation of the intermediate forebay and spillway. These features would generate noise and introduce visual disturbances to the recreation site.

Recreation occurring at the Bullfrog Landing Marina on Middle River could be affected by noise and visual disturbance as a result of constructing the water conveyance across Bacon Island. This would include impacts from constructing a temporary access road on the island as well as a temporary safe haven work area. Anglers on the river between the marina and the construction area would also experience noise and visual disturbances during construction.

On-water recreation opportunities not associated with formal recreation sites could be affected by the introduction of noise and light during the construction period. The quality of recreation opportunities in the vicinity of construction sites may be adversely affected by noise and changes in visual character.

As discussed in detail under Alternative 4, recreation opportunities, including fishing and hunting, could be adversely affected by expanding Clifton Court Forebay. Recreation would be adversely affected because access to the forebay would not be allowed during construction.

Construction of Alternative 4A intakes and water conveyance facilities would result in disruption to recreational opportunities. Indirect effects on recreation experiences may occur as a result of impaired access, construction noise, or negative visual effects. Overall, construction and geotechnical exploration may occur year-round and last from 2.5 to 13.5 years at individual construction sites near recreation sites or areas and in-river construction would be primarily limited to June 1 through October 31 each year, which would result in a long-term reduction of recreational opportunities or experiences. Mitigation measures (REC-2, BIO-75, AES-1a, AES-1b, AES-1c, AES-1d, AES-1e, AES-1f, AES-1g, AES-4a, AES-4b, AES-4c, TRANS-1a, TRANS-1b, TRANS-1c, NOI-1a, and NOI-1b) are available to address adverse effects on recreation resulting from introduction of noise and light and the loss of access. However, due to the length of time that construction would occur and the dispersed effects across the Delta, the direct and indirect effects related to temporary disruption of existing recreational activities at facilities within the impact area would be adverse.

CEQA Conclusion: Construction of the Alternative 4A intakes and related water conveyance facilities would result in permanent and long-term (i.e., lasting over 2 years) impacts on well-established recreational opportunities and experiences in the study area because of access, noise, and visual setting disruptions that could result in loss of public use. These impacts would occur year-round. The mitigation measures described below, in combination with environmental commitments, would reduce some construction-related impacts by compensating for effects on wildlife habitat and species; minimizing the extent of changes to the visual setting, including nighttime light sources; manage construction-related traffic; and implementing noise reduction and complaint tracking measures. However, the level of impact would not be reduced to a less-than-significant level because it is not certain the mitigation would reduce the level of these impacts to less than significant in all the instances occurring within the entire study area. Therefore, these impacts are considered significant and unavoidable.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation* of the Draft EIR/EIS.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

Please see Mitigation Measure BIO-75 under Impact BIO-75 in the discussion of Alternative 4 in Chapter 12, *Biological Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources* of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see to Mitigation Measure AES-1c under Impact AES-1in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Please see Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please see Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please see Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please see Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please see Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact REC-3: Result in Long-Term Reduction of Recreational Navigation Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction in recreational navigation opportunities as a result of constructing the proposed water conveyance facilities under Alternative 4A would be identical to Alternative 4. Construction activities associated with constructing the three intakes on the Sacramento River, siphons near Clifton Court Forebay, Head of Old River barrier and operating barges and constructing temporary barge unloading facilities at Snodgrass Slough, Potato Slough, San Joaquin River, Middle River, Connection Slough, Old River, and the West Canal would disrupt boat passage and navigation at and near these sites. Although implementing Mitigation Measure TRANS-1a and helping to fund measures to reduce aquatic weeds would reduce impacts on recreational navigation, these effects would remain adverse because of the long duration of construction which would continually reduce recreation opportunities and distract from experiences occurring near construction activity.

CEQA Conclusion: Impacts on recreational navigation during construction of the water conveyance facilities under Alternative 4A would be identical to those described under Alternative 4. Impeding boat passage and navigation and resulting impacts on recreation would occur during construction of the intakes, temporary barge unloading facilities, and siphons. Although Mitigation Measure TRANS-1a would reduce impacts on navigation associated with barge unloading facilities and participating in the aquatic weed reduction program would help address impacts on navigation, the impact of constructing the water conveyance facilities would be considered significant and unavoidable.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact REC-4: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of changes in sport fishing opportunities occurring within the study area under Alternative 4A would be the same as Alternative 4. Constructing water intakes, siphons, and operable barrier and placement and use of barge unloading facilities during tunnel/pipeline construction would result in temporary water quality effects (e.g., turbidity, accidental spills, disturbance of contaminated sediments); elevated underwater noise (associated with pile driving and other construction activities); fish exposure to stranding and direct physical injury; and temporary exclusion or degradation of spawning and rearing habitats. Expanding Clifton Court Forebay would restrict access to bank fishing sites during the construction period. Although fish populations likely would not be affected to the degree that the abundance of sport fish would be substantially reduced, construction conditions would introduce noise and visual disturbances that would affect the recreation experience for anglers.

Although construction would occur for more than 2 years and cause a long-term reduction in fishing opportunities at one recreational site, construction of the proposed water conveyance facilities would not affect most fishing opportunities throughout the Delta. Additionally, mitigation measures are available to enhance and ensure access to nearby fishing sites and to address noise and visual disturbances.

Construction of the water conveyance facilities would not result in a long-term adverse effect on fishing opportunities because the effects would be limited to construction sites and would not limit fishing opportunities occurring in other parts of the Delta. Mitigation Measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would help reduce or avoid impacts on recreational fishing occurring at construction sites.

CEQA Conclusion: The impact on recreational fishing opportunities as a result of constructing the water conveyance facilities under Alternative 4A would be the same as Alternative 4. The combined impact on recreational fishing opportunities would be considered significant. Implementing mitigation measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would reduce the impact on recreational fishing to a less-than-significant level by providing alternate fishing sites, reducing noise generated during construction activities, and limiting changes in the visual character of recreational fishing sites.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under, Alternative 1A in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact REC-5: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of the Operation of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of operating the water conveyance facilities on recreational fishing opportunities under Alternative 4A would be the same as described under Alternative 4, because the same conveyance facilities would be built under Alternative 4A as under Alternative 4 and the operational scenarios analyzed under Alternative 4 cover the range of operational scenarios under Alternative 4A. Operation of Alternative 4A may result in changes in entrainment, spawning, rearing, and migration. However, effects on fish species that are popular for recreational fishing are not of a nature/level that will adversely affect recreational fishing. While there are some significant impacts on specific non-listed species, as discussed in Section 4.3.7, *Fish and Aquatic Resources*, of this RDEIR/SDEIS they are typically limited to specific rivers and not the population of that species as a whole. The effect is not adverse because it would not result in a substantial long-term reduction in recreational fishing opportunities.

CEQA Conclusion: The potential impact on covered and non-covered sport fish species from operation of Alternative 4A would be considered less than significant because any impacts on fish and, as a result, impacts on recreational fishing, are anticipated to be isolated to certain areas and would not affect the abundance of popular sport fish.

Impact REC-6: Cause a Change in Reservoir or Lake Elevations Resulting in Substantial Reductions in Water-Based Recreation Opportunities and Experiences at North- and South-of-Delta Reservoirs

NEPA Effects: The methodology for assessing effects on recreation at major upstream storage reservoirs for Alternative 4A is the same as applied to Alternative 4 with the exception that Alternative 4A includes only Operational Scenarios H3 and H4. The results of this assessment are shown in Tables 4.3.11-1 and 4.3.11-2 below.

Existing Conditions (CEQA Baseline) Compared to Alternative 4A ELT (2025)

Under Alternative 4A Operational Scenarios H3 and H4 recreation thresholds would be exceeded more frequently at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs relative to Existing Conditions. These changes represent a greater than 10% increase in the frequency the recreation thresholds are exceeded under Operational Scenario H3 and H4 at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs, compared to Existing Conditions. However, as discussed in Section 15.3.1, *Methods for Analysis*, of the Draft EIR/EIS these changes in SWP/CVP reservoir elevations are primarily attributable to change in demand and other external factors such as sea level rise and climate change. It is not possible to specifically define the exact extent of the changes due to implementation of the action alternative using these model simulation results. Thus, the precise contributions of the external factors to the total differences between Existing Conditions and Alternative 4A Operational Scenarios H3 and H4 cannot be isolated in this comparison. Please refer to the comparison of the No Action Alternative (ELT) to Alternative 4A for a discussion of the potential effects on end-of-September reservoir and lake elevations attributable to operation of Alternative 4A.

Existing Conditions (CEQA Baseline) Compared to Alternative 4A LLT (2060)

Under Alternative 4A Operational Scenarios H3 and H4 recreation thresholds would be exceeded more frequently at Trinity, Shasta, Oroville, Folsom, New Melones, and San Luis Reservoirs relative to Existing Conditions. These changes represent a greater than 10% increase in the frequency the recreation thresholds are exceeded under Operational Scenario H3 at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs and under Operational Scenario H4 at Trinity, Shasta, Oroville, Folsom, New Melones, and San Luis Reservoirs. However, as discussed in Section 15.3.1, *Methods for Analysis*, of the Draft EIR/EIS these changes in SWP/CVP reservoir elevations are primarily attributable to change in demand and other external factors such as sea level rise and climate change. It is not possible to specifically define the exact extent of the changes due to implementation of the action alternative using these model simulation results. Thus, the precise contributions of the external factors to the total differences between Existing Conditions and Alternative 4A Operational Scenarios H3 and H4 cannot be isolated in this comparison.

No Action Alternative (ELT) Compared to Alternative 4A

The comparison of Alternative 4A to the No Action Alternative (ELT) condition most closely represents changes in reservoir elevations that may occur as a result of operation of Alternative 4A because both conditions external factors such as change in demand and sea level rise and climate change (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS). As shown in Table 4.3.11-1 and Table 4.3.11-2, below, Alternative 4A Operational Scenarios H3 and H4 would result in changes in the frequency with which the end-of-September reservoir levels at Trinity, Shasta, Oroville, Folsom, New Melones, and San Luis Reservoirs would fall below levels identified as important water-dependent recreation thresholds. The CALSIM II modeling results indicate that reservoir levels under Alternative 4A operations would either not change or would fall below the individual reservoir recreation thresholds less frequently than under No Action Alternative (ELT) conditions at Trinity, Shasta, Oroville, and New Melones Reservoirs. Operation of Alternative 4A would not adversely affect water-dependent or water-enhanced recreation at these reservoirs. Overall, these conditions represent improved recreation conditions under operation of Alternative 4A because there would be slightly fewer years in which end-of-September reservoir levels would fall below the recreation thresholds thus indicating better boating opportunities, when compared to No Action Alternative (ELT) conditions.

The modeling result for Folsom Reservoir indicates there could be up to 3 and 2 additional years under Alternative 4A Operational Scenarios H3 and H4, respectively, during which the reservoir level would fall below the reservoir's boating threshold at the end of September. The incremental change would not exceed the 10% increase in the frequency threshold that would indicate an adverse impact on recreation occurring at the reservoir.

The modeling results for San Luis Reservoir indicate there could be up to 23 and 45 additional years under Alternative 4A Operational Scenarios H3 and H4, respectively, during which the reservoir level would fall below the reservoir boating threshold at the end of September relative to the No Action Alternative (ELT) condition. This is a greater than 10% change and would be considered a substantial reduction in recreational boating opportunities at San Luis Reservoir. Shoreline fishing would still be possible, and other recreation activities at the reservoir—picnicking, biking, hiking, and fishing—would be available. The reduction in surface elevations at San Luis Reservoir under Operational Scenarios H3 and H4 would result in an adverse impact on recreation occurring at the reservoir by restricting access by boaters. Mitigation Measure REC-6 would be available to address this effect.

CEQA Conclusion: This impact on water-dependent and water-enhanced recreation opportunities at north- and south-of-Delta reservoirs would be less than significant because, with the exception of San Luis Reservoir, the CALSIM II modeling results indicate that reservoir levels attributable to Alternative 4A operations would either slightly decrease (Folsom Reservoir) or would fall below the individual reservoir thresholds less frequently than under No Action Alternative (ELT). These changes in reservoir and lake elevations would result in a less-than-significant impact on recreation opportunities and experiences at Trinity, Shasta, Oroville, Folsom, and New Melones Reservoirs. At Trinity, Shasta, Oroville, and Folsom Reservoirs, because there would be fewer years in which the reservoir or lake levels fall below the recreation threshold relative to No Action Alternative (ELT) conditions, these effects would be considered beneficial to recreation opportunities and experiences. At Trinity, Shasta, Oroville, Folsom, New Melones, and San Luis Reservoirs, there would be more years in which the reservoir or lake levels fall below the recreation threshold at Late Long Term relative to Existing Conditions. However, as discussed in Section 15.3.1, *Methods for Analysis*, of the Draft EIR/EIS these changes in SWP/CVP reservoir elevations are primarily attributable to change in demand and other external factors such as sea level rise and climate change. It is not possible to specifically define the exact extent of the changes due to implementation of the action alternative using these model simulation results. Operation of Alternative 4A would not substantially affect water-dependent or water-enhanced recreation at these reservoirs. At San Luis Reservoir, the reduction in reservoir access by boaters under Operational Scenarios H3 and H4 would be significant because it is a greater than 10% change and could result in a significant impact on recreation. Mitigation Measure REC-6 would reduce this impact to less than significant.

Mitigation Measure REC-6: Provide a Temporary Alternative Boat Launch to Ensure Access to San Luis Reservoir

Consistent with applicable recreation management plans, DWR and Reclamation will work with DPR to establish a boat ramp extension at or near the Basalt boat launch or other alternative boat ramp site at San Luis Reservoir to maintain reservoir access in years when access becomes unavailable.

Table 4.3.11-1. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 4A

	Recreation Threshold[a]								
	Trinity Lake			Shasta Lake			Lake Oroville		
	<2,270 ft Elevation			<967 ft Elevation			<700 ft Elevation		
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)
Existing Condition (CEQA)	21			17			17		
No Action Alternative (ELT)	32	11		22	5		26	9	
Alternative 4A (ELT)									
Operational Scenario H3	29	8	-3	22	5	0	21	4	-5
Operational Scenario H4	29	8	-3	20	3	-2	24	7	-2
Alternative 4A (LLT)									
Operational Scenario H3	41	20		28	11		29	12	
Operational Scenario H4	40	18		24	7		35	18	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action Alternative ELT). A positive change would indicate more years with reduced recreation opportunities.

Table 4.3.11-2. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 4A

	Recreation Threshold[a]								
	Folsom Lake <405 ft Elevation			New Melones Lake <900 ft Elevation			San Luis Reservoir <360 ft Elevation		
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action ELT (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action ELT (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action ELT (CEQA/ NEPA)
Existing Condition (CEQA)	22			9			3		
No Action (ELT)	33	11		8	-1		9	6	
Alternative 4A (ELT)									
Scenario H3	36	14	3	8	-1	0	32	29	23
Scenario H4	35	13	2	9	0	1	54	51	45
Alternative 4A (LLT)									
Operational Scenario H3	44	22		13	4		37	34	
Operational Scenario H4	47	25		12	3		55	52	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action ELT). A positive change indicates more years with reduced recreation opportunities relative to the comparison condition. A negative change indicates fewer years with reduced recreation opportunities relative to the comparison condition.

Impact REC-7: Result in Long-Term Reduction in Water-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on water-based recreation under Alternative 4A would be the same as described under Alternative 4. These potential effects would occur as a result of regular maintenance activities of the intakes. The effect on boating is not considered adverse because the boat passage around the intakes would be maintained and disruption of boat access in the immediate vicinity of the intakes would be short-term.

CEQA Conclusion: Effects on recreation resulting from the maintenance of intake facilities would be short-term and intermittent and would not result in significant impacts on boat passage, navigation, or water-based recreation within the vicinity of the intakes.

Impact REC-8: Result in Long-Term Reduction in Land-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on land-based recreation under Alternative 4A would be the same as described under Alternative 4. Maintenance activities would be short-term and intermittent, occur within the immediate vicinity of water conveyance facility, and are not expected to generate noise that would distract from adjacent recreation opportunities. Therefore, there would be no effects on recreation opportunities as a result of maintenance of the proposed water conveyance facilities.

CEQA Conclusion: Maintenance of conveyance facilities would be short-term and intermittent and would not result in any changes to land-based recreational opportunities. Therefore, there would be no impact and no mitigation would be required.

Impact REC-9: Result in Long-Term Reduction in Fishing Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 4A would result in effects on fishing opportunities similar to those described for Alternative 4. The magnitude of the effects occurring under Alternative 4A would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions (Environmental Commitments 3, 4, 6–12, 15, and16) occurring in the Plan Area would be much less than the conservation measures proposed under Alternative 4. Construction, operation, and maintenance of the conservation and stressor reduction components could have affects that would be similar in nature to those discussed above for construction, operation, and maintenance of proposed water conveyance facilities. Although similar in nature, the potential intensity of any effects would likely be substantially lower because the nature of the activities associated with implementing the conservation and stressor reduction components would be much less when compared to Alternative 4. In addition, the conservation and stressor reduction components would be expected to result in long-term benefits to aquatic species.

During the implementation stage, construction activity associated with the conservation and stressor reduction components could result in adverse effects on recreation by temporarily or permanently limiting access to fishing sites and disturbing fish habitat. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would not be considered adverse because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance. Therefore, overall, there would not be an adverse impact to fishing opportunities in the long-term.

CEQA Conclusion: Conservation and stressor reduction components would be expected to improve fishing opportunities within the Plan Area. The adverse and beneficial impacts would be similar to those described under Alternative 4, however the extent of those impacts would be much less because the restoration actions occurring under Alternative 4A would include much less acreage and a smaller geographic scope than the conservation measures described under Alternative 4. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would be considered less than significant because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance.

Impact REC-10: Result in Long-Term Reduction in Boating-Related Recreation Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 4A would result in effects on boating-related recreation similar to the effects discussed under Alternative 4 for implementing conservation measures. However, the extent of the effects on boating under Alternative 4A would be much less because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less when compared to Alternative 4. Restoration of channel margin enhancement, riparian natural community, and nontidal marsh could provide increased boating opportunities within the study area.

CEQA Conclusion: Channel modification and other activities associated with implementation of some of the conservation and stressor reduction components may limit some opportunities for boating and boating-related recreation by reducing the extent of navigable water available to boaters. However, overall the conservation and stressor reduction components would also lead to an enhanced boating experience by expanding the extent of waterways available to boaters. Overall, these measures would not be anticipated to result in a long-term reduction in boating-related recreation activities; therefore, this impact is considered less than significant.

Impact REC-11: Result in Long-Term Reduction in Upland Recreational Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 4A would result in effects on upland recreational opportunities similar to Alternative 4. However, the extent of these effects occurring under Alternative 4A would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less. The actions could benefit the same types of recreation opportunities (e.g., hunting, hiking, walking, wildlife viewing, botanical viewing, nature photography, picnicking, and sightseeing) as described for Alternative 4, however the recreational benefits accruing from these actions would be much less because of the smaller acreage that would be restored. Conversely, the conservation and stressor reduction actions could adversely affected established recreation activities that would no longer be possible or compatible with restoration. These potential adverse effects would be would be similar to those described under Alternative 4, however the effects are expected to be much less because of the smaller total acreage that would be restored.

Implementing the conservation and stressor reduction components could result in an adverse effect on recreation opportunities by reducing the extent of upland recreation sites and activities available to hiking, nature photography, or other similar activity. However, implementation of the measures would also restore or enhance new potential sites for upland recreation thereby potentially improving the quality of recreational opportunities. Therefore, overall, there would not be an adverse impact.

CEQA Conclusion: Similar to Alternative 4, site preparation and earthwork activities occurring under Alternative 4A required to implement the conservation and stressor reduction components could temporarily limit or disrupt opportunities for upland recreational. These impacts on upland recreational opportunities would be considered less than significant because—similar to Alternative 4—environmental commitments incorporated into the project would require the project proponents to consult with CDFW to expand wildlife viewing, angling, and hunting opportunities as an element of the conservation and stressor reduction components. These components would not be anticipated to result in a substantial long-term disruption of upland recreational activities; thus, this impact is considered less than significant.

Impact REC-12: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Recreation Resources

NEPA Effects: Similar to Alternative 4A, constructing the water conveyance facilities and implementing the conservation and stressor reduction components under Alternative 4A could result in incompatibilities with plans and policies that address recreation. A number of plans and policies that coincide with the study area provide guidance for recreation resource issues are overviewed in Chapter 15, *Recreation*, Section 15.2, *Regulatory Setting*, of the Draft EIR/EIS. This overview of plan and policy compatibility evaluates whether Alternative 4A is compatible or incompatible with such enactments, rather than whether impacts are adverse or not adverse or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or regulation adopted to avoid or mitigate recreation effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 4A on recreation resources are addressed in Impacts REC-1 through REC-11, and in other sections, such as Section 4.3.19, *Noise*, and Section 4.3.13, *Aesthetics and Visual Resources*, of this RDEIR/SDEIS. A summary of the compatibility evaluations related to recreation resources for plans and policies is contained in the analysis of Alternative 4 and is applicable to Alternative 4A. Generally the evaluation found that implementing Alternative 4A would not be compatible with some provisions of The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992 and some policies of the Sacramento, San Joaquin, Contra Costa, and Alameda Counties general plans that address recreation.

CEQA Conclusion: The incompatibilities identified in the analysis indicate the potential for a physical consequence to the environment. The physical effects are discussed in Alternative 4A, impacts REC-1 through REC-11, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices.

4.3.12 Socioeconomics

Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities

The regional economic effects on employment and income in the Delta region during construction of Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are identical. Under Alternative 4A, direct construction employment is anticipated to vary over the 14-year construction period with an estimated 66 full time equivalent (FTE) jobs in the first year and 486 FTE jobs in the final year of the construction period. Construction employment is estimated to peak at 2,278 FTE jobs in year 9. Total employment (direct, indirect, and induced) would peak in year 12, at 8,673 FTE jobs.

The footprint of conveyance and related facilities such as roads and utilities would remove some existing agricultural land from production, so the effects on employment and income would be negative. Direct agricultural employment would be reduced by an estimated 16 FTE jobs, while total employment (direct, indirect, and induced) associated with agricultural employment would fall by 57 FTE jobs. Based on the crop production values changes described in Impact ECON-6 for construction effects, the direct agricultural job losses would more likely be concentrated in the vegetable, truck, orchard, and vineyard crop sectors, which are relatively labor intensive, than in the grain, field, and forage crop sectors, where more jobs are mechanized. Mapbook Figures M14-7 and M14-8 in the Mapbook Volume of the Draft EIR/EIS display areas of Important Farmland and lands under Williamson Act contracts that could be converted to other uses due to the construction of water conveyance facilities for the Modified Pipeline/Tunnel alignment.

The Alternative 4A construction footprint would not result in the abandonment of any active producing natural gas wells in the study area, as described in Section 4.3.22, *Minerals*, Impact MIN-1 in this RDEIR/SDEIS. Therefore, this alternative would not be anticipated to result in the loss of employment or labor income associated with monitoring and maintaining these wells.

NEPA Effects: Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would temporarily increase total employment and income in the Delta region. The change would result from expenditures on construction, increasing employment, and from changes in agricultural production, decreasing employment. Changes in recreational expenditures and natural gas well operations could also affect regional employment and income, but these have not been quantified. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts within the meaning of CEQA would only result if the changes in regional economics cause reasonably foreseeable physical impacts. Such environmental effects are discussed in other sections throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed under Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources*, of this RDEIR/SDEIS; changes in recreation related activities are addressed under Impacts REC-1 through REC-4 in Section 4.3.11, *Recreation*, of this RDEIR/SDEIS; abandonment of natural gas wells is addressed under Impact MIN-1 in Section 4.3.22, *Mineral Resources*, of this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, in Appendix A of this RDEIR/SDEIS.

Impact ECON-2: Effects on Population and Housing in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on population and housing in the Delta region during construction of Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are identical.

Construction of conveyance facilities would require an estimated peak of 2,278 workers in year 9 of the assumed 14-year construction period. It is anticipated that many of these new jobs would be filled from within the existing five-county labor force; however, it is anticipated that some specialized workers may be recruited from outside the five-county region and would relocate to the area. An estimated 30%of workers could come from out of the Delta region, suggesting that approximately 690 workers could relocate to the Delta region at the peak of the construction period. However, this additional population would constitute a minor increase in the total 2025 projected regional population of 4.6 million and be distributed throughout the region. Changes in demand for public services resulting from any increase in population are addressed under Impacts UT-1 through UT-6 in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS.

Changes in housing demand are based on changes in supply resulting from displacement during facilities construction and changes in housing demand resulting from employment associated with construction of conveyance facilities. As described under Impact LU-2 in Section 4.3.9, *Land Use,* of this RDEIR/SDEIS, construction of water conveyance facilities under Alternative 4 would conflict with approximately 19 residential structures. The physical footprints of the three intake facilities, along with associated work areas, are anticipated to create the largest disruption to structures, conflicting with 12 of these residences.

The construction workforce would most likely commute daily to the work sites from within the five-county region; however, if needed, there are about 53,000 housing units available to accommodate workers who may choose to commute on a workweek basis or who may choose to temporarily relocate to the region for the duration of the construction period, including the estimated 690 workers who may temporarily relocate to the Delta region from out of the region. In addition to the available housing units, there are recreational vehicle parks and hotels and motels within the five-county region to accommodate any construction workers. As a result, and as discussed in more detail in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS, construction of the proposed conveyance facilities is not expected to substantially increase the demand for housing within the five-county region.

NEPA Effects: Within specific local communities, there could be localized effects on housing. However, given the availability of housing within the five-county region, predicting where this impact might fall would be speculative. In addition, new residents would likely be dispersed across the region, thereby not creating a burden on any one community. Because these activities would not result in permanent concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population. Therefore, the minor increase in demand for housing is not anticipated to lead to reasonably foreseeable adverse physical changes constituting a significant impact on the environment.

Impact ECON-3: Changes in Community Character as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in community character in the Delta region during construction of Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are identical.

Throughout the five-county Delta region, population and employment would expand as a result of the construction of water conveyance facilities, as discussed under Impacts ECON-1 and ECON-2. Agricultural contributions to the character and culture of the Delta would be likely to decline commensurate with the projected decline in agricultural-related acreage, employment, and production. This could result in the closure of agriculture-dependent businesses or those catering to agricultural workers, particularly in areas where conversion of agricultural land would be most concentrated, including near the intakes in the vicinity of Clarksburg and Hood and the expanded Clifton Court Forebay east of Byron. Similar effects on community character could result from anticipated changes to recreation in the study area. However, social influences associated with the construction industry would grow during the multi-year construction period for water conveyance structures under Alternative 4A.

Legacy communities in the Delta, which are those identified as containing distinct historical and cultural character, include Locke, Bethel Island, Clarksburg, Courtland, Freeport, Hood, Isleton, Knightsen, Rio Vista, Ryde, and Walnut Grove. These communities provide support services and limited workforce housing for the area's agricultural industry. Some housing is also provided to retirees and workers commuting to nearby urban areas including Sacramento. Construction activities associated with water conveyance facilities would be anticipated to result in changes to the rural qualities of these communities during the construction period (characterized by predominantly agricultural land uses, relatively low population densities, and low levels of associated noise and vehicular traffic), particularly for those communities in proximity to water conveyance structures, including Clarksburg, Hood, and Walnut Grove. Effects associated with construction activities could also result in changes to community cohesion if they were to restrict mobility, reduce opportunities for maintaining face-to-face relationships, or disrupt the functions of community organizations or community gathering places (such as schools, libraries, places of worship, and recreational facilities). Under Alternative 4A, several gathering places that lie in the vicinity of construction areas could be indirectly affected by noise and traffic associated with construction activities, including Delta High School, the Clarksburg Library, Clarksburg Community Church, Resurrection Life Community Church, Citizen Land Alliance, Discovery Bay Chamber of

Commerce, Courtland Fire Department, and several marinas or other recreational facilities (see Chapter 15, *Recreation*, Table 15-15 in the Draft EIR/EIS).

Under Alternative 4A, additional regional employment and income could create net positive effects on the character of Delta communities. In addition to potential demographic effects associated with changes in employment, however, property values may decline in areas that become less desirable in which to live, work, shop, or participate in recreational activities. For instance, negative visual- or noise-related effects on residential property could lead to localized abandonment of buildings. While water conveyance construction could result in beneficial effects relating to the economic welfare of a community, adverse social effects could also arise as a result of declining economic stability in communities closest to construction effects and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

CEQA Conclusion: Construction of water conveyance facilities under Alternative 4A could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to reasonably forseeable physical impacts involving population growth, such impacts are described under Impact ECON-2 and in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-4: Changes in Local Government Fiscal Conditions as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in local government fiscal conditions during construction of Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are identical. Under Alternative 4A, publicly-owned water conveyance facilities would be constructed on land of which some is currently held by private owners. Property tax and assessment revenue generated by lands that would be transferred from private to is estimated to total $7.3 million over the construction period. Typically, decreases in revenue could potentially result in the loss of a substantial share of some agencies' tax bases and particularly for smaller districts affected by a project. However, California Water Code (Section 85089 subdivision 9b) specifies that the entities constructing and operating a new Delta conveyance facility will fully mitigate for the loss of property tax revenues or assessments levied by local governments or special districts. This Water Code requirement will ensure that tax revenues forgone as a result of transferring land from private to public ownership will be fully offset. In addition, as discussed under Impact ECON-1, construction of the water conveyance facilities would be anticipated to result in a net temporary increase of income and employment in the Delta region. This would also create an indirect beneficial effect through increased sales tax revenue for local government entities that rely on sales taxes.

CEQA Conclusion: Under Alternative 4A, construction of water conveyance facilities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. Over the construction period, property tax and assessment revenue generated by these properties is estimated at $7.3 million. These potential losses would be offset by the provisions in the California Water Code that require entities constructing and operating new Delta conveyance facilities to fully mitigate for the loss of property tax or assessments levied by local governments or special districts. It is anticipated that the Water Code requirement will ensure that forgone tax revenues will be fully offset. In addition, CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. The potential for a physical change to the environment as a result of changes in tax revenues would be avoided by offsetting the potential losses in tax revenues.

Impact ECON-5: Effects on Recreational Economics as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects on recreational economics under Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, Socioeconomics, Section 16.3.3.9, in Appendix A, because the water conveyance facilities proposed under these alternatives are identical. As described and defined under Impacts REC-1 through REC-4 in Section 4.3.11, *Recreation*, of this RDEIR/SDEIS, construction of water conveyance facilities under Alternative 4A would include elements that would be permanently located in two existing recreation areas. Additionally, substantial disruption of other recreational activities considered temporary and permanent would occur in certain areas during the construction period. Were it to occur, a decline in visits to Delta recreational sites as a result of facility construction would be expected to reduce recreation-related spending, creating an adverse effect throughout the Delta region. Additionally, if construction activities shift the relative popularity of different recreational sites, implementation of Alternative 4A may carry localized beneficial or adverse effects.

Access would be maintained to all existing recreational facilities, including marinas, throughout construction. As part of Mitigation Measure REC-2, project proponents would enhance nearby fishing access sites and would incorporate public recreational access into design of the intakes along the Sacramento River. Implementation of this measure along with separate, non-environmental commitments as set forth in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS relating to the enhancement of recreational access and control of aquatic weeds in the Delta would reduce these effects. Environmental commitments would also be implemented to reduce some of the effects of construction activities on the recreational experience. Similarly, mitigation measures proposed throughout other sections of this document, and listed under Impact REC-2 in Section 4.3.11, *Recreation*, of this RDEIR/SDEIS would also contribute to reducing construction effects on recreational experiences in the study area.

Construction of water conveyance structures would be anticipated to result in a lower-quality recreational experience in a number of localized areas throughout the Delta, despite the implementation of environmental commitments. With a decrease in recreational quality, particularly for boating and fishing (two of the most popular activities in the Delta), the number of visits would be anticipated to decline, at least in areas close to construction activities. Under this alternative, recreational uses at Clifton Court Forebay and in small areas of the Cosumnes River Preserve on Staten Island would be directly affected by construction activities. Six other recreational sites or areas would experience periods of construction-related effects, including noise, access, visual disturbances, or a combination of these effects. As described under Impact REC-2 in Section 4.3.11, *Recreation*, of this RDEIR/SDEIS, these include Clarksburg Boat Launch (fishing access), Stone Lakes NWR, Wimpy's Marina, Delta Meadows River Park, Bullfrog Landing Marina, and Lazy M Marina. Overall, the multi-year schedule and geographic scale of construction activities and the anticipated decline in recreational spending would be considered an adverse effect. The commitments and mitigation measures cited above would contribute to the reduction of this effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities under Alternative 4A could affect recreational revenue in the Delta region if construction activities result in fewer visits to the area. Fewer visits would be anticipated to result in decreased economic activity related to recreational activities. This section considers only the economic effects of recreational changes brought about by construction of the proposed water conveyance facilities. Potential physical changes to the environment relating to recreational resources are described and evaluated under Impacts REC-1 through REC-4 in Section 4.3.11, *Recreation*, in this RDEIR/SDEIS.

Impact ECON-6: Effects on Agricultural Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on agricultural economics related to construction of Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are identical.

Construction of conveyance facilities would convert land from existing agricultural uses to project-related construction uses, and agricultural land could also be affected by changes in water quality and other conditions that would affect crop productivity. These direct effects on agricultural land are described under Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources,* in this RDEIR/SDEIS. Total value of irrigated crop production in the Delta would decline on average by $5.3 million per year during the construction period, with total irrigated crop acreage declining by about 4,700 acres. Other effects related to production costs, travel time, and loss of investments in production facilities and standing orchards and vineyards would also occur as a result of facilities construction.

NEPA Effects: Because construction of the proposed water conveyance facilities would lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2 in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would reduce the total value of agricultural production in the Delta region. The removal of agricultural land from production is addressed under Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources,* in this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably forseeable physical impacts. Such physical effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative.

While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2 in Appendix A of this RDEIR/SDEIS.

Impact ECON-7: Permanent Regional Economic and Employment Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

While the specific criteria guiding operations of water conveyance facilities under Alternative 4A would differ somewhat from those under Alternative 4, for the purposes of socioeconomic analysis, it is assumed that operation and maintenance effects under Alternative 4A would be essentially identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are identical and, in the context of the regional economy, operational outcomes related to water supply, water quality, recreation, or fisheries would be similar between the two alternatives. Ongoing operation and maintenance of facilities would result in increased expenditures. The increased project operation and maintenance expenditures are expected to result in a permanent increase in regional employment and income, including an estimated 129 direct and 183 total (direct, indirect, and induced) FTE jobs.

The operation and maintenance of conveyance and related facilities such as roads and utilities would result in the permanent removal of agricultural land from production following construction, and the effects on employment and income would be negative, including the loss of an estimated 11 agricultural and 39 total (direct, indirect, and induced) FTE jobs. Based on the permanent crop production value changes described in Impact ECON-12, the agricultural job losses would more likely be concentrated in the vegetable, truck, orchard, and vineyard crop sectors, which are relatively labor intensive, than in the grain, field, and forage crop sectors, where more jobs are mechanized. Mapbook Figures M14-7 and M14-8 in the Mapbook Volume of the Draft EIR/EIS display areas of Important Farmland and lands under Williamson Act contracts that could be converted to other uses due to the construction of water conveyance facilities for the Modified Pipeline/Tunnel alignment.

NEPA Effects: Because continued operation and maintenance of water conveyance facilities would result in an increase in operations-related employment and labor income, this would be considered a beneficial effect. However, the long-term footprint of facilities would lead to a continued decline in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2 in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would increase total employment and income in the Delta region. The net change would result from expenditures on operation and maintenance and from changes in agricultural production. The total change in income and employment is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably forseeable physical impacts. Such physical effects are discussed in other chapters throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed under Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources*, of this RDEIR/SDEIS; and changes in recreation related activities are addressed under Impacts REC-5 through REC-8 in Section 4.3.11, *Recreation* in this RDEIR/SDEIS. When required, DWR would provide compensation to landowners as a result of acquiring lands for the proposed conveyance facilities. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2 in Appendix A of this RDEIR/SDEIS.

Impact ECON-8: Permanent Effects on Population and Housing in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

While the specific criteria guiding operations of water conveyance facilities under Alternative 4A would differ somewhat from those under Alternative 4, for the purposes of socioeconomic analysis, it is assumed that operation and maintenance effects under Alternative 4A would be identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are identical. Operations and maintenance of conveyance facilities would require approximately 130 permanent new workers. Given the nature of those operation and maintenance jobs, the existing water conveyance facilities already in the five-county region, the large workforce in the region, and the large water agencies with headquarters in that region, it is anticipated that most of these new jobs would be filled from within the existing five-county labor force; however, it is anticipated that some workers with specialized skills may be recruited from outside the five-county region and would relocate to the area. This additional population would constitute a minor increase in the total 2025 projected regional population of 4.6 million and be distributed throughout the region. Changes in demand for public services resulting from any increase in population are addressed under Impact UT-7 in Section 4.3.16, *Public Services and Utilities* in this RDEIR/SDEIS. It is anticipated that most of the operational workforce would be drawn from within the five-county region. Consequently, operation of the conveyance facilities would not result in impacts on housing.

NEPA Effects: Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population and therefore significant impacts on the physical environment are not anticipated.

Impact ECON-9: Changes in Community Character during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: While the specific criteria guiding operations of water conveyance facilities under Alternative 4A would differ somewhat from those under Alternative 4, for the purposes of socioeconomic effects, it is assumed that operation and maintenance effects under Alternative 4A would be essentially identical to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are identical and, in the context of community character, operational outcomes related to water supply, water quality, recreation, or fisheries would be similar between the two alternatives. Throughout the five-county Delta region, population and employment could slightly expand as a result of continued operation and maintenance of the water conveyance facilities. Agricultural contributions to the character and culture of the Delta would be likely to decline commensurate with the projected decline in agricultural-related employment and production. This could result in the closure of agriculture-dependent businesses or those catering to agricultural employees, particularly in areas where conversion of agricultural land would be most concentrated, including near the intakes in the vicinity of Clarksburg and Hood and near the expanded Clifton Court Forebay. Similar effects could accrue to areas disproportionately dependent on existing recreational activities. However, influences associated with those hired to operate, repair, and maintain water conveyance facilities would grow. To the extent that this anticipated economic shift away from agriculture results in demographic changes in population, employment level, income, age, gender, or race, the study area would be expected to see changes to its character, particularly in those Delta communities most substantially affected by demographic changes based on their size or proximity to water conveyance facilities.

While some of the rural qualities of Delta communities, including relatively low noise and traffic levels, could return to near pre-construction conditions during the operational phase, other effects would be lasting. For instance, the visual appearance of intakes and other permanent features would compromise the predominantly undeveloped and agricultural nature of communities like Clarksburg, Courtland, and Hood, which would be located closest to the permanent water conveyance features. Lasting effects on areas made less desirable in which to live, work, shop, or participate in recreational activities as a result of water conveyance facility operations could lead to localized abandonment of buildings. Such lasting effects could also result in changes to community cohesion if they were to restrict mobility, reduce opportunities for maintaining face-to-face relationships, or disrupt the functions of community organizations or community gathering places (such as schools, libraries, places of worship, and recreational facilities). While ongoing operations could result in beneficial effects relating to the economic welfare of a community, adverse social effects could linger in communities closest to character-changing effects and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation would reduce adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Specifically, these commitments include notification of maintenance activities in waterways, development and implementation of a noise abatement plan, and preparation and implementation of mosquito management plans.

CEQA Conclusion: Operation and maintenance of water conveyance facilities under Alternative 4A could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to reasonably forseeable physical impacts involving population growth, such impacts are described under Impact ECON-8 and in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-10: Changes in Local Government Fiscal Conditions during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Effects on local government fiscal conditions during operation and maintenance of Alternative 4A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are identical. While Alternative 4A would not be associated with a 50-year permit term, forgone revenue is estimated to be the same as for Alternative 4 ($44.1 million) over a 50-year period. These decreases in revenue could potentially result in the loss of a substantial share of some agencies' tax bases, particularly for smaller districts affected by Alternative 4A. However, as discussed under Impact ECON-4, California Water Code, requires that entities constructing and operating a new Delta conveyance for offsetting the loss of property tax or assessment revenues. The requirement will ensure that forgone tax revenues resulting from transferring lands for private to public ownership will be fully offset.

CEQA Conclusion: Under Alternative 4A, the ongoing operation and maintenance of water conveyance facilities would reduce t property tax revenue levels for various local government entities in the Delta region. Over a 50-year period, property tax and assessment revenue forgone is estimated at $44.1 million. These potential losses would be offset by the provisions in the Water Code that require entities constructing and operating new Delta conveyance facilities to fully mitigate for the loss of property tax assessments levied by local governments or special districts. It is anticipated that the Water Code requirement will ensure that forgone tax revenues will be fully offset. Furthermore, CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably forseeable physical changes. The potential for physical change to the environment as a result of changes would be avoided by offsetting the losses in tax revenues.

Impact ECON-11: Effects on Recreational Economics during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: As discussed under Impacts REC-5 through REC-8 in Section 4.3.11, *Recreation,* in this RDEIR/SDEIS, operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 4A are anticipated to create minor effects on recreational resources. Maintenance of conveyance facilities, including intakes, would result in periodic temporary but not substantial adverse effects on boat passage and water-based recreational activities. As discussed in Impact REC-7 in Chapter 15, *Recreation*, of the Draft EIR/EIS, most intake maintenance, such as painting, cleaning, and repairs, would be done with barges and divers, and could cause a temporary impediment to boat movement in the Sacramento River in the immediate vicinity of the affected intake structure and reduce opportunities for waterskiing, wakeboarding, or tubing in the immediate vicinity of the intake structures. However, boat passage and navigation on the river would still be possible around any barges or other maintenance equipment and these effects would be expected to be short-term (2 years or less). Although water-based recreation (e.g., boating, waterskiing, wakeboarding) may be restricted at and in the vicinity of intakes, many miles of the Sacramento River would still be usable for these activities during periodic maintenance events. Additionally, implementation of the environmental commitment to provide notification of maintenance activities in waterways (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would reduce these effects. Because effects of facility maintenance would be short-term and intermittent, substantial economic effects are not anticipated to result from operation and maintenance of the facilities.

CEQA Conclusion: Operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 4A are anticipated to create minor effects on recreational resources and therefore, are not expected to substantially reduce economic activity related to recreational activities. This section considers only the economic effects of recreational changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Impacts REC-5 through REC-8 in Section 4.3.11, *Recreation,* of this RDEIR/SDEIS.

Impact ECON-12: Permanent Effects on Agricultural Economics in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Effects on agricultural economics during operation and maintenance of Alternative 4A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are identical and, in the context of the regional agricultural economy, outcomes related to water quality would be similar between the two alternatives.

During operation and maintenance of conveyance facilities existing agricultural land would be in uses that include direct facility footprints and associated permanent roads and utilities. Agricultural land could also be affected by changes in water quality and other conditions that would affect crop productivity. These direct effects on agricultural land are described in Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources,* in this RDEIR/SDEIS. Total value of irrigated crop production in the Delta region would decline on average by $3.6 million per year during operation and maintenance, with total irrigated crop acreage declining by about 3,400 acres. Other effects related to production costs, travel time, crop yields, and crop selection could also occur during operation and maintenance activities. If operation of the proposed conveyance facilities increases salinity in part of the Delta, crops that are more sensitive to salinity could shift to other lands in the five-county Delta region. See Section 4.3.10, *Agricultural Resources*, Impact AG-2, in this RDEIR/SDEIS for further discussion of effects from changes in salinity.

NEPA Effects: The footprint of water conveyance facilities would result in lasting reductions in crop acreage and in the value of agricultural production in the Delta region; therefore, this is considered an adverse effect. Mitigation Measure AG-1, described under Impact AG-1 in Chapter 14, *Agricultural Resources*, Section 14.3.3.2 in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: During operation and maintenance of the proposed water conveyance facilities the value of agricultural production in the Delta region would be reduced. The permanent removal of agricultural land from production is addressed under Impacts AG-1 and AG-2 in Section 4.3.10, *Agricultural Resources,* of this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably forseeable physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical effect. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-13: Effects on the Delta Region's Economy and Employment Due to the Implementation of Environmental Commitments 3, 4, 6–12, 15, and16

In the Delta region, spending on conservation actions would include construction, operation, and maintenance activities that would convert or disturb existing land use. The effects on the economy of the Delta region would be similar in kind, though not in magnitude, to those estimated for Alternative 4. As described under Section 4.1, *Introduction*, Alternative 4A would include substantially less habitat enhancement and restoration. Additionally, under Alternative 4A, Conservation Measures 2, 5, 13, 20, and 21 would not be implemented. In general, changes in regional economic activity (employment and income) would include increases from the construction and operation and maintenance-related activity, declines resulting from agricultural or other land uses converted or impaired, changes in recreation spending that could be positive or negative depending on the specific restoration action, and declines from abandonment of natural gas wells. As discussed in Section 4.3.22, *Minerals*, Impact MIN-5, in this RDEIR/SDEIS, operations of natural gas wells in the Delta region would be affected where wells are located in restoration areas to be inundated. In areas that would be permanently inundated at restoration sites, producing natural gas wells may be abandoned.

NEPA Effects: Because implementation of conservation actions would be anticipated to result in an increase in construction and operation and maintenance-related employment and labor income, this would be considered a beneficial effect. However, implementation of these components would also be anticipated to result in a decrease in agricultural-related and natural gas production-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite. Additionally, measures to reduce impacts on natural gas wells are discussed in Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

CEQA Conclusion: Implementation of the proposed conservation actions would affect total employment and income in the Delta region. The change in total employment and income in the Delta region is based on expenditures resulting from implementation of the habitat enhancement and restoration activities and any resulting changes in agricultural production, recreation, and natural gas production. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts within the meaning of CEQA would only result if the changes in regional economics cause reasonably forseeable physical impacts. Such environmental effects are discussed in other chapters throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed in Section 4.3.10, *Agricultural Resources*, Impacts AG-3 and AG-4; changes in recreation-related activities are addressed in Section 4.3.11, *Recreation,* Impacts REC-9 through REC-11; and abandonment of natural gas wells is addressed in Section 4.3.22, *Minerals*, Impact MIN-5. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts and impacts on natural gas wells are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, and Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

Impact ECON-14: Effects on Population and Housing in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: In the Delta region, implementation of habitat enhancement and restoration activities could increase employment and convert land from existing uses, including possible displacement of residential housing and business establishments. The effects on population and housing in the Delta region would be similar in kind, though substantially smaller in magnitude, to those described for Alternative 4. In general, the changes in population and housing would include increases in population from the construction and operation and maintenance-related activity and declines in residential housing and business establishments as a result of lands converted or impaired. Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Implementation of the proposed habitat enhancement and restoration activities could affect total population and housing in the Delta region. The change in total population and housing in the Delta region is based on employment resulting from implementation of the proposed conservation activities. The change in population and housing is expected to be minor relative to the five-county Delta region, and dispersed throughout the region. Therefore, significant impacts on the physical environment are not anticipated to result.

Impact ECON-15: Changes in Community Character as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: As noted under Impacts ECON-13 and ECON-14, conservation activities designed to restore, conserve, or enhance natural habitat would be anticipated to create economic effects similar in kind, if not in magnitude, to those described for Alternative 4, including increases to employment and changes in land use that could trigger the disruption of agricultural and recreational economies. They could also affect the possible displacement of residences and businesses. The effects these activities would create with regard to community character would depend on the nature of each measure along with its specific location, size, and other factors that are not yet defined.

Under Alternative 4A, temporary construction associated with implementation of these measures could lead to demographic changes and resulting effects on the composition and size of Delta communities. Earthwork and site preparation associated with environmental commitments could also detract from the rural qualities of the Delta region; however, their implementation would take place in phases over time, which would limit the extent of effects taking place at any one point in time.

Implementation of these measures could also alter community character over the long term. Conversion of agricultural land to restored habitat would result in the erosion of some economic and social contributions stemming from agriculture in Delta communities. However, in the context of the Delta region, a substantial proportion of land would not be converted. Additionally, restored habitat could support some rural qualities, particularly in terms of visual resources and recreational opportunities. These effects could attract more residents to some areas of the Delta, and could replace some agricultural economic activities with those related to recreation and tourism. To the extent that agricultural facilities and supportive businesses were affected and led to vacancy, alteration of community character could result from these activities. However, protection of cultivated lands would ensure the continuation of agricultural production on up to 10,100 of acres in the Delta. If necessary, implementation of mitigation measures and environmental commitments related to transportation, agriculture, and recreation would be anticipated to reduce these adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities under Alternative 4A could affect community character within the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character are related to physical impacts involving population growth, these impacts are described in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to certain areas, sectors, or the vacancy of individual buildings, could result in decay and blight stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIS/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-16: Changes in Local Government Fiscal Conditions as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

As discussed in relation to construction of water conveyance facilities, habitat restoration and enhancement activities under Alternative 4A would also take place, in part, on land held by private owners and from which local governments derive revenue through property taxes and assessments. In particular, environmental commitments related to protection and restoration of natural communities would require the acquisition of multiple parcels of land.

The loss of a substantial portion of an entity's tax base would represent an adverse effect on an agency, resulting in a decrease in local government's ability to provide public goods and services. Under Alternative 4A, property tax and assessment revenue forgone as a result of environmental commitment implementation is estimated to reach $13.4 million as a result of implementing Environmental Commitments 3, 4, 6-12, and 16. Decreases in revenue could potentially represent a substantial share of individual agency tax bases, particularly for smaller districts affected by large, contiguous areas identified for habitat restoration.

Additionally, installation of non-physical fish barriers at Georgiana Slough may require that land currently on property tax rolls be acquired and eventually removed from the tax base. The fiscal effects stemming from this activity are, however, anticipated to be minor based upon the relatively small areas of land necessary for its implementation.

NEPA Effects: Effects on local government fiscal conditions during operation and maintenance Environmental Commitments 3, 4, 6-12, 15, and 16 is estimated to total $13.4 million. However, as discussed under Impact ECON-4, California Water Code, requires that entities constructing and operating a new Delta conveyance for offsetting the loss of property tax or assessment revenues.

The requirement will ensure that forgone tax revenues resulting from transferring lands for private to public ownership will be fully offset and an adverse impact on local agency tax revenues would be avoided.

CEQA Conclusion: Under Alternative 4A, implementation of habitat enhancement and restoration activities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. Over a 50-year period, property tax and assessment revenue forgone is estimated to reach $13.4 million, compared with annual property tax revenue of more than $934 million in the Delta counties (California State Controller's Office 2012). These potential losses would be offset by the provisions in the Water Code that require entities constructing and operating new Delta conveyance facilities to fully mitigate for the loss of property tax assessments levied by local governments or special districts. It is anticipated that the Water Code requirement will ensure that forgone tax revenues will be fully offset. Furthermore, CEQA does not require a discussion of socioeconomic effects except where they would result in physical changes. The potential for a physical change to the environment attributable to foregone tax revenues would be avoided by offsetting the loss of those revenues.

Impact ECON-17: Effects on Recreational Economics as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of habitat enhancement and restoration activities under this alternative would be anticipated to create an adverse effect on recreational resources by limiting access to facilities, restricting boat navigation, and disturbing fish habitat while restoration activities are taking place. These measures may also permanently reduce the extent of upland recreation sites. However, these components could also create beneficial effects by enhancing aquatic habitat and fish abundance, expanding the extent of navigable waterways available to boaters, and improving the quality of existing upland recreation opportunities. Therefore, the potential exists for the creation of adverse and beneficial effects related to recreational economics. Adverse effects would be anticipated to be primarily limited to areas close to restoration areas and during site preparation and earthwork phases. These effects could result in a decline in visits to the Delta and reduction in recreation-related spending, creating an adverse economic effect throughout the Delta. Beneficial recreational effects would generally result during later stages of restoration implementation as environmental conditions supporting recreational activities are enhanced. These effects could improve the quality of recreational experiences, leading to increased economic activities related to recreation, particularly in areas where habitat enhancement or restoration could create new recreational opportunities.

CEQA Conclusion: Site preparation and earthwork activities associated with a number of environmental commitments would limit opportunities for recreational activities where they occur in or near existing recreational areas. Noise, odors, and visual effects of construction activities would also temporarily compromise the quality of recreation in and around these areas, leading to potential economic impacts. However, over time, implementation could improve the quality of existing recreational opportunities, leading to increased economic activity. This section considers only the economic effects of recreational changes brought about by implementation of habitat enhancement and restoration activities. CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.3.11, *Recreation,* Impacts REC-9 through REC-11 in this RDEIR/SDEIS.

Impact ECON-18: Effects on Agricultural Economics in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Habitat enhancement and restoration activities would convert land from existing agricultural uses. These direct effects on agricultural land are described qualitatively in Section 4.3.10, *Agricultural Resources,* Impacts AG-3 and AG-4 in this RDEIR/SDEIS. Effects on agricultural economics would include effects on crop production and agricultural investments resulting from restoration actions on agricultural lands. The effects would be similar in kind to those described for lands converted due to construction and operation of the conveyance features and facilities. The total acreage and crop mix of agricultural land potentially affected is not specified at this time, but when required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative. Because implementation of habitat enhancement and restoration activities would be anticipated to lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities would reduce the total value of agricultural production in the Delta region. The permanent removal of agricultural land from production is addressed in Section 4.3.10, *Agricultural Resources,* Impacts AG-3 and AG-4, of this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably forseeable physical impacts. Such physical effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-19: Socioeconomic Effects in the South-of-Delta Hydrologic Regions

As described in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS, the operational components of water conveyance facilities under Alternative 4A could result in a number of effects in areas receiving SWP and CVP water deliveries outside of the Delta. Generally, these effects would be similar to those described for Alternative 4 (Operational Scenarios H3 and H4) in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the incremental change in Delta exports is similar, when compared to the relevant No Action condition.

Under Operational Scenario H3 as considered for Alternative 4A (at the ELT), Delta exports would increase by 11% when compared to the No Action Alternative (ELT), as shown in Table B.1-3 in Appendix B of this RDEIR/SDEIS. Under Operational Scenario H3 as considered for Alternative 4 (LLT), Delta exports would also increase by 11% when compared to the No Action Alternative (LLT), as shown in Table 5-9 in Appendix A of this RDEIR/SDEIS. Under Scenario H4 as considered for Alternative 4A (ELT), Delta exports would decrease by less than 1% when compared to the No Action Alternative (ELT), as shown in Table B.1-3 in Appendix B of this RDEIR/SDEIS. Under Operational Scenario H4 as considered for Alternative 4 (at the late long-term), Delta exports would decrease by 1% when compared to the No Action Alternative (LLT), as shown in Table 5-9 in Appendix A of this RDEIR/SDEIS.

Changes in the amount, cost, or reliability of water deliveries could create socioeconomic effects in the hydrologic regions. To the extent that unreliable or insufficient water supplies currently represent obstacles to agricultural production, Alternative 4A may support more stable agricultural activities by enabling broader crop selection or by reducing risk associated with uncertain water deliveries. As a result of an increase in water supply and supply reliability, farmers may choose to leave fewer acres fallow and/or plant higher-value crops. While the locations and extent of any increases in production would depend on local factors and individual economic decisions, a general increase in production would be anticipated to support growth in seasonal and permanent on-farm employment, along with the potential expansion of employment in industries closely associated with agricultural production. These include food processing, agricultural inputs, and transportation.

In contrast, decreased water deliveries may affect socioeconomics in hydrologic regions through mechanisms similar to those described above; however, the effects would generally be reversed. For example, it is reasonable to expect that reduced or less reliable water deliveries would result in decreased agricultural production and, in turn, a reduction in both direct and indirect agricultural employment. Economic and social patterns tied to predominant agricultural industrial activities and land uses could erode, changing the character of agricultural communities in hydrologic regions. If operation of water conveyance facilities under Alternative 4A reduced M&I deliveries to the extent that it would, in the long run, constrain population growth, its implementation could reinforce a socioeconomic status quo or limit potential economic and employment growth in hydrologic regions. Such changes to agricultural production and population growth with its associated economic activity could also lead to shifts in the character of communities in the hydrologic regions with resultant beneficial or adverse effects.

Generally, these effects (both beneficial and adverse) would be most concentrated in hydrologic regions where agriculture is a primary industry and where agricultural operations depend most heavily on SWP and CVP deliveries.

NEPA Effects: Increases in average annual water deliveries to service areas could induce population growth and new housing to accommodate growth. Such deliveries could also provide support for water-intensive industries. Long-term water supply reliability is an important component in enabling long-term population increases. However, other factors—including natural growth, employment opportunities, local policy, and quality of life—are more likely to determine population growth. Nonetheless, population growth could stimulate economic activity resulting from increased demand for goods and services. This increased demand could create broad economic benefits for regions whose growth is supported by increased deliveries under Alternative 4A.

Social changes, including changes in community character, could also result from an expansion in population or economic activity linked to changes in water deliveries. For example, more stable agricultural production and associated economic activities in areas where agriculture is a predominant industry could strengthen and reinforce existing economic and social patterns and institutions. Increased production could also intensify existing socioeconomic challenges, including seasonal cycles in employment, housing demand, and provision of social services. In areas where population growth would be enabled by increased water supplies or reliability, changes to community character could result from an increased population, including the potential for changes in urban form, environmental factors such as traffic or noise, demographic composition, or the rise of new or broader economic or social opportunities. Again, the nature and extent of such changes would be predominantly influenced by prevailing socioeconomic forces, rather than any specific change associated with implementation of Alternative 4A.

Changes in agricultural production and population growth could also affect local government fiscal conditions. Population growth would be anticipated to result in higher property and sales tax revenue while increased agricultural activity could result in higher sales tax receipts for a local jurisdiction. However, growth would also require expanded public services to meet the needs of a larger population and a larger economic base. Expansion could require additional spending on education, police and fire protection, medical services, and transportation and utility infrastructure. Whether such growth would result in a long-term net benefit or cost would depend on a number of factors including prevailing local service levels and tax rates, as well as the characteristics of the growth.

Changes in water deliveries associated with operation of Alternative 4A could result in beneficial or adverse socioeconomic effects in areas receiving water from the SWP and CVP. In hydrologic regions where water deliveries are predicted to increase when compared with the No Action Alternative, more stable agricultural activities could support employment and economic production associated with agriculture. Where M&I deliveries increase, population growth could lead to general economic growth and support water-intensive industries. Such changes could also lead to shifts in the character of communities in the hydrologic regions with resultant beneficial or adverse effects. Likewise, growth associated with deliveries could require additional expenditures for local governments while also supporting increases in revenue.

CEQA Conclusion: As described above, the operational components of the proposed water conveyance facilities could result in a number of socioeconomic effects in areas receiving SWP and CVP water deliveries outside of the Delta. However, because these impacts are social and economic in nature, rather than physical, they are not considered environmental impacts under CEQA. To the extent that changes in socioeconomic conditions in the hydrologic regions would lead to reasonably forseeable physical impacts, such impacts are described in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS.

4.3.13 Aesthetics and Visual Resources

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

NEPA Effects: The potential under Alternative 4A to create substantial alteration in visual quality or character during construction of conveyance facilities would be identical to those impacts described under Alternative 4 and would constitute an adverse effect on existing visual character because of the long-term nature of construction, combined with the proximity to sensitive receptors, effects on residences and agricultural buildings, removal of vegetation, and changes to topography through grading. The primary features that would affect the existing visual quality and character under Alternative 4A, once the facility has been constructed, would be Intakes 2, 3, and 5, the intermediate forebay and expanded Clifton Court Forebay, landscape effects from spoil/borrow and RTM areas, the operable barrier, and transmission lines. These changes would be most evident in the northern portion of the study area, which would undergo extensive changes from the permanent establishment of large industrial facilities and the supporting infrastructure along and surrounding the segment of the Sacramento River from Clarksburg to north of Courtland where the intakes would be situated. Mitigation Measures AES-1a through AES-1g are available to address visual effects resulting from construction of Alternative 4A water conveyance facilities.

CEQA Conclusion: Construction of Alternative 4A would substantially alter the existing visual quality and character present in the study area in an identical manner as described for Alternative 4. The long-term nature of construction of the intakes, pipeline/tunnel, work areas, spoil/borrow and RTM areas, shaft sites, barge unloading facilities, and operable barrier; presence and visibility of heavy construction equipment; proximity to sensitive receptors; relocation of residences and agricultural buildings; removal of riparian vegetation and other mature vegetation or landscape plantings; earthmoving and grading that result in changes to topography in areas that are predominantly flat; addition of large-scale industrial structures (intakes and related facilities); remaining presence of large-scale borrow/spoil and RTM area landscape effects; and introduction of tall, steel transmission lines would all contribute to this impact. This impact would be significant because of the substantial visual changes that would result from conveyance facility construction. Mitigation Measures AES-1a through AES-1g would partially reduce impacts, but not to a less-than-significant level because not all of the visual changes could be eliminated and permanent changes would be made to the regional landscape. Thus, Alternative 4A would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation MeasureAES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

NEPA Effects: Effects related to scenic vistas under Alternative 4A would be identical to those described for Alternative 4. During construction the introduction of construction equipment and removal of vegetation would alter the scenic elements that contribute to the viewing experience from scenic vistas. The intakes would introduce visually dominant and discordant features in the foreground and middleground views in vistas that would be very noticeable to all viewer groups in areas of low to high landscape sensitivity levels. As described for Alternative 4, the effects of permanent access road effects on scenic vistas would not be adverse. The effects of shaft site pads and access hatches on scenic vistas could be adverse. The large scale of intakes, the visual presence of large-scale borrow/spoil and RTM area landscape effects, and transmission lines may result in adverse effects on scenic vistas (see discussions under Sections 17.3.1.2, *Preparation of Visual Simulations*, and 17.3.1.3, *Analysis of the Alternatives' Impact on Visual Resources*, of the Draft EIR/EIS). Overall, effects on scenic vistas associated with Alternative 4A would be adverse because some elements of the conveyance facilities would permanently change views to scenic vistas. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 4A would have identical effects on scenic vistas as described for Alternative 4. Because proposed permanent access roads generally follow existing rights-of-way, they would have less-than-significant impacts on scenic vistas. The presence of the intake structures and pumping plants, large-scale borrow/spoil and RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vistas in the study area. Mitigation Measure AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level. Thus, impacts on scenic vistas associated with Alternative 4A would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

NEPA Effects: Effects on state scenic highways under Alternative 4A would be identical to those described for Alternative 4. Intakes 2, 3, and 5, the RTM area north of Intake 2, and the intermediate forebay would be immediately and prominently visible in the foreground from SR 160 and would result in an overall noticeable effect on viewers relative to their current experience of the study area's scenic resources along SR 160 and River Road, where the landscape sensitivity level is high. As described for Alternative 4, the visual elements introduced by the intakes, RTM area north of Intake 2, and intermediate forebay associated with Alternative 4A would conflict with the existing forms, patterns, colors, and textures along River Road and SR 160; would dominate riverfront visible from SR 160; and would alter broad views and the general nature of the visual experience presently available from River Road and SR 160. These changes would reduce the visual quality near intake structure locations and result in noticeable changes in the visual character of scenic vista viewsheds in the study area. This effect would be adverse for the same reasons discussed for Alternative 4. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 4A would have identical effects on scenic highways as described for Alternative 4. Because proposed permanent access roads generally follow existing rights-of-way, they would have less-than-significant impacts on scenic vistas. The presence of the intake structures and pumping plants, RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vista viewsheds in the study area. Mitigation Measures AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level for the same reasons identified for Alternative 4. Thus, impacts on scenic vistas associated with Alternative 4A would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

NEPA Effects: Effects resulting from light and glare under Alternative 4A would be identical to those described for Alternative 4. Intakes 2, 3, and 5 and their associated pumping plants, surge towers, and facilities and the pumping plant at the intermediate forebay would create noticeable effects relating to light and glare (Figures 17-76 through 17-78 in the Draft EIR/EIS). Overall, because the study area currently experiences low levels of light and because there are a larger number of viewers in and around the waterways, intake structures, and forebay that would be affected by these noticeable changes contrasting with the existing rural character, effects associated with new sources of daytime and nighttime light and glare are considered adverse. Mitigation Measures AES-4a through AES-4c are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 4A would have identical effects, related to light and glare, as described for Alternative 4. The impacts associated with light and glare under Alternative 4A are significant because there are a larger number of viewers in and around the waterways, intake structures, and intermediate forebay; project facilities would increase the amount of nighttime lighting in the Delta above existing ambient light levels; and the study area currently experiences low levels of light because there are fewer light/glare producers than are typical in urban areas. Mitigation Measures AES-4a through AES-4c would partially reduce these impacts but not to a less-than-significant level because all instances of light and glare impacts would not be reduced by the available mitigation measures. Thus, the new sources of daytime and nighttime light and glare associated with Alternative 4A would result in significant and unavoidable impacts on public views in the project vicinity.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact AES-5: Substantial Alteration in Existing Visual Quality or Character during Operation

NEPA Effects: Effects on the visual environment through operations and maintenance of the water conveyance facilities under Alternative 4A would be identical to those described for Alternative 4. The greatest visual effects resulting from operations would be maintenance of the intakes and dredging the forebays. However, all activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. These effects on the existing visual quality and character during operation would not be adverse because the activities would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features.

CEQA Conclusion: Operation of Alternative 4A would have identical visual quality effects as those described for Alternative 4. Maintenance of the conveyance facilities (i.e., intakes, tunnels, forebays and transmission lines) would be required periodically and would involve painting, cleaning, and repair of structures; dredging at forebays (at approximately 50-year intervals); vegetation removal and care along embankments; tunnel inspection; and vegetation removal within transmission line rights-of-way. These activities could be visible from the water or land by sensitive viewers in proximity to these features. All activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. Maintenance and operation of Alternative 4A once constructed, would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features. Thus, overall, operation and maintenance of Alternative 4A would have a less-than-significant impact on existing visual quality and character in the study area because operations would not change the visual quality of the environment and maintenance activities would be minor and intermittent. No mitigation is required.

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 4A related to the potential for alteration of existing visual quality or character from implementing these environmental commitments would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, 6, 7, 8 and 9–11 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 4A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Effects on the existing visual character, scenic vistas, scenic highways, and light and glare would be similar to those under Alternative 4 because restored/enhanced lands would result in incremental and site-specific changes to the landscape in a similar manner. Because only portions of the restoration environmental commitments and fewer of the other stressor reduction environmental commitments would be implemented under Alternative 4A, it is likely that the visual and aesthetic effects would be less than those presented for Alternative 4. However, these visual and aesthetic impacts are considered to be adverse because site-specific, localized adverse visual effects could occur at the sites of projects implemented under the Alternative 4A environmental commitments. Mitigation Measures AES-1a through AES-1g and Mitigation Measures AES-4a through AES-4c are available to address effects from habitat restoration and enhancement actions.

In addition, Mitigation Measures AES-6a and AES-6b are available to help reduce adverse visual effects. Upon development of site-specific design information and plans, additional mitigation measures may be identified to address action-specific adverse effects. Mitigation Measure AES-6c is also available to help inventory, classify, and protect the unique visual landscape of the Delta.

CEQA Conclusion: Implementation of environmental commitments under Alternative 4A would have similar but less impacts than identified for Alternative 4. Alternative 4A has the potential to affect existing visual quality and character, views of scenic vistas, views from scenic highways, and introduce new sources of light and glare in the study area. These potential impacts are considered to be significant because construction of environmental commitments could potentially change views from public areas, negatively affect sensitive receptors and require multiple year construction at specific locations that are currently unknown.

Implementing mitigation measures AES-1a through AES-1g would partially reduce the impacts of Alternative 4A on aesthetic and visual resources but not to a less-than-significant level because restoration and other actions implemented under this alternative could create considerable changes to the visual character of sensitive receptors that may not be fully mitigated by these mitigation measures. Thus, implementation of environmental commitments under Alternative 4A would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 1A in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please refer to Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please refer to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please refer to Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please refer to Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours Within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Please refer to Mitigation Measure AES-6a under Impact AES-6 in the discussion of Alternative 1A in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-Intensity and Lights Off Policy

Please refer to Mitigation Measure AES-6b under Impact AES-6 in the discussion of Alternative 1A in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

Please refer to Mitigation Measure AES-6c under Impact AES-6 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact AES-7: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Aesthetics and Visual Resources

NEPA Effects: Constructing water conveyance facilities and implementing other environmental commitments under Alternative 4A would generally have the same potential for incompatibilities with one or more plans and policies related to preserving the visual quality and character of the Delta as described for Alternative 4. As described for Alternative 4, potential incompatibility with plans and policies could exist related to preserving the visual quality and character of the Delta (i.e., The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, Delta Protection Commission Land Use and Resource Management Plan for the Primary Zone of the Delta, Delta Plan, Brannan Island and Franks Tract State Recreation Areas General Plan). In addition, with the exception of Solano County, the alternative may be incompatible with county general plan policies that protect visual resources in the study area.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts AES-1 through AES-6, above, and no additional CEQA conclusion is required related to the compatibility of Alternative 4A with relevant plans and policies.

4.3.14 Cultural Resources

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

The extent of identified archaeological sites within the area that could be affected by construction of Alternative 4A conveyance facilities are the same as described for Alternative 4. This encompasses the 10 previously recorded archeological sites occurring in the footprint of the conveyance facility. Site descriptions summarizing available information regarding these resources, are provided in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2, *Archaeological Site Descriptions*, of the Draft EIR/EIS.

The significance of the identified archeological sites are the same as described for Alternative 4. Because many of these resources are large (typically in excess of 30 meters across), they are each likely to contain sufficient integrity to yield artifacts in their original associations in a manner that will convey the significance themes outlined in the Alternative 4 discussion. These resources are likely to qualify as historical resources under CEQA and historic properties under the National Register of Historic Places (NRHP).

The mechanisms that could affect the archeological sites would be identical to those described for Alternative 4. These resources occur within the footprint of both temporary work areas and permanent surface impacts and would be subject to the same types of disturbance described under Alternative 4. Construction of the water conveyance facilities has the potential to materially impair these resources under CEQA and to adversely affect the resources as defined by Section 106 of the National Historic Preservation Act (NHPA).

NEPA Effects: Construction may disturb and damage NRHP and California Register of Historic Resources CRHR-eligible archaeological resources. This effect is considered adverse because the damage may impair the integrity of these resources and thus reduce their ability to convey their significance

CEQA *Conclusion:* Construction of conveyance facilities would affect 10 identified archaeological resources that occur in the footprint of this alternative. DWR identified these resources and found that they are likely to qualify as historical resources under CEQA (see the individual site descriptions in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2, *Archaeological Site Descriptions*, of the Draft EIR/EIS). This impact would be significant because construction could materially alter or destroy the physical integrity of the resource and/or their potential to yield information useful in archaeological research through excavation and disruption of the spatial associations that contain meaningful information. Identified but currently inaccessible resources may also be significant under other register criteria; indirect effects such as introduction of inconsistent changes to the setting may also diminish the significance of these resources. Mitigation Measure CUL-1 would reduce this impact, by recovering data at affected significant archeological sites and by monitoring and protecting resources during construction. However, this measure would not ensure preservation of the physical integrity of the resources or ensure that all of the scientifically important material would be retrieved because feasible archaeological excavation only typically retrieves a sample of the deposit, and portions of the site containing important information may remain after treatment. The impact on identified archaeological sites is considered significant and unavoidable because construction could damage the remaining portions of the deposit.

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Please see Mitigation Measure CUL-1 under Impact CUL-1 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

The potential effects of constructing water conveyance facilities on archaeological sites identified through future inventories would be the same as described for Alternative 4. These future impacts could occur because most of the area crossed by the proposed water conveyance facility is not currently legally accessible and as such has not been surveyed for the presence of archaeological sites. As with Alternative 4, Alternative 4A would also require extensive geotechnical testing that could damage or destroy archaeological sites. Although the majority of the footprint of the water conveyance facility has not been surveyed, sensitive resources have been located within and near the portions of the alignment that have been surveyed. For this reason, additional archaeological resources are likely to be found in the portion of the footprint where surveys have not yet been conducted. For the reason enumerated under Alternative 4, these sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

The potential effects on historic sites under Alternative 4A would be the same as those disclosed for Alternative 4. In summary, historic sites are likely to be associated with the historic-era themes of settlement, reclamation, agriculture, and flood management in the Delta region and as such contributed to the economic base for developing urban centers. These historic sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

Absent mitigation, ground-disturbing construction is likely to physically damage many of these resources by disrupting the spatial associations that convey data useful in research or changing the setting such that the resource no longer contains its significance. These impacts would materially impair these resources within the meaning of CEQA and adversely affect the resources within the meaning of Section 106 of the NHPA. These effects would be adverse.

NEPA Effects: This alternative has the potential to damage previously unidentified archaeological sites. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA *Conclusion:* The footprint for this alternative is sensitive for both prehistoric and historic-era resources that cannot be identified at this time because much of the footprint is not legally accessible. Because many of these resources are likely to have data useful in prehistoric and historic archaeological research, as well as the integrity to convey this significance, they are likely to qualify as historical resources or unique archaeological sites under CEQA or historic properties under the Section 106 of the NHPA. Ground-disturbing construction may materially alter the significance of these resources by disrupting the spatial associations that could yield important data, resulting in a significant effect. Mitigation Measure CUL-2 would address the impacts of both prehistoric and historic resources through conducting inventories, evaluating significance, and proposing treatment of archeological and historic resources as well as monitoring during the construction phase. However, this mitigation cannot guarantee that all eligible or significant resources would be preserved in place, or that all important data would be retrieved before construction destroys these resources. The scale of the project, investment into existing designs, and the presence of other important environmental resources such as habitat, natural communities, and wetlands that should be avoided are constraints on the flexibility and feasibility of avoidance. For these reasons this impact is significant and unavoidable.

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Please see Mitigation Measure CUL-2 under Impact CUL-2 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

The potential effects of construction of the water conveyance facilities on archaeological sites that may not be identified during inventory efforts would be the same as described for Alternative 4. The effects on archaeological resources would be the same because the design of the water conveyance facilities and construction methods and duration would be identical for both alternatives. As described for Alternative 4, although surveys will be completed for the water conveyance footprint, such surveys cannot guarantee that all sites will be identified prior to construction.

Ground-disturbing activities occurring under Alternative 4A, including the construction of surface features such as intakes, subterranean tunnel boring operations, and access may disturb and damage these resources before they can be identified and avoided during monitoring efforts required under Mitigation Measure CUL-3. This damage and disturbance may materially impair these resources within the meaning of CEQA or adversely affect the resources within the meaning of Section 106 because this disturbance would impair the ability of these resources to yield data useful in research. While Mitigation Measure CUL-3 would reduce the potential for this impact, it would not guarantee the impact would be avoided entirely. Therefore, this impact would be adverse.

NEPA Effects: Constructing Alternative 4A has the potential to damage previously unidentified archaeological sites that also may not necessarily be identified prior to construction. While cultural resource inventories will be completed once legal access is secured, no inventory can ensure that all resources are identified prior to construction. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA *Conclusion:* This impact on archeological resources not identified during inventory efforts would be considered significant for the same reasons described for Alternative 4. Construction has the potential to disturb previously unidentified archaeological sites qualifying as historical resources, historic properties, or unique archaeological resources. Mitigation Measure CUL-3 would reduce but not entirely avoid the potential for this impact, by implementing construction worker training, monitoring, and discovery protocols. This impact would remain significant and unavoidable because archaeological resources may not be identified prior to disturbance.

Mitigation Measure CUL-3: Implement an Archaeological Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Please see Mitigation Measure CUL-3 under Impact CUL-3 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Effects on buried human remains during construction occurring under Alternative 4A would be the same as described for Alternative 4. As described in greater detail for Alternative 4, the footprint of the water conveyance facilities is sensitive for buried historic and prehistoric human remains. While inventory and monitoring efforts are prescribed by Mitigation Measures CUL-2 and CUL-3, the large land area subject to disturbance under Alternative 4A make exhaustive sampling to identify all buried and isolated human remains technically and economically infeasible. For these reasons the potential remains that such resources may be damaged or exposed before they can be discovered through inventory or monitoring. This effect would be adverse.

NEPA Effects: Buried human remains may be damaged by constructing Alternative 4A because such remains may occur either in isolation or as part of identified and previously unidentified archaeological resources where construction will occur. This effect would be adverse.

CEQA *Conclusion:* Damage to buried human remains during construction would be considered a significant impact for the same reasons described for Alternative 4. The project area is sensitive for buried human remains and construction of Alternative 4A would likely result in disturbance of these features. Disturbance of human remains, including remains interred outside of cemeteries is considered a significant impact in the State CEQA Guidelines Appendix G checklist. Mitigation Measure CUL-4 would reduce the severity of this impact by following state and federal guidelines, including notifying the county coroner and the Native American Heritage Commission (NAHC), if human remains are discovered during construction. This impact would be considered significant and unavoidable, because mitigation would not guarantee that these features could be discovered and treated in advance of construction and the scale of construction makes it technically and economically infeasible to perform the level of sampling necessary to identify all such resources prior to construction.

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains if Such Resources Are Discovered during Construction

Please see Mitigation Measure CUL-4 under Impact CUL-4 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on built-environment resources under Alternative 4A would be the identical to those described for Alternative 4. As described in greater detail under Alternative 4 and Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, of the Draft EIR/EIS, a total of 17 built-environment resources have the potential to be directly or indirectly affected by constructing the water conveyance facilities. These effects would materially impair the resources within the meaning of CEQA and result in adverse effects within the meaning of Section 106 because they would diminish the characteristics that convey the significance of the resources.

NEPA Effects: This alternative would result in direct and indirect effects on NRHP and CRHR eligible built environment resources. These alterations may diminish the integrity of these resources. For these reasons this effect would be adverse.

CEQA *Conclusion:* Alternative 4A would result in the same impacts on identified historic-era built-environment resources that are described for Alternative 4. The impacts on the 17 built-environment resources are considered significant because construction may require demolition or alter the character of the resource to such a degree that each resource may no longer be able to convey its significance. Mitigation Measure CUL-5 would reduce the impact by implementing a built environment treatment plan that includes preparing an HSR, assessing preconstruction conditions, implementing protection measures, and preparing Historic American Buildings Survey (HABS) records for CRHR and NRHP-eligible historic buildings and structures that will be demolished. The impact on historic-era built-environment resources would remain significant and unavoidable because even with mitigation, the scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely.

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Please see Mitigation Measure CUL-5 under Impact CUL-5 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on unidentified and unevaluated historic architectural and built-environment resources under Alternative 4A would be the identical to those described for Alternative 4. As described in detail for Alternative 4, although DWR does not have legal access to the majority of the footprint for the water conveyance, historical documentation suggests numerous additional resources occur in the footprint of the water conveyance facilities that have not been identified or which cannot currently be accessed and evaluated. Construction may result in direct demolition of these resources, damage through vibration, or indirect effects such as changes to the setting.

The resources may exhibit significance under both CEQA (State CEQA Guidelines Section 15064.5[a][3]) and the NRHP (30 CFR 60.4). In addition, because many of the historic-era structures in the Delta region are intact, and retain their rural agricultural setting, many of these resources are likely to have integrity within the meaning of CEQA and the NRHP (14 California Code of Regulations [CCR] Section 4852[c], 30 CFR 60.4). Because many unidentified resources are likely to have significance and integrity, they may qualify as historical resources under CEQA and historic properties under Section 106 of the NHPA.

NEPA Effects: This alternative may result in direct modification or indirect changes to the setting for inaccessible and NRHP and CRHR-eligible resources. These changes may diminish the integrity of these resources. For these reasons, this effect would be adverse.

CEQA *Conclusion:* Alternative 4A would result in the same impacts on unidentified and unevaluated historic architectural and built-environment resources that are described for Alternative 4.

Construction may also result in permanent indirect effects such as changes to the setting. Direct demolition or changes to the setting would be material alterations because they would either remove the resource or alter the resource character, resulting in an inability of the resource to convey its significance. Many of these resources are likely to qualify as historic properties or historical resources under the NHPA and CEQA. Mitigation Measure CUL-6 would reduce these impacts by requiring surveys be conducted on previously inaccessible properties to determine if constructing the water conveyance facilities would adversely affect the properties and if so, the development and implementation of treatment plans. The scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely. For these reasons this impact remains significant and unavoidable even with implementation of the following mitigation measure.

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Please see Mitigation Measure CUL-6 under Impact CUL-6 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-7: Effects of Environmental Commitments on Cultural Resources

Implementing conservation and stressor reduction components at part of Alternative 4A would result in impacts on cultural resources similar in kind to those of Alternative 4. The extent of these impacts occurring under Alternative 4A would be much less than under Alternative 4, however, because the total acreage that would be affected by the restoration actions occurring within the Plan Area would be substantially less. The following Environmental Commitments could result in impacts on cultural because they involve ground-disturbing activities:

- *Environmental Commitment 3 Natural Communities Protection and Restoration*
- *Environmental Commitment 4 Tidal Natural Communities Restoration*
- *Environmental Commitment 6 Channel Margin Enhancement*
- *Environmental Commitment 7 Riparian Natural Community Restoration*
- *Environmental Commitment 8 Grassland Natural Community Restoration*
- *Environmental Commitment 9 Vernal Pool and Alkali Seasonal Wetland Complex Restoration*
- *Environmental Commitment 10 Nontidal Marsh Restoration*

These environmental commitments would result in effects on cultural resources when ground-disturbing work is performed to construct improvements and enhance or restore natural communities. Similar to Alternative 4, direct effects would occur through demolition or destruction of NRHP-, CRHR-, and/or local registry-eligible prehistoric and historic archaeological sites, unique archaeological sites, traditional cultural places (TCPs), human remains, and built-environment resources. In addition, indirect effects may occur where changes to the setting alter the existing setting in a manner that is inconsistent with the feeling and association of the resource. Because the ability of the resources to convey their significance would be lost this effect would materially alter these resources under CEQA and would be adverse under NEPA. For example, reclaimed agricultural landscapes that are converted to habitat may no longer convey the themes of agriculture and settlement, and thus would be inconsistent with remaining features associated with rural historic landscapes created by reclamation, cultivation, and ranching.

Mitigation Measure CUL-7 below addresses the impact on cultural resources as a result of implementing the conservation and stressor reduction components. Because of the large acreages of land included in all these components, it is unlikely that all effects on NRHP-, CRHR-, and /or local registry-eligible resources and unique archaeological sites could be avoided. Therefore, this impact would be adverse.

NEPA Effects: Implementation of conservation and stressor reduction components would result in ground-disturbing work and introduction of new infrastructure to the Plan Area. These physical modifications may result in direct effects on NRHP and CRHR eligible resources. These changes may therefore reduce the integrity of these resources. For these reasons these effects would be adverse.

CEQA *Conclusion:* Implementing conservation and stressor reduction components would require ground-disturbing activities that could alter the significant characteristics of NRHP, CRHR, and/or local registry-eligible cultural resources, including prehistoric and historic archaeological sites, TCPs, and built-environment resources such as historic architectural structures and rural historic landscapes. The same construction may damage unique archaeological sites. This construction would likely result in materially adverse changes for the following reasons.

- Ground-disturbing construction in archaeological sites disrupts the spatial associations that contain data useful in research, thus diminishing or destroying the basis for the significance of the resource.
- Ground-disturbing construction may either directly demolish or indirectly affect the setting of built-environment resources, resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may either directly demolish or change the setting of TCPs resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may inadvertently disturb human remains.

The alteration of a resource that changes the characteristics that convey its significance is a material alteration under CEQA. The inadvertent disturbance of human remains is a significant impact under CEQA under the CEQA Guidelines Appendix G checklist. Because this construction would materially alter these categories of resources and disturb human remains it would result in a significant impact. Mitigation Measure CUL-7 would reduce these impacts by identifying and evaluating resources, avoiding resources where possible, and developing treatment where avoidance is not possible. In addition construction would be monitored. However, because of the acreage that could be disturbed as a result of implementing the components, as well as the multiple constraints associated with other environmental resources that require mitigation or avoidance, it is unlikely that all cultural resources could be avoided. Therefore, this impact remains significant and unavoidable.

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of Environmental Commitments 3, 4, 6–12, 15, and16

Please see Mitigation Measure CUL-7 under Impact CUL-7 in the discussion of Alternative 4 in Chapter 18, *Cultural Resources*, of the Draft EIR/EIS.

Impact CUL-8: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments with Plans and Policies

Similar to Alternative 4, constructing the proposed water conveyance facilities and implementing conservation and stressor reduction components under Alternative 4A could result in the potential for incompatibilities with plans and policies adopted to protect the cultural resources of the Delta. A number of plans and policies that coincide with the study area provide guidance for protection of cultural resources as overviewed in Section 18.2.3, *Regional and Local Plans, Policies, and Regulations*, of the Draft EIR/EIS. The policies include the Alameda County East Area Plan, Contra Costa County General Plan, San Joaquin County General Plan, Sacramento County General Plan, Solano County General Plan, and the Yolo County General Plan. A detailed summary of the policies is provided in the discussion of Alternative 4. Similar to Alternative 4, the construction of the water conveyance facilities and conservation and stressor reduction components under Alternative 4A would be compatible with the cultural resource protection policies indicated in the Alameda County East Area Plan, San Joaquin County General Plan, Yolo County General Plan, and potentially incompatible with the Contra Costa County General Plan, Sacramento County General Plan, and Solano County General Plan. Similar to Alternative 4, restoration actions under Alternative 4A would be compatible with policies that emphasize mitigation and incompatible with policies that emphasize preservation.

As described in Chapter 13, *Land Use*, Section 13.2.3, of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment.

NEPA Effects: Because federal agencies are not regulated by local land use policy, the alternative would not result in a conflict with local land use laws.

CEQA Conclusion: As under Alternative 4, the Plan Area under Alternative 4A is governed by cultural resource management policies adopted by the various counties with jurisdiction in this region. For policies that emphasize preservation or mitigation Alternative 4 will be compatible with these policies because DWR and appropriate federal agencies will implement cultural resource management practices that will identify significant resources, preserve such resources where feasible, and complete mitigation to reduce significant effects where preservation is not feasible. For policies that emphasize preservation, the project is incompatible in some instances because multiple constraints governing the location of proposed facilities makes preservation of all significant cultural resources unlikely. It should be noted that, as described in Chapter 13, *Land Use*, Section 13.2.3, of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment.

4.3.15 Transportation

Impact TRANS-1: Increased Construction Vehicle Trips Resulting in Unacceptable LOS Conditions

NEPA Effects: Traffic volumes generated during construction of Alternative 4A would be identical to those evaluated under Alternative 4. As shown in Table 19-25 in the Draft EIR/EIS, under baseline plus background growth (BPBG) conditions, a total of 23 roadway segments would exceed level of service (LOS) for at least 1 hour during the 6:00 AM to 7:00 PM analysis period. Construction associated with Alternative 4A would cause LOS thresholds to be exceeded for at least 1 hour during the 6:00 AM to 7:00 PM analysis period on a total of 38 roadway segments under baseline plus background growth plus project (BPBGPP) conditions. Alternative 4A would therefore exacerbate an already unacceptable LOS under BPBG conditions on 15 roadway segments (38 minus the 23 that would already be operating at an unacceptable LOS under BPBG conditions). The effect of increased traffic volumes in excess of LOS thresholds would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Construction under Alternative 4A would add hourly traffic volumes to study area roadways that would exceed acceptable LOS thresholds. This would be a significant impact. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that required roadway capacity improvements outlined under TRANS-1c will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of unacceptable LOS would occur. Accordingly, this impact would be significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-2: Increased Construction Vehicle Trips Exacerbating Unacceptable Pavement Conditions

NEPA Effects: Traffic volumes generated during construction of Alternative 4A would be identical to those evaluated under Alternative 4. As shown in Table 19-26 in the Draft EIR/EIS, construction of Alternative 4 would deteriorate existing pavement conditions to less than the acceptable pavement condition index (PCI) or similar applicable threshold on a total of 46 roadway segments. Damage to roadway pavement is also expected throughout the study area on various local and state roads, as well as on a few interstates. The effect of roadway damage in excess of PCI thresholds would be adverse.

Mitigation Measures TRANS-2a through TRANS-2c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, an adverse effect in the form of deficient pavement conditions would occur. Accordingly, this effect could remain adverse. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, adverse effects could be avoided.

CEQA Conclusion: Construction under Alternative 4A would add traffic trips to study area roadways that would exacerbate unacceptable pavement conditions. This would be a significant impact. Mitigation Measures TRANS-2a through TRANS-2c would reduce the severity of this impact, but not necessarily to less-than-significant levels, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, a significant impact in the form of deficient pavement conditions would occur. Accordingly, this impact could be significant and unavoidable. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, impacts would be reduced to less than significant.

Mitigation Measure TRANS-2a: Prohibit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2b: Limit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2c: Improve Physical Condition of Affected Roadway Segments as Stipulated in Mitigation Agreements or Encroachment Permits

Please refer to Mitigation Measure TRANS-2c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-3: Increase in Safety Hazards, Including Interference with Emergency Routes during Construction

NEPA Effects: The potential for Alternative 4A to increase safety hazards during construction would be identical to those impacts described under Alternative 4. Increases in heavy construction traffic on local roadways could increase safety hazards, such as conflicts with recreational and commuter traffic and with farming operations. The increase in heavy construction traffic using emergency routes could also interfere with emergency service response times. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could create localized interferences with emergency service response times in the vicinity of Bryon Highway. The effect of increased safety hazards from increased heavy construction traffic on local roadways and emergency routes would be adverse.

Mitigation Measure TRANS-1c is available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of increased safety hazards would occur. Accordingly, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Construction of Alternative 4A would increase the amount of trucks using the transportation system in the study area, which could increase the potential for safety hazards, including conflicts with farming operations, emergency services, and recreational and commuter traffic. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could also create localized interferences with emergency service response times in the vicinity of Bryon Highway. This would be a significant impact.

Mitigation Measure TRANS-1c will reduce the severity of this impact, but not to less-than-significant levels since the project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of increased safety hazards would occur. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-4: Disruption of Marine Traffic during Construction

NEPA Effects: The potential for Alternative 4A to disrupt marine traffic during construction would be identical to those impacts described under Alternative 4. Commercial barges would be used to transport tunnel segments from three concrete precast yards to temporary barge unloading facilities on Bouldin Island and at the Clifton Court Forebay. Tugboats would also be used during intake and forebay construction.

Approximately 5,500 barge trips are projected to carry tunnel segments from existing precast yards to project sites via the Sacramento River and other waterways, averaging approximately 8 trips per day through the segment hauling period (2020 to 2025). This potential effect is not considered adverse because construction of Alternative 4A would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area, such that existing marine traffic would be disrupted. Barge routes and landing sites will be selected to maximize continuous waterway access and a minimum waterway width greater than 100 feet. Moreover, Mitigation Measure TRANS-1a would also reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

CEQA Conclusion: Construction of Alternative 4A would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area such that existing marine traffic would be disrupted (on average, only 8 additional barge trips per day are expected through the segment hauling period). Accordingly, this impact would be less than significant. While no mitigation is required, it is important to note that Mitigation Measure TRANS-1a (implemented to reduce effects from Impact TRANS-1) would reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

Impact TRANS-5: Disruption of Rail Traffic during Construction

NEPA Effects: The potential for Alternative 4A to disrupt rail traffic during construction would be identical to those impacts described under Alternative 4. The water conveyance alignment crosses under the existing BNSF/Amtrak San Joaquin line between Bacon Island and Woodward Island and would therefore have no effect on freight service. Similarly, construction of the Clifton Court Forebay would not disrupt UPRR Tracy Subdivision service since the line is currently inactive. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities may adversely affect new service. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) is available to address this effect.

CEQA Conclusion: Construction of Alternative 4A would not physically cross or require modification to an active railroad. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities at the Clifton Court Forebay may affect new service. This would be a significant impact. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) would reduce this impact to less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-6: Disruption of Transit Service during Construction

NEPA Effects: The potential for Alternative 4A to disrupt transit service during construction would be identical to those impacts described under Alternative 4. Construction activities associated with Alternative 4A would increase LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions (refer to Impact TRANS-1). Increased congestion resulting from construction traffic would result in an adverse effect on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Construction activities associated with Alternative 4A would increase LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions. Increased congestion resulting from construction traffic would result in a significant impact on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines. Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this impact, but not necessarily to a level that would not be less than significant, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, a significant and unavoidable impact in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the impact is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-7: Interference with Bicycle Routes during Construction

NEPA Effects: The potential for Alternative 4A to interfere with bicycle routes during construction would be identical to those impacts described under Alternative 4. Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12. The effect of disruption to bicycle routes during construction would be adverse. Mitigation Measure TRANS-1a, which requires alternative access routes via detours or bridges be provided to maintain continual circulation for bicyclists, is available to reduce this effect.

CEQA Conclusion: Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12, resulting in a significant impact. However, Mitigation Measure TRANS-1a would reduce the severity of this impact to less-than-significant levels because project proponents would provide alternate access routes via detours or bridges to maintain continual circulation for local travelers in and around construction zones, including bicycle riders.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-8: Increased Traffic Volumes and Delays during Operations and Maintenance of Conveyance Facilities

NEPA Effects: Traffic volumes generated during long-term operation of Alternative 4A would be identical to those evaluated under Alternative 4. It is estimated that routine operations and yearly maintenance activities would require approximately 40 and 35 employees, respectively. Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during project operations would not be adverse.

CEQA Conclusion: Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections under Alternative 4A would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during operations would therefore be less than significant. No mitigation is required.

Impact TRANS-9: Permanent Alteration of Transportation Patterns during Operations and Maintenance

NEPA Effects: The potential for Alternative 4A to permanently alter transportation patterns during operations and maintenance would be identical to those impacts described under Alternative 4. Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. The effect of permanent alteration of transportation patterns during operations would therefore not be adverse.

CEQA Conclusion: Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. Accordingly, the impact of permanent alteration of transportation patterns during operations would be less than significant. No mitigation is required.

Impact TRANS-10: Increased Traffic Volumes during Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 4A related to increased traffic volumes during implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar to, but less than, those described for Alternative 4. Habitat restoration and enhancement activities that require personnel or heavy-duty equipment transport would generate traffic on area roadways. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. The effect would vary according to the amount of traffic generated by implementation of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the roadway and traffic conditions at the time of implementation.

As described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, the Yolo Bypass Fisheries Enhancement (CM2) would not be completed as a component of Alternative 4A. Similarly, Alternative 4A would only restore up to 1,396 acres of habitat under Environmental Commitments 3, 4, 6, 7, and 9–11 as compared with 83,839 acres under Alternative 4. Therefore, the magnitude of traffic volumes and associated traffic impacts under Alternative 4A would likely be smaller than those associated with Alternative 4. Nevertheless, the effect of increased traffic volumes during construction and maintenance of Environmental Commitments 3, 4, 6–12, 15, and 16 would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Impacts on roadways could result in circulation delays or the inability to maintain adequate vehicular access in or around restoration or enhancement work zones. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. The impact of increased traffic volumes during implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be significant. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact would occur. Therefore, the project's impacts on roadway segment LOS would be conservatively significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-11: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Plans and Policies

NEPA Effects: Constructing the water conveyance facilities and implementing the environmental commitments under Alternative 4A would generally have the same potential for incompatibilities with one or more transportation plans and policies as described for Alternative 4. As described for Alternative 4, the project would be constructed with regulations related to transportation and circulation enforced by local (including the local metropolitan planning organizations [MPOs]) and federal agencies (including the Federal Highway Administration [FHWA] and Federal Aviation Administration [FAA]). The project would also be consistent with Public Resources Code Section 21092.4, Delta Protection Act of 1992, and Delta Plan. Accordingly, there would be no adverse effect.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts TRANS-1 and TRANS-10, above and no additional CEQA conclusion is required related to the compatibility of Alternative 4A with relevant plans and policies.

Impact TRANS-12: Potential Effects on Navigation From Changes in Surface Water Elevations Caused by Construction of Water Conveyance Facilities

Construction for Intakes 2, 3, and 5 will be accomplished using coffer dams at each location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Intakes and screens have been designed and located on-bank to minimize changes to river flow characteristics. Nevertheless, some localized water elevation changes will occur upstream and adjacent to each coffer dam at these intake sites due to facility location within the river. These localized surface elevation changes will not exceed an increase of 0.10 feet at any intake location even at high river flows (when surface elevation changes would be expected to be highest). This represents the highest surface upstream elevation increase after coffer dam removal and during intake operation. Because this maximum increase in elevation is entirely localized, downstream surface elevation changes during intake construction would be insignificant and changes to river depth and width at any location will be insignificant. As a result, boat passage and river use, including Sacramento River tributaries, will not be affected.

As explained in Chapter 6, *Surface Water*, construction of facilities within or adjacent to waterways could change surface water elevations or runoff characteristics. In total, Alternative 4A would result in alterations to drainage patterns, stream courses, and runoff; and potential for slightly increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway, as described for Alternative 1A. Construction of the facilities under Alternative 4A would not result in a substantial decrease in surface water elevations on any navigable waterways and therefore would not have an adverse effect on navigation. Although the increase in surface water elevations in rivers and streams under Alternative 4 creates a potential impact regarding flooding (which is considered less-than-significant with implementation of Mitigation Measure SW-4) the changes in surface water elevation would not have any adverse effects on navigation. See Chapter 6, *Surface Water*, for additional information regarding changes to surface water under Alternative 4A.

NEPA Effects: Water surface changes and potential impacts associated with intake construction are not considered adverse to navigation. Water depth and surface elevations will not be substantially effected from construction of the water conveyance facilities (either localized or downstream of the intake structures). Although some construction activities and in-water features (i.e., cofferdams) may cause minor changes in surface water elevations, these effects are highly localized and surface water elevations would not increase by more than .10 feet at any location, even during flood events. These changes would not result in a substantial decrease in surface water elevations on any navigable waterways. Therefore, surface water changes associated with construction of the water conveyance facilities would not cause an adverse impact to navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during construction of the intakes will not have a significant impact on navigation.

Impact TRANS-13: Potential Effects of Navigation from Changes in Surface Elevations Caused by Operation of Intakes

The hydraulic modeling scenario for this analysis included five intakes because that is the maximum number of intakes included under any alternative. The modeling also assumed the highest North Delta diversion capacity allowed under any alternative. Alternatives with fewer intakes and/or lower diversion capacity, such as Alternative 4A (three intakes and 9,000 cfs maximum diversion capacity), would have less effects to surface water elevations. With respect to Alternative 4A, operation of Intakes 2, 3, and 4 may have localized effects on water surface elevation during certain operational regimes and at various river flows. While intake operations and pumping levels are dictated by many factors, Sacramento River diversions are limited during low flows by operational rules. The nature and extent of impacts caused by diversions at an intake are dependent in large part on the location of the intake on the river. To minimize the intake effects on river surface elevations, intakes were designed as on-bank structures and were placed so that river flood and flow characteristic will be minimally altered. Based on hydrologic modelling, even at the lowest river flows (taking into account both seasonal and tidal variations) and at maximum intake operation (full diversions at each of five alternative intakes), estimates are that boat draft depths of at least 16.5 feet will be maintained within the Sacramento River. *Planning and Design of Navigation Locks* United States Army Corps of Engineers, EM 1110-2-2602 (September 30, 1995) pages 3-8. This river depth has occurred historically and has been adequate to support navigation along the Sacramento River. Additionally, under these same intake divisions/river flows, water surface elevations would be lowered by no more than 0.7 feet, which represents a localized and maximum estimate. Surface elevations downstream of the intakes would be affected less, and during higher river flow and lower intake diversions, river depths would be greater than the minimum estimate.

The minimal changes in surface water elevation anticipated under Alternative 4A, even assuming a maximum lowering of 0.7 feet, would not likely expose any currently unexposed natural or man-made features that would affect or impeded. There would be no new snags or obstructions that would impede navigation.

Moreover, even when operating at maximum capacity, the intakes would not alter flows in a way that would affect commercial vessels or recreational watercraft. The intakes are designed to ensure pumping velocities will have minimal impacts to aquatic species. It is unlikely that changes in flow velocity would be perceptible to operators of marine vessels or recreational watercraft and would have no effect on navigation.

Additional information regarding changes to surface water elevations can be found in Chapter 6, *Surface Water*.

NEPA Effects: Water surface changes and potential impacts associated with intake operation are not considered adverse. Water depth and surface elevations will not be significantly effected (either localized or downstream of the intake structures) and will therefore not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during operation of the intakes will not have a significant impact on navigation.

Impact TRANS-14: Potential Effects on Navigation Caused by Sedimentation from Construction of Intakes

Construction for Intakes 2, 3, and 5 will be accomplished using coffer dams at each location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Construction of coffer dams would require sheet pile driving that would result in incremental suspension of bed sediments. These effects would be temporary and would not have an effect on navigation. Sheet piles at the edge of the levee embankment would likely change eddy currents locally, but rock slope in the transition zone would limit those currents and potential changes to bed load dynamics. As a result, erosion and sedimentation into the Sacramento River during intake construction would be minimal.

Moreover, potential sedimentation effects will be further minimized by limiting the duration of in-water construction activities and through implementing the environmental commitments described in Appendix 3B, *Environmental Commitments,* including the commitment to *Develop and Implement Erosion and Sediment Control Plans* to control short-term and long-term erosion and sedimentation effects and to restore soils and vegetation in areas affected by construction activities following construction. This commitment is related to Avoidance and Minimization Measure (AMM) 4, *Erosion and Sediment Control Plan*, described in BDCP Appendix 3.C. It is anticipated that multiple erosion and sediment control plans will be prepared for construction activities, each taking into account site-specific conditions such as proximity to surface water, erosion potential, drainage, etc. The plans will include all the necessary state requirements regarding erosion control and will implement BMPs for erosion and sediment control that will be in place for the duration of construction activities.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Construction of coffer dams and intake construction would not have an adverse effect on navigation through increased sedimentation and erosion/deposition in the navigable channel.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during construction of the intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-15: Potential Effects on Navigation Caused by Sedimentation From Construction of Barge Facilities

Under Alternative 4A, five temporary barge landings would be constructed at locations adjacent to construction work areas for the delivery of construction materials. Each of the five proposed barge landings would include in-water and over-water structures, such as piling dolphins, docks, ramps, and possibly conveyors for loading and unloading materials; and vehicles and other machinery. Construction of the five barge landings would involve piles at each landing.

To address potential erosion and sedimentation impacts from barge facility construction associated with Alternative 4A, the project proponents will ensure that a Barge Operations Plan is developed and implemented for facility construction. The requirements for the Barge Operations Plan are described in Draft EIR/EIS Appendix 3B, *Environmental Commitments*. This commitment is related to AMM7, *Barge Operations Plan*, described in BDCP Appendix 3.C. This plan will be developed and submitted by the construction contractors per standard DWR contract specifications. Erosion control measures during construction activities at project locations are provided in Appendix 3B, *Environmental Commitments*, as noted above in the discussion of the intakes. Fleeting facilities will be either docking facilities built through pile and wharves or loaded and unloaded using landward positioned cranes. In either case, through AMM7 and the Environmental Commitments, impacts to sedimentation through construction related activities will be localized and minimal.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects**:** Construction and operation of the barge facilities under Alternative 4A would not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation from the temporary barge facilities will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-16: Potential Effects on Navigation Caused by Sedimentation From Construction of Clifton Court Forebay

Clifton Court Forebay would be dredged and redesigned to provide an area where water flowing from the new north Delta facilities will be isolated from water diverted from south Delta channels. While Clifton Court Forebay is a "navigable water," use of the forebay is limited to maintenance operations and is not open to commercial or recreational navigation.

NEPA Effects: Since Clifton Court Forebay is not open to navigation, there is no effect.

CEQA Conclusion: No impact.

Impact TRANS-17: Potential Effects on Navigation Caused by Sedimentation From Operation of Intakes

Sediment loads are present in the Sacramento River as bed loads or distributed within the water column. The Sacramento River is sediment "starved" for most of the year since upstream reservoirs act as settling basins for suspended sediments. In most cases, sediment load is concentrated on the river bed and this bed load depends on several factors including particle size, particle density and flow velocity. To exclude bed loads from entering intake structures during operation, design criteria for the intakes require that the lowest point of the screen is placed above the river bed in such a way that there is no change in bed sediment erosion/distribution patterns. Additionally, screen locations for this alternative are placed on the outer bends of the river to minimize scour, erosion and sediment loading at those locations. Flow control baffles at intakes would be adjusted to control sedimentation near the screens as needed and air jets at screens are proposed to re-suspend sediments as needed.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Operational criteria and design specifications for intake operations will result in no change to water column or bed load sediment dynamics. Erosion and deposition patterns will change little if any during intake operation. As a result, there will be no adverse effect on navigation either near or downstream of the intake locations.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during operation of the proposed intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-18: Potential Effects on Navigation From Construction and Operations of Head of Old River Barrier

Alternative 4A proposes work at the Head of Old River including the construction of fish and flow control gates as well as a small boat lock to allow recreational boat passage. An analysis of potential impacts of this work on navigation was completed in 2005 by Jones and Stokes (*South Delta Improvements Program Vol I: Environmental Impact Statement/Environmental Impact Report*. Draft. October. (J&S 020533.02.) State Clearinghouse #2002092065. Sacramento, CA.) ("SDIP EIS/EIR"). The SDIP EIS/R analyzed whether the proposed barrier/gates facility and locks would cause a change in south Delta flows or water level, river flows or surface water elevations that would result in substantial changes to existing recreational or commercial boating activity and opportunities.

The changes in access to Delta waterways by boats and other vessels during construction and operation of the gates, during channel dredging activities, and attributable to changes in water levels/depths were addressed. Most of the waterways in the immediate project vicinity are public waterways navigable by recreational craft, including rowboats, large houseboats, and cabin cruisers. These waterways are also navigable by smaller commercial vessels, including towing and salvage vessels, clamshell dredges, dredges for repair and maintenance of levees and channels, and pile-driving vessels. Boat access points in the project area include River's End Marina, located on the south side of the DMC, at the confluence with Old River; Tracy Oasis Marina Resort, located on the east side of Tracy Boulevard and the north side of Old River; and possibly at Heinbockle Harbor, located at Tracy Boulevard, on the south side of Grant Line/Fabian and Bell Canal.

According to a California Department of Parks and Recreation (DPR) survey, minimal boat launching and use occurs in the project area. The channels within the project area are too small to accommodate large commercial vessels, and because the channels are also part of an existing temporary barriers project, larger vessels cannot use these channels when the barriers are in place. A boat lock at the proposed facility would ensure boat access upstream of the gate regardless of gate operations. In this regard, upstream boat access could improve over current conditions. Additionally, from June 16 through September 30, the gates will be open and no boat lock operations will be necessary.

With respect to both recreational and commercial navigation, and based on analysis provided in the SDIP EIS/EIR, boat access impacts during facility construction will be less than significant (p. 5.8-14, 5.8-18, 5.8-21), impacts to navigation caused by water level changes during barrier operation will be less than significant (p. 5.8-15. 5.8-19, 5.8-22), impact to non-recreational boaters due to temporary dredging operation will be less than significant (p. 5.8-16, 5.8-19, 5.8-22), and impacts on recreation as a result of constructing and operating any of the alternatives will not be significant (p. 7.4-1).

Construction of the operable barrier could result in increased sedimentation near the gates. Maintenance dredging around the gate would be necessary to clear out sediment deposits. Dredging around the gates would be conducted using a sealed clamshell dredge. Depending on the rate of sedimentation, maintenance would occur every 3 to 5 years. A formal dredging plan with further details on specific maintenance dredging activities will be developed prior to dredging activities. Guidelines related to dredging activities, including compliance with in-water work windows and turbidity standards are described further in Appendix 3B, *Environmental Commitments*, under *Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material*. These activities would ensure that sedimentation would not result in an adverse impact to navigation.

NEPA Effects: With respect to construction and operations of the Head of Old River Barrier, Alternative 4A would have no adverse effect on either commercial or recreational navigation activities.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, construction and operations of the Head of Old River barrier will not have a significant impact on navigation.

Impact TRANS-19: Potential Cumulative Effects on Navigation from Construction and Operations of Water Conveyance Facilities

As explained above and with respect to the construction and operation of these facilities, Alternative 4A would not result in an adverse effects to navigation due to water level elevation changes or altered sedimentation patterns. It is highly unlikely that other projects would combine with these impacts of the project to result in cumulative effects on navigation. This is because the minimal effects of these elements of the project on navigation are localized and would combine only with probable future projects if the projects were located immediately adjacent to the project components. There are no other reasonably foreseeable projects proposed to be located near or adjacent to the planned Alternative 4A facilities.

NEPA Effects: Alternative 4A in combination with other reasonably foreseeable projects would not have a cumulatively adverse effect on navigation.

CEQA Conclusion**:** Because it does not involve a physical change in the environment, effects to navigation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, Alternative 4A in combination with other reasonably foreseeable projects would not have a cumulatively significant impact on navigation.

4.3.16 Public Services and Utilities

Impact UT-1: Increased Demand on Law Enforcement, Fire Protection, and Emergency Response Services from New Workers in the Plan Area as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the provision of law enforcement, fire protection, and emergency response services as a result of construction of the proposed water conveyance facilities would be identical to those described for Alternative 4. Increased Public Service Demands Associated with Workers Relocating to the Study Area

Alternative 4A would not result in a permanent increase in population that could tax the ability to provide adequate law enforcement, fire protection services, and medical services, the increase in construction workers anticipated during the construction period of approximately 13.5 years could increase demands for these services during this period. The construction population needed for construction of the water conveyance facilities would primarily come from the existing five-county labor force which is already served by law enforcement agencies and medical/emergency response services (hospitals) in the Plan Area (Tables 20A-1 to 20A-3 in Appendix 20A of the Draft EIR/EIS), and because the minor increase in demand from the worker population that would move into the area to fill specialized jobs (e.g., tunnel construction) would be spread across the large multi-county study area, construction of the alternative is not anticipated to result in an increased demand on law enforcement, fire protection, or medical services. This effect is not considered adverse.

Increased Public Service Demands Associated with Construction Work Areas and Activities

Construction of Alternative 4A would be identical to Alternative 4. Alternative 4A would not increase the demand on law enforcement, fire protection, and emergency response services either due to an increased worker population or due to construction-related hazards, such that it would result in substantial adverse physical effects associated with the provision of, or the need for, new or physically altered governmental facilities. Environmental commitments to lessen the impacts associated with construction property protection and the potential for construction-related accidents associated with hazardous materials spills, contamination, or fires, and reduce potential effects associated with increased service demands from new construction workers in the Plan Area (as discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would continue to reduce potential effects associated with increased service demands from new construction workers in the project area. Impacts on emergency response times from construction traffic using emergency routes are discussed in Chapter 19, *Transportation*, Impact Trans-3, of the Draft EIR/EIS. Therefore, the effect would not be adverse.

CEQA Conclusion: The potential for impacts on law enforcement and fire services and facilities is not expected to be significant because the estimated increase in population in the Plan Area associated with construction of the alternative during peak construction would be distributed over multiple cities and counties within the Plan Area. Incorporation of environmental commitments (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires, and provide for onsite security at construction sites would minimize potential effects related to the potential for construction-related accidents, and increased demand for public services associated with construction property protection. Environmental commitments would also be incorporated to reduce potential exposure of hazardous materials to the human and natural environment, thereby minimizing the potential demand for fire or emergency services.

Construction of Alternative 4A would not require new or physically altered governmental facilities since it would not cause a marked increase in the worker population in the Plan Area, nor would it increase the potential for construction-related hazards. This impact would be less than significant. No mitigation is required.

Impact UT-2: Displacement of Public Service Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Construction impacts of water facilities under Alternative 4A would be identical to those under Alternative 4. There are no public facilities in the proposed tunnel alignment. Construction of the tunnel facilities is not anticipated to conflict with any public facilities, nor would it require the construction or major alteration of such facilities. Therefore, this effect would not be adverse.

CEQA Conclusion: Construction of the proposed water conveyance facilities under Alternative 4A would not require the construction or major alteration of public service facilities. Therefore, this impact would be less than significant. No mitigation is required.

Impact UT-3: Effects on Public Schools as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Construction of Alternative 4A water conveyance facilities will be identical to Alternative 4 and is not anticipated to result in a substantial increase in demand for public schools in the Plan Area and would not create a need for new or physically altered public schools due to the fact that any increase in the population due to the necessary construction workforce would be temporary and would represent a small incremental increase in the projected regional population. Most of the project construction jobs would be filled by workers from within the existing five-county labor force and any incremental increase in school-age children of construction personnel moving into the area for specialized jobs (e.g., tunnel construction) required by construction of Alternative 4A would likely be distributed through a number of schools within the Plan Area. There would be no adverse effect.

CEQA Conclusion: There would be a significant impact if the proposed action resulted in substantial adverse physical effects associated with the provision of, or the need for, new or physically altered governmental facilities, the construction of which could cause significant environmental effects, for any public services. The majority of construction jobs are expected to be filled by workers from the existing five-county labor force. The incremental increase in school-age children of construction personnel moving into the area for specialized construction jobs (e.g., tunnel construction) would likely be distributed through a number of schools within the Plan Area. This increase in school enrollment would not be substantial enough to exceed the capacity of any individual district, or to warrant construction of a new facility or alteration of an existing facility within the Plan Area. The impact would be less than significant. No mitigation is required.[1]

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[1] Under California law, the rules governing what constitutes adequate mitigation for impacts on school facilities is governed by legislation. Pursuant to the operative statutes, impacts on schools, with some exceptions, are sufficiently mitigated, as a matter of law, by the payment of school impact fees by residential developers. (See Cal. Gov. Code, §§ 65995[h], 65996[a].)

Impact UT-4: Effects on Water or Wastewater Treatment Services and Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the need for expanded water or wastewater treatment facilities would be similar to those for Alternative 4. For purposes of this analysis, the amount of water supply required under this alternative would be the same as under Alternative 4. As such, the total potable water supply needed under this alternative is estimated to be 177.8 million gallons (Table 20-3 in the Draft EIR/EIS). It is anticipated that if there are existing water lines in the vicinity of the construction sites, the field office will connect to them. Because construction of this alternative would primarily occur in rural parts of the study area, and is not likely to occur in areas with municipal water service, it is not expected to impact municipal water systems. If there are no existing water lines in the vicinity, then field offices will require construction of a water tank. Water for construction will be provided by available sources to the extent possible; if needed, water may be brought to the construction sites in water trucks. Construction impacts associated with trucks, including water trucks, are addressed in Chapter 19, *Transportation*, Chapter 22, *Air Quality and Greenhouse Gases*, and Chapter 23, *Noise*. As such, this alternative would not likely adversely affect municipal water supplies. Additionally, the potable water demand would be temporary and limited to the construction period.

Tunnel boring for Alternative 4A would create a substantial amount of wastewater as with Alternative 4. As part of the alternative, DWR would implement an environmental commitment (as discussed in Appendix 3B, *Environmental Commitments*) that would dispose of and reuse spoils, reusable tunnel material, and dredged material. Concrete batch plants would also create wastewater, which would be treated onsite at designated concrete batch plant sites. Wastewater generated during construction at field offices and temporary construction facilities will be served by temporary portable facilities (e.g., portable toilets). As discussed in Chapter 8, *Water Quality*, as part of the *Environmental Commitments* (Appendix 3B) for each alternative, DWR will be required to conduct project construction activities in compliance with the State Water Board's *NPDES Stormwater General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order No. 2009-0009-DWQ/NPDES Permit No. CAS000002). This General Construction NPDES Permit requires the development and implementation of a SWPPP that outlines the temporary construction-related BMPs to prevent and minimize erosion, sedimentation, and discharge of other construction-related contaminants, as well as permanent post-construction BMPs to minimize adverse long-term stormwater related–runoff water quality effects.

Considered across the alternative, potable water supply needs are substantial in volume; however, these requirements would need to be met over a construction period of approximately 13.5 years, and would be anticipated to be met with non-municipal water sources without any need for new water supply entitlements. Also similar to Alternative 4, wastewater created as a result of tunnel boring and concrete batching would be provided by temporary facilities and treated onsite. Construction of Alternative 4A would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. This effect would not be adverse.

CEQA Conclusion: Construction of Alternative 4A would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. While construction of Alternative 4A would require 177.8 million gallons of potable water, this supply could be met by non-municipal sources such as non-municipal water wells or water trucks, without any new water supply entitlements. Additional needs for wastewater treatment and potable water could also be served by non-municipal entities. Water for construction activities would be brought to the site in water trucks. Wastewater services for construction crews would be provided by temporary portable facilities. This impact would be less than significant. Mitigation is not required.

Impact UT-5: Effects on Landfills as a Result of Solid Waste Disposal Needs during Construction of the Proposed Water Conveyance Facilities

NEPA Effects: Alternative 4A would create the same amount of solid waste as Alternative 4. Overall, the construction waste that could be generated by implementing Alternative 4A would not result in an adverse effect on the capacity of available landfills because 50% or more of construction waste generated by this alternative would be diverted (in accordance with diversion requirements set forth by the State Agency Model IWMA and BMP 13 [Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS]), and the construction debris and excavated material that would require disposal at a landfill could be accommodated by, and would have a negligible effect, on the remaining permitted capacity of Plan Area landfills. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. This effect would not be adverse.

CEQA Conclusion: Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it would be expected that construction of the proposed water conveyance facilities would not cause any exceedance of landfill capacity. RTM resulting from construction of tunnel segments would be treated in designated RTM work areas. Debris from structure demolition, power poles, utility lines, piping, and other materials would be diverted from landfills to the maximum extent feasible at the time of demolition. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. Further, implementation of BMP 13 (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would require development of a project-specific construction debris recycling and diversion program to achieve a documented 50% diversion of construction waste. Construction of Alternative 4A would not create solid waste in excess of the permitted capacity of area landfills, nor would it adversely affect the expected lifespan of these solid waste facilities. Therefore, there would be a less-than-significant impact on solid waste management facilities.

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Disruption of utility services or relocation of existing facilities would be identical to that described under Alternative 4. This water conveyance alignment, along with its associated physical structures, could interfere with 12 overhead power/electrical transmission lines Figure 24-6 in the Draft EIR/EIS), 6 natural gas pipelines (Table 20-5 and Figure 24-3 in the Draft EIR/EIS), 11 inactive oil or gas wells (Figure 24-5 in the Draft EIR/EIS), the Mokelumne Aqueduct, and 43 miles of agricultural delivery canals and drainage ditches, including approximately 13 miles on Byron Tract, and 7 miles on Bouldin Island. Additionally, active gas wells may need to be plugged and abandoned. Relocation of additional facilities near proposed forebays, RTM, and borrow or spoils areas could also be necessary. The potential damage and disruption to buried and overhead electric transmission lines would be similar for telecommunication infrastructure. Because relocation and disruption of existing utility infrastructure would be required under this alternative and would have the potential to create environmental effects, this effect would be adverse.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce the severity of this effect. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the effect would not be adverse.

CEQA Conclusion: Under this alternative, most features would avoid disrupting existing facilities by crossing over or under infrastructure. However, construction of facilities would conflict with existing utility facilities in some locations. Regional power transmission lines and one natural gas pipeline would require relocation. Because the relocation and potential disruption of utility infrastructure would be required, this impact would be significant.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce these impacts through measures that could avoid disruption of utility infrastructure. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the impact would be less-than-significant. However, because coordination with a third party is required in order to carry out this mitigation, a conservative assessment of significant and unavoidable is being made.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Impact UT-7: Effects on Public Services and Utilities as a Result of Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Operation and maintenance activities would require minimal labor. Impacts under Alternative 4A would be identical to that under Alternative 4. Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial demand for law enforcement, fire protection, or emergency response services. In addition, operation and maintenance would not place service demand on public schools or libraries. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new or physically altered government facilities as a result of increased need for public services.

Potential effects associated with operation and maintenance of water conveyance facilities would be similar to those described under Alternative 4. Therefore, Alternative 4A would not result in physical effects associated with the provision of new or physically altered government facilities.

Operation and maintenance of Alternative 4A facilities would involve use of water for pressure washing intake screen panels and basic cleaning of building facilities and other equipment. Impacts would be identical to those under Alternative 4. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new water supply entitlements, or require construction of new water or wastewater treatment facilities or expansion of existing facilities.

Similar to Alternative 4, the operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to generate solid waste such that there would be an increase in demand for solid waste management providers in the Plan Area and surrounding communities. Therefore, there would be no or minimal effect on solid waste management facilities.

As with Alternative 4, operation and maintenance of proposed water conveyance facilities under this alternative would require new transmission lines for intakes, pumping plants, operable barriers, boat locks, and gate control structures throughout the various proposed conveyance alignments and construction of project facilities. Points of interconnection would be located identically to Alternative 4.

Operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to result in the disruption or relocation of utilities. Effects associated with energy demands of operation and maintenance of the proposed water conveyance facilities are addressed in Chapter 21, *Energy*, of the Draft EIR/EIS.

Overall, operation and maintenance of the conveyance facilities under Alternative 4A would not result in adverse effects on service demands, water supply and treatment capacity, wastewater and solid waste facilities nor conflict with local and regional utility lines. There would not be an adverse effect.

CEQA Conclusion: Operation and maintenance activities associated with the Alternative 4A proposed water conveyance facilities would not result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities. The impact on public services and utilities would be less than significant. No mitigation is required.

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 4A related to the potential for effects on public services and utilities from implementing applicable conservation and other stressor reductions would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, 6–10 as compared with 83,900 acres under Alternative 4. Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 4A would likely be smaller than those associated with Alternative 4.

Public Services

Potential effects of implementing conservation and other stressor reductions under Alternative 4A on law enforcement, fire protection, and emergency response services would primarily involve demand for services related to construction site security and construction-related accidents. The effect would be similar to that under Alternative 4, but because only portions of the restoration conservation measures and fewer of the other stressor reduction conservation measures would be implemented under Alternative 4A, it is likely that the effects on public services would be less than those presented for Alternative 4. This effect would not be considered adverse with the implementation of environmental commitments to provide onsite private security services at construction areas and environmental commitments that would minimize the potential for construction-related accidents associated with hazardous materials spills, contamination, or fires, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS. These environmental commitments would be incorporated into this alternative and would provide for onsite security at construction sites and minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the conservation components.

Utilities

Water and Wastewater

Implementation of some of the conservation components, in particular those involved with restoration and enhancement of some habitat types, could require a water supply, but would not require city or county treated water sources. Effects would be similar to, but lesser in magnitude than that under Alternative 4, due to the fact that Alternative 4A involves smaller acreage amounts of restoration and conservation. Additionally, some components that would require water supply under Alternative 4 are not a part of Alternative 4A (CM5). Conservation components that could increase need for water supply are restoration of natural tidal communities (Environmental Commitment 4), channel margin (Environmental Commitment 6), riparian (Environmental Commitment 7), vernal pool and alkali seasonal wetland complex (Environmental Commitment 9), and nontidal marsh habitats (Environmental Commitment 10); and maintenance of these habitats. Measures related to the reduction of stressors on covered species that are a part of Alternative 4A would not generally require a treated water supply or generate wastewater. Because the location and construction or operational details (i.e., water consumption and water sources associated with conservation components of these facilities and programs) have not yet been developed, the need for new or expanded water or wastewater treatment facilities is uncertain. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely.

Solid Waste

Implementation of some of the conservation components would result in construction debris and green waste. Implementation of habitat restoration and enhancement proposed under Environmental Commitments 4, 6, 7, and 9–11 would involve restoration, enhancement, and management of various types of habitat. Construction activities could require clearing and grubbing, demolition of existing structures (e.g., roads and utilities), surface water quality protection, dust control, establishment of storage and stockpile areas, temporary utilities and fuel storage, and erosion control. Effects would be similar to, but less in magnitude than that under Alternative 4, due to the fact that Alternative 4A involves smaller acreage amounts of restoration and conservation. The estimated tonnage of construction debris and solid waste that would be generated from construction associated with the proposed conservation components is unknown. However, there is a remaining landfill capacity of over 300 million tons in nearby landfills (Table 20A-6 in Appendix 20A of the Draft EIR/EIS). The disposal of construction debris and excavated material would occur at several different locations depending on the type of material and its origin. Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it is expected that construction and operation of the proposed conservation components would not cause any exceedance of landfill capacity.

Electricity and Natural Gas

Conservation components including habitat restoration and enhancement would, in some cases, involve substantial earthwork and ground disturbance. As discussed above under Impact UT-6, construction could potentially disrupt utility services, and ground disturbance has potential to damage underground utilities. The long-term conversion of existing utility corridors to habitat purposes could require the relocation of utility infrastructure, which could carry environmental effects. Mitigation Measures UT-6a, UT-6b, and UT-6c would be available to reduce the severity of these effects.

Effects would be similar to, but less in magnitude than that under Alternative 4, due to the fact that Alternative 4A involves smaller acreage amounts of restoration and conservation. The locations, construction, and operational details for these and other conservation components have not been identified. Adverse effects due to the construction, operation and maintenance activities associated with the conservation components are not expected to result in the need for new government facilities to provide public services or the need for new or expanded water or wastewater treatment facilities based on increased demand. Environmental commitments would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the conservation components. However, there is a potential for the disruption or relocation of utility infrastructure, which has the potential to result in an adverse effect. Further, no substantive adverse effects on solid waste management facilities are anticipated. Because the location and construction and operational details (i.e., water consumption and water sources associated with conservation components) related to these facilities and programs have not yet been developed, the need for new or expanded water or wastewater treatment facilities is uncertain. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely. This effect would be adverse.

CEQA Conclusion: Significant impacts could occur if implementation of the proposed conservation components would result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities.

Implementation of the proposed conservation components under Alternative 4A is not likely to require alteration or construction of new government facilities due to increased need for public services and utilities. Several measures to reduce stressors on covered species could result in water supply requirements, but are not expected to require substantial increases in demand on municipal water and wastewater treatment services.

Construction and operation activities associated with the proposed conservation measures would result in a less-than-significant impact on solid waste management facilities based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California.

Potential impacts of implementing conservation components on law enforcement, fire protection, and emergency response services within the ROAs would be less-than-significant with the incorporation of environmental commitments into this alternative and would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the conservation components (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

The need for new or expanded water facilities and the potential to disrupt utilities in the study area as a result of construction of operation of conservation and other stressor reductions is unknown at this time, nor have construction and operational details been settled upon. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely. While Mitigation Measures UT-6a, UT-6b, and UT-6c could reduce the significance of impacts on utilities; it is uncertain whether these mitigations could reduce this impact in every case. Therefore, this impact would be significant and unavoidable.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

4.3.17 Energy

Impact ENG-1: Wasteful or Inefficient Energy Use for Temporary Construction Activities

NEPA Effects: Total construction energy use (2,132 GWh and 104 million gallons of diesel and gasoline) and the potential for Alternative 4A to result in a wasteful, inefficient or unnecessary consumption of construction energy would be identical to Alternative 4. Construction BMPs would ensure that only high-efficiency equipment is utilized during construction (see Appendix 3B, *Environmental Commitments*, Section 3B.5.3, in Appendix A of this RDEIR/SDEIS) and that construction activity would not result in an adverse effect on energy resources.

CEQA Conclusion: Energy requirements for construction of the water conveyance facilities associated with Alternative 4A would equate to 2,132 GWh during the construction period. Alternative 4A would also consume approximately 104 million gallons of diesel and gasoline. Construction BMPs would ensure that only high-efficiency equipment is utilized during construction and that construction activity would result in a less-than-significant impact on energy resources. No mitigation is required.

Impact ENG-2: Wasteful or Inefficient Energy Use for Pumping and Conveyance

NEPA Effects: Alternative 4A water conveyance operations would be similar to the range of possible operations for the spring and fall Delta outflow requirements that would occur under Alternative 4 Operational Scenario H3 and Alternative 4 Operational Scenario H4. As shown in Table 21-12 in Appendix A of this RDEIR/SDEIS, energy use for north Delta intake pumping and tunnel conveyance would range between 150 GWh per year and 170 GWh per year under ELT conditions. Accordingly, increased energy use at the north Delta would be slightly higher under Alternative 4A (ELT) than estimated for Alternative 4 (energy use under Alternative 4A LLT would be identical to energy use under Alternative 4). While Alternative 4A would still increase energy demand at the north Delta, relative to the No Action Alternative, operation of the water conveyance facility would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 4A would not result in a wasteful or inefficient energy use and there would be no adverse effect.

CEQA Conclusion: Operation of Alternative 4A would require an additional 150 and 170 GWh per year under ELT conditions for north Delta pumping, relative to Existing Conditions. Operation of the water conveyance facility under both scenarios would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 4A would not result in a wasteful or inefficient energy use and this impact would be less than significant. No mitigation is required.

Impact ENG-3: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 with Plans and Policies

NEPA Effects: Constructing the water conveyance facilities and implementing the environmental commitments under Alternative 4A would generally have the same potential for incompatibilities with one or more plans and policies related to energy resources as described for Alternative 4. As described for Alternative 4, the project would be constructed and operated in compliance with regulations related to energy resources enforced by Federal Energy Regulatory Commission (FERC) and other federal agencies. The project would not conflict with the Warren-Alquist Act or State CEQA Guidelines, Appendix F, *Energy Conservation.* Accordingly, there would be no adverse effect.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts ENG-1 and ENG-2, above and no additional CEQA conclusion is required related to the compatibility of Alternative 4A with relevant plans and policies.

4.3.18 Air Quality and Greenhouse Gases

Impact AQ-1: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

NEPA Effects: Construction emissions generated by Alternative 4A in the Sacramento Metropolitan Air Quality Management District (SMAQMD) would be identical to those generated by Alternative 4. As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, nitrogen oxide (NO_X) emissions would exceed SMAQMD's daily threshold for all years between 2018 and 2029, even with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Since NO_X is a precursor to ozone and particulate matter (PM), violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the national ambient air quality standards (NAAQS) and California ambient air quality standards (CAAQS). Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

CEQA Conclusion: NO_X emissions generated during construction of Alternative 4A would exceed SMAQMD regional threshold of significance. Since NO_X is a precursor to ozone and PM, violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation. The impact of generating NO_X emissions in excess of local air district thresholds would violate applicable air quality standards in the study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions to a less-than-significant level by offsetting emissions to quantities below SMAQMD CEQA thresholds.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants[2]

Please refer to Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[2] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Impact AQ-2: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

NEPA Effects: Construction emissions generated by Alternative 4A in the Yolo-Solano Air Quality Management District (YSAQMD) would be identical to those generated by Alternative 4. As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, criteria pollutant emissions would not exceed YSAQMD regional thresholds. Accordingly, construction of Alternative 4A would not contribute to or worsen existing air quality conditions. There would be no adverse effect.

CEQA Conclusion: Construction emission would not exceed YSAQMD's regional thresholds of significance. Accordingly, Alternative 4A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-3: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

NEPA Effects: Construction emissions generated by Alternative 4A in the Bay Area Air Quality Management District (BAAQMD) would be identical to those generated by Alternative 4. As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, construction emissions would exceed BAAQMD's daily thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

- Reactive organic gases (ROG): 2020–2028
- NO_X: 2018–2029

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Mitigation Measures AQ-3a and AQ-3b are available to reduce ROG and NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

CEQA Conclusion: Emissions of ROG and NO_X generated during construction would exceed BAAQMD regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could affect both regional ozone and PM formation. The impact of generating ROG and NO_X emissions in excess of BAAQMD's regional thresholds would therefore violate applicable air quality standards in the Study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-3a and AQ-3b would be available to reduce ROG and NO_X emissions to a less-than-significant level by offsetting emissions to quantities below BAAQMD CEQA thresholds.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[3]

Please refer to Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[3] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-4: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

NEPA Effects: Construction emissions generated by Alternative 4A in the San Joaquin Valley Air Pollution Control District (SJVAPCD) would be identical to those generated by Alternative 4. As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, construction emissions would exceed SJVAPCD's regional thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

- ROG: 2020-2025
- NO_X: 2018–2028
- PM less than 10 microns in diameter (PM10): 2019–2025

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. Mitigation Measures AQ-4a and AQ-4b are available to reduce ROG, NO_X, and PM10 emissions, and would thus address regional effects related to secondary ozone and PM formation.

CEQA Conclusion: Emissions of ROG, NO_X, and PM10 generated during construction would exceed SJVAPCD's regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. The impact of generating ROG, NO_X, and PM10 emissions in excess of SJVAPCD's regional thresholds would therefore violate applicable air quality standards in the study area and could contribute to or worsen an existing air quality condition. This would be a significant impact. Mitigation Measures AQ-4a and AQ-4b would be available to reduce ROG, NO_X, and PM10 emissions to a less-than-significant level by offsetting emissions to quantities below SJVAPCD CEQA thresholds.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants[4]

Please refer to Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-5: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

NEPA Effects: The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., number and location of intakes). Since the water conveyance footprint under Alternative 4A would be identical to Alternative 4, operational activities required for Alternative 4A in the SMAQMD would be the same as those required for Alternative 4. Accordingly, operational emissions generated by Alternative 4A under the ELT and LLT conditions would be the same as those analyzed for Alternative 4 under the ELT and LLT conditions. As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, emissions under both conditions would not exceed SMAQMD's regional thresholds of significance. Accordingly, project operations would not contribute to or worsen existing air quality violations. There would be no adverse effect.

CEQA Conclusion: Emissions generated during operation and maintenance activities would not exceed SMAQMD regional thresholds of significance. Accordingly, Alternative 4A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-6: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

NEPA Effects: No permanent features would be constructed in the YSAQMD that would require routine operations and maintenance. Accordingly, no operational emissions would be generated in the YSAQMD under either Alternative 4 or 4A. Alternative 4A would therefore neither exceed the YSAQMD regional thresholds of significance nor result in an adverse effect on air quality.

CEQA Conclusion: No operational emissions would be generated in the YSAQMD. Consequently, operation of Alternative 4A would not exceed the YSAQMD regional thresholds of significance. This impact would be less than significant. No mitigation is required.

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[4] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Impact AQ-7: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

NEPA Effects: The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the Clifton court forebay). Since the water conveyance footprint under Alternative 4A would be identical to Alternative 4, operational activities required for Alternative 4A in the BAAQMD would be the same as those required for Alternative 4. Accordingly, operational emissions generated by Alternative 4A under the ELT and LLT conditions would be the same as those analyzed for Alternative 4. As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions under the ELT condition would not exceed BAAQMD's regional thresholds of significance. Accordingly, project operations would not contribute to or worsen existing air quality violations. There would be no adverse effect.

CEQA Conclusion: Emissions generated during operation and maintenance activities would not exceed BAAQMD regional thresholds of significance. Accordingly, Alternative 4A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-8: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

NEPA Effects: The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the tunnel segments). Since the water conveyance footprint in SJVAPCD under Alternative 4A would be identical to Alternative 4, operational activities required for Alternative 4A in the SJVAPCD would be the same as those required for Alternative 4. Accordingly, operational emissions generated by Alternative 4A in SJVAPCD under the ELT and LLT conditions would be the same as those analyzed for Alternative 4. As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions under the ELT condition would not exceed SJVAPCD's regional thresholds of significance. Accordingly, project operations would not contribute to or worsen existing air quality violations. There would be no adverse effect.

CEQA Conclusion: Emissions generated during operation and maintenance activities would not exceed SJVAPCD regional thresholds of significance. Accordingly, Alternative 4A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-9: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SMAQMD's Health-Based Concentration Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the SMAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized PM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-101 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would exceed SMAQMD's 24-hour PM10 threshold at 10 receptor locations. The exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce this effect

CEQA Conclusion: As shown in Table 22-102 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would exceed SMAQMD's 24-hour PM10 threshold at 10 receptor locations. The exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce impacts to less than significant (see Table 22-102 in Appendix A of this RDEIR/SDEIS).

Mitigation Measure AQ-9: Implement Measures to Reduce Re-Entrained Road Dust and Receptor Exposure to PM2.5 and PM10

Please refer to Mitigation Measure AQ-9 under Impact AQ-9 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-10: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of YSAQMD's Health-Based Concentration Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the YSAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized PM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than YSAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

CEQA Conclusion: As shown in Table 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than YSAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-11: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of BAAQMD's Health-Based Concentration Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the BAAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized PM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 concentrations under Alternative 4 are less than BAAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

CEQA Conclusion: As shown in Table 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 concentrations under Alternative 4 are less than BAAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-12: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SJVAPCD's Health-Based Concentration Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the SJVAPCD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized PM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

CEQA Conclusion: As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 4A would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-13: Exposure of Sensitive Receptors to Health Threats from Localized Carbon Monoxide

NEPA Effects: Construction activity required for Alternative 4A would be equal to activity required for Alternative 4. Emissions and associated health risks from localized carbon monoxide (CO) exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As described under Alternative 4, given that 1) construction activities typically do not result in CO hot-spots, 2) onsite concentrations must comply with the Occupational Safety and Health Administration (OSHA) standards, and 3) CO levels dissipate as a function of distance, equipment-generated CO emissions (see Table 22-99 in Appendix A of this RDEIR/SDEIS) are not anticipated to result in adverse health threats to sensitive receptors.

With respect to CO hot-spot formation along construction haul routes, as shown in Table 19-25 in Appendix A of this RDEIR/SDEIS, the highest peak hour traffic volumes under BPBGPP—8,088 vehicles per hour—would occur on westbound Interstate 80 between Suisun Valley Road and SR 12. This is about half of the congested traffic volume modeled by BAAQMD (24,000 vehicles per hour) that would be needed to contribute to a localized CO hot-spot, and less than half of the traffic volume modeled by SMAQMD (31,600 vehicles per hour). Accordingly, construction traffic is not anticipated to result in adverse health threats to sensitive receptors.

CEQA Conclusion: Continuous engine exhaust may elevate localized CO concentrations. Receptors exposed to these CO "hot-spots" may have a greater likelihood of developing adverse health effects. Construction sites are less likely to result in localized CO hot-spots due to the nature of construction activities (Sacramento Metropolitan Air Quality Management District 2014), which normally utilize diesel-powered equipment for intermittent or short durations. Moreover, construction sites must comply with the OSHA CO exposure standards for onsite workers. Accordingly, given that construction activities typically do not result in CO hot-spots, onsite concentrations must comply with OSHA standards, and CO levels dissipate as a function of distance, equipment-generated CO emissions are not anticipated to result in significant health threats to sensitive receptors. Similarly, peak-hour construction traffic on local roadways would not exceed BAAQMD's or SMAQMD's conservative screening criteria for the formation potential CO hot-spots. This impact would be less than significant. No mitigation is required.

Impact AQ-14: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SMAQMD's Chronic Non-Cancer and Cancer Risk Assessment Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the SMAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized diesel particulate matter (DPM) exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-106 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SMAQMD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

CEQA Conclusion: DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 4A construction would not exceed the SMAQMD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-15: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of YSAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the YSAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized DPM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-107 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the YSAQMD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

CEQA Conclusion: DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 4A construction would not exceed the YSAQMD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-16: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of BAAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the BAAQMD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized DPM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-108 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

CEQA Conclusion: DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 4A construction would not exceed the BAAQMD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-17: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SJVAPCD's Chronic Non-Cancer and Cancer Risk Thresholds

NEPA Effects: Construction activity required for Alternative 4A within the SJVAPCD would be equal to activity required for Alternative 4. Emissions and associated health risks from localized DPM exposure for Alternative 4 would therefore be representative of emissions and health risks generated by Alternative 4A. As shown in Table 22-109 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

CEQA Conclusion: DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 4A construction would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-18: Exposure of Sensitive Receptors to Coccidioides immitis (Valley Fever)

NEPA Effects: The potential for Alternative 4A to expose receptors adjacent to the construction site to spores known to cause Valley Fever would be identical to Alternative 4. As discussed under Alternative 4, earthmoving activities during construction could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of advanced air-district recommended fugitive dust controls outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, the effect of exposure of sensitive receptors to increased Valley Fever risk during construction would not be adverse.

CEQA Conclusion: Construction of the water conveyance facility would involve earthmoving activities that could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of air-district recommended fugitive dust controls outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, this impact would be less than significant. No mitigation is required.

Impact AQ-19: Creation of Potential Odors Affecting a Substantial Number of People during Construction or Operation of the Proposed Water Conveyance Facility

NEPA Effects: Odors from construction would primarily originate from diesel equipment and excavated organic material. Since construction equipment activity and the quantity of excavated material under Alternative 4A would be identical to Alternative 4, the potential for Alternative 4A to expose receptors to nuisance odors during construction of the water conveyance facilities would be the same as Alternative 4. As discussed under Alternative 4, odors from construction activities would be localized and generally confined to the immediate area surrounding the construction site. Moreover, odors would be temporary and localized, and they would cease once construction activities have been completed. Thus, it is not anticipated that construction of water conveyance facilities would create objectionable odors from construction equipment or asphalt paving. Similarly, drying and stockpiling of removed muck and sediment will occur under aerobic conditions, which will limit any potential decomposition and associated malodorous products. Accordingly, tunnel and sediment excavation would not create objectionable odors.

With respect to odors during long-term operation, Alternative 4A would not result in the addition of odors facilities (e.g., wastewater treatment plants). Accordingly, similar to Alternative 4, long-term operation of the water conveyance facility would not result in objectionable odors. There would be no adverse effect.

CEQA Conclusion: Alternative 4A would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Likewise, potential odors generated during asphalt paving would be addressed through mandatory compliance with air district rules and regulations. While tunnel excavation would unearth approximately 27 million cubic yards of muck, geotechnical tests indicate that soils in the Plan Area have relatively low organic constituents. Moreover, drying and stockpiling of the removed muck will occur under aerobic conditions, which will further limit any potential decomposition and associated malodorous products. Accordingly, the impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-20: Generation of Criteria Pollutants in the Excess of Federal *De Minimis* Thresholds from Construction and Operation and Maintenance of the Proposed Water Conveyance Facility

NEPA Effects: The potential for Alternative 4A to exceed the federal *de minimis* thresholds during construction of the water conveyance facilities would be identical to Alternative 4. As shown in Table 22-110 in Appendix A of this RDEIR/SDEIS, implementation of Alternative 4 would exceed the following federal *de minimis* thresholds during construction:

<u>Sacramento Federal Nonattainment Area (SFNA)</u>

- NO_X: 2019–2027

<u>San Joaquin Valley Air Basin (SJVAB)</u>

- ROG: 2020–2025
- NO_X: 2018–2028

<u>San Francisco Bay Area Air Basin (SFBAAB)</u>

- NO_X: 2024–2025

ROG and NO_X are precursors to ozone, for which the SFNA, SJVAB, and SFBAAB are in nonattainment for the NAAQS. Since project emissions exceed the federal *de minimis* thresholds for ROG (SJVAB only) and NO_X, a general conformity determination must be made to demonstrate that total direct and indirect emissions of ROG (SJVAB only) and NO_X would conform to the appropriate SFNA, SJVAB, and SFBAAB state implementation plans (SIPs) for each year of construction in which the *de minimis* thresholds are exceeded.

NO_X is also a precursor to PM and can contribute to PM formation. Sacramento County and the SJVAB are currently designated maintenance for the PM10 NAAQS, whereas the SJVAB, SFBAAB, and portions of the SFBA are designated nonattainment for the PM2.5 NAAQS. NO_X emissions in excess of 100 tons per year in Sacramento County and SJVAB trigger a secondary PM10 precursor threshold, whereas NO_X emissions in excess of 100 tons per year in the SFNA, SJVAB, or SFBAAB trigger a secondary PM2.5 precursor threshold. Since NOx emissions can contribute to PM formation, NO_X emissions in excess of these secondary precursor thresholds could conflict with the applicable PM10 and PM2.5 SIPs.

As shown in Table 22-110 in Appendix A of this RDEIR/SDEIS, NO_X emissions generated by construction activities in SFNA would exceed 100 tons in 2025. However, only 96 of these tons would be generated in Sacramento County. Accordingly, the project does not trigger the secondary PM10 precursor threshold in Sacramento County, but would trigger the secondary PM2.5 precursor threshold in 2025. The PM2.5 precursor threshold would also be exceeded in the SFBAAB in 2024 and 2025. The PM10 and PM2.5 precursor thresholds would be exceeded in the SJVAB in 2021 and 2022. Accordingly, secondary PM2.5 and PM10 (SJVAB only) effects must be considered in the general conformity determination.

A general conformity determination has been prepared for Alternative 4/4A and is included in Appendix 22E, *General Confomrity Determination,* of the Draft EIR/EIS. As shown in Appendix 22E of the Draft EIR/EIS, the federal lead agencies (Reclamation, USFWS, and NMFS) demonstrate that project emissions would not result in a net increase in regional ROG (SJVAB only) or NO_X emissions, as construction-related ROG (SJVAB only) and NO_X would be fully offset to zero through implementation of Mitigation Measures AQ-1a through AQ-4b which require additional onsite mitigation and/or offsets. Mitigation Measures AQ-1a through AQ-4b will ensure the requirements of the mitigation and offset program are implemented and conformity requirements for ROG (SJVAB only) and NO_X are met.

With respect to long-term operational emissions, the number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., number and location of intakes). Since the water conveyance footprint under Alternative 4A would be identical to Alternative 4, operational activities required for Alternative 4A would be the same as those required for Alternative 4. Accordingly, operational emissions generated by Alternative 4A under the ELT and LLT conditions would be the same as those analyzed for Alternative 4. As, shown in Table 22-110 in Appendix A of this RDEIR/SDEIS, operational emissions under both conditions would not exceed the federal *de minimis* thresholds. No further analysis is required.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[5]

Please refer to Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[5] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

CEQA Conclusion: SFNA, SJVAB, and SFBAAB are classified as nonattainment areas with regard to the ozone NAAQS and the impact of increases in criteria pollutant emissions above the air basin *de minimis* thresholds could conflict with or obstruct implementation of the applicable air quality plans. Since construction emissions in the SFNA, SJVAB, and SFBAAB would exceed the *de minimis* thresholds for ROG (SJVAB only) and NO_X, this impact would be significant. Mitigation Measures AQ-1a, AQ-1b, AQ-3a, AQ-3b, AQ-4a, and AQ-4b would ensure project emissions would not result in an increase in regional ROG (SJVAB only) or NO_X emissions. These measures would therefore ensure total direct and indirect ROG (SJVAB only) and NO_X emissions generated by the project would conform to the appropriate air basin SIPs by offsetting the action's emissions in the same or nearby area to net zero. This impact would be less than significant.

Impact AQ-21: Generation of Cumulative Greenhouse Gas Emissions during Construction of the Proposed Water Conveyance Facility

NEPA Effects: Effects from GHG emissions generated by construction of the watery conveyance facilities under Alternative 4A would be identical to those described under Alternative 4. As shown in Table 22-111 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would generate 3.0 million metric tons of carbon dioxide equivalent (CO_2e) after implementation of environmental commitments and state mandates. This is equivalent to adding 633,000 typical passenger vehicles to the road during construction (U.S. Environmental Protection Agency 2014). As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2 of the Draft EIR/EIS, any increase in emissions above net zero associated with construction of the project water conveyance features would be adverse. Mitigation Measure AQ-21, which would develop a GHG Mitigation Program to reduce construction-related GHG emissions to net zero, is available address this effect.

CEQA Conclusion: Construction of Alternative 4A would generate a total of 3.0 million metric tons of GHG emissions. As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2 of the Draft EIR/EIS, any increase in emissions above net zero associated with construction of the project water conveyance features would be significant. Mitigation Measure AQ-21 would develop a GHG Mitigation Program to reduce construction-related GHG emissions to net zero. Accordingly, this impact would be less-than-significant with implementation of Mitigation Measure AQ-21.

Mitigation Measure AQ-21: Develop and Implement a GHG Mitigation Program to Reduce Construction Related GHG Emissions to Net Zero (0)

Please see Mitigation Measure AQ-21 under Impact AQ-21 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-22: Generation of Cumulative Greenhouse Gas Emissions from Operation and Maintenance of the Proposed Water Conveyance Facility and Increased Pumping

NEPA Effects: Alternative 4A water conveyance operations would be similar to the range of possible operations for the spring and fall Delta outflow requirements that would occur under Alternative 4 Operational Scenario H3 and Alternative 4 Operational Scenario H4. Table 4.3.18-1 summarizes long-term operational GHG emissions associated with operations, maintenance, and increased SWP pumping under Alternative 4A at the ELT and LLT timeframes. Emissions are compared to both the No Action Alternative (NEPA point of comparison) and Existing Conditions (CEQA baseline). The equipment emissions presented in Table 4.3.18-1 are representative of project impacts for both the NEPA and CEQA analysis and are identical to emissions that would be generated under Alternative 4.

Table 4.3.18-1. GHG Emissions from Operation, Maintenance, and Increased SWP Pumping, Alternative 4A (Operational Scenarios H3 through H4) (metric tons/year)

Condition	Equipment CO_2	NEPA Point of Comparison (Electricity)		CEQA Baseline (Electricity)		NEPA Point of Comparison (Total)		CEQA Baseline (Total)	
		H3	H4	H3	H4	H3	H4	H3	H4
ELT	815	137,538	12,812	51,457	-46,611	138,353	13,627	52,272	-45,796
LLT	791	19,086	2,795	-2,489	-22,533	19,878	3,586	-1,698	-21,742

Note: The *NEPA point of comparison* compares total CO_2e emissions after implementation of Alternative 4 to the No Action Alternative (ELT), whereas the *CEQA baseline* compares total CO_2e emissions to Existing Conditions.

As shown in Table 4.3.18-1, operations, maintenance, and increased SWP pumping under Alternative 4A would generate 3,586 to 138,353 metric tons CO_2e per year, relative to the No Action Alternative. Emissions relative to existing conditions would range from a net reduction of 45,796 metric tons CO_2e per year to a net increase of 52,272 metric tons CO_2e per year. This increase relative to existing conditions is lower than emissions and potential effects analyzed under the Operational Scenario H1 for Alternative 4 (113,555 metric tons CO_2e).

As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their Climate Action Plan (CAP) goals with implementation of BMPs and modification to DWR's Renewable Energy Procurement Program (REEP). The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines Section 15183.5. Since emissions under Alternative 4A would be lower than those analyzed for Alternative 4 (Operational Scenario H1) and because DWR demonstrated that implementation of Alternative 4 (Operational Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 4A would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. There would be no adverse effect.

CEQA Conclusion: As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their CAP goals with implementation of BMPs and modification to DWR's REEP. The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines Section 15183.5. As shown in Table 22-115, the assessment considers the amount of additional renewable energy that would need to be added to the REPP annually following construction in order for DWR to meet their long-term GHG reduction goals. Since emissions under Alternative 4A ELT would be lower than those analyzed for Alternative 4 ELT, and because DWR demonstrated that implementation of Alternative 4 (Operational Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 4A would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. Prior adoption of the CAP by DWR already provides a commitment on the part of DWR to make all necessary modifications to DWR's REEP or any other GHG emission reduction measure in the CAP necessary to achieve DWR's GHG emissions reduction goals. Therefore no amendment to the approved CAP is necessary to ensure the occurrence of the additional GHG emissions reduction activities needed to account for project-related operational emissions. The effect of Alternative 4A with respect to GHG emissions is less than cumulatively considerable and therefore less than significant. No mitigation is required.

Impact AQ-23: Generation of Cumulative Greenhouse Gas Emissions from Increased CVP Pumping as a Result of Implementation of Water Conveyance Facility

NEPA Effects: Alternative 4A water conveyance operations would be similar to the range of possible operations for the spring and fall Delta outflow requirements that would occur under Alternative 4 Operational Scenario H3 and Alternative 4 Operational Scenario H4. Under Alternative 4A, operation of the CVP yields the generation of clean, GHG emissions-free, hydroelectric energy. This electricity is sold into the California electricity market or directly to energy users. Implementation of Alternative 4A could result in an increase of up to 89 GWh in the demand for CVP generated electricity at the ELT timeframe, which would result in a reduction of up to 89 GWh or electricity available for sale from the CVP to electricity users. This reduction in the supply of GHG emissions-free electricity to the California electricity users could result in a potential indirect effect of the project, as these electricity users would have to acquire substitute electricity supplies that may result in GHG emissions (although additional conservation is also a possible outcome).

It is unknown what type of power source (e.g., renewable, natural gas) would be substituted for CVP electricity or if some of the lost power would be made up with higher efficiency. Given State mandates for renewable energy and incentives for energy efficiency, it is possible that a considerable amount of this power would be replaced by renewable resources or would cease to be needed as a result of higher efficiency. However, to ensure a conservative analysis, indirect emissions were quantified for the entire quantity of electricity (up to 89 GWh) using the current and future statewide energy mix [adjusted to reflect California's Renewables Portfolio Standard (RPS)].

Substitution of up to 89 GWh of electricity with a mix of sources similar to the current statewide mix would result in emissions of up to 24,738 metric tons of CO_2e; however, under expected future conditions (after full implementation of the RPS), emissions would be up to 19,223 metric tons of CO_2e. While this effect is less than expected under Alternative 4, the emissions could contribute to a cumulatively considerable effect and are therefore adverse. The emissions would be caused by dozens of independent electricity users, who had previously bought CVP power, making decisions about different ways to substitute for the lost power. These decisions are beyond the control of Reclamation or any of the other project Lead Agencies. Further, monitoring to determine the actual indirect change in emissions as a result of project actions would not be feasible. In light of the impossibility of predicting where any additional emissions would occur, as well as Reclamation's lack of regulatory authority over the purchasers of power in the open market, no workable mitigation is available or feasible.

CEQA Conclusion: Operation of the CVP is a federal activity beyond the control of any State agency such as DWR, and the power purchases by private entities or public utilities in the private marketplace necessitated by a reduction in available CVP-generated hydroelectric power are beyond the control of the State, just as they are beyond the control of Reclamation. For these reasons, there are no feasible mitigation measures that could reduce this potentially significant indirect impact, which is solely attributable to operations of the CVP and not the SWP, to a less-than-significant level. This impact is therefore determined to be significant and unavoidable.

Impact AQ-24: Generation of Regional Criteria Pollutants from Implementation of Environmental Commitments 3, 4, 6–11

NEPA Effects: Effects of Alternative 4A related to the generation of regional criteria pollutants during implementation of Environmental Commitments 3, 4, and 6–11 would be similar to those described for Alternative 4. Habitat restoration and enhancement activities that require physical changes or heavy-duty equipment would generate construction emissions through earthmoving activities and heavy-duty diesel-powered equipment. Criteria pollutants from restoration and enhancement actions could exceed applicable general conformity *de minimis* levels and applicable local thresholds. The effect would vary according to the equipment used in construction of a specific environmental commitment, the location, the timing of the actions called for in the environmental commitment, and the air quality conditions at the time of implementation.

As described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, the Yolo Bypass Fisheries Enhancement (CM2) would not be completed under Alternative 4A. Similarly, Alternative 4A would only restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6–11, as compared with 152,639 acres under Alternative 4. Therefore, the magnitude of emissions and regional air quality effects under Alternative 4A would likely be smaller than those associated with Alternative 4. Nevertheless, the effect of increases in emissions during implementation of Environmental Commitments 3, 4, and 6–11 in excess of applicable general conformity *de minimis* levels and air district regional thresholds could violate air basin SIPs and worsen existing air quality conditions. Mitigation Measure AQ-24 would be available to reduce this effect, but emissions would still be adverse.

CEQA Conclusion: Construction and operational emissions associated with the restoration and enhancement actions would result in a significant impact if the incremental difference, or increase, relative to Existing Conditions exceeds the applicable local air district thresholds. Mitigation Measure AQ-24 would be available to reduce this effect, but may not be sufficient to reduce emissions below applicable air quality management district thresholds. Consequently, this impact would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-25: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter, Carbon Monoxide, and Diesel Particulate Matter from Implementation of Environmental Commitments 3, 4, 6–11

NEPA Effects: Construction activities and criteria pollutant emissions generated during implementation of Environmental Commitments 3, 4, and 6–11 would be similar to those described for Alternative 4. However, because Alternative 4A would only restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6–11 as compared with 152,639 acres under CM4–CM11 under Alternative 4, the magnitude of emissions under Alternative 4A would likely be smaller than those associated with Alternative 4. Accordingly, health threats from receptor exposure to localized PM, CO, and DPM would likewise be smaller under Alternative 4A. Potential health effects from localized pollutant increases would vary according to the equipment used, the location and timing of the actions called for in the environmental commitment, the meteorological and air quality conditions at the time of implementation, and the location of receptors relative to the emission source. Increases in PM, CO, or DPM (cancer and non-cancer-risk) in excess of applicable air district thresholds at receptor locations would be adverse. Mitigation Measures AQ-24 and AQ-25 would be available to reduce this effect.

CEQA Conclusion: Construction and operational emissions associated with the restoration and enhancement actions under Alternative 4A would result in a significant impact if PM, CO, or DPM (cancer and non-cancer-risk) concentrations at receptor locations exceed the applicable local air district thresholds. Mitigation Measures AQ-24 and AQ-25 would ensure localized concentrations at receptor locations would be below applicable air quality management district thresholds (see Table 22-8 in Appendix A of this RDEIR/SDEIS). Consequently, this impact would be less than significant.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-25: Prepare a Project-Level Health Risk Assessment to Reduce Potential Health Risks from Exposure to Localized DPM and PM Concentrations

Please see Mitigation Measure AQ-25 under Impact AQ-25 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-26: Creation of Potential Odors Affecting a Substantial Number of People from Implementation of Environmental Commitments 3, 4, 6–11

NEPA Effects: The potential for Alternative 4A to expose sensitive receptors to increased odors from implementation of Environmental Commitments 3, 4, and 6–11 would be similar to Alternative 4. As described under Alternative 4, diesel emissions from earthmoving equipment could generate temporary odors, but these would quickly dissipate and cease once construction is completed. The magnitude of diesel emissions and odors would likely be smaller than those associated with Alternative 4 due to the reduced restoration acreage under Alternative 4A. Similarly, potential odors generated by restored estuarine wetland, upland habitats, or tidal mudflats would likely be less under Alternative 4A. While restored land uses have the potential to generate odors from natural processes, the odors would be similar in origin and magnitude to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, implementation of Environmental Commitments 3, 4, and 6–11 are not anticipated to result in additional odor complaints or public nuisance, relative to the No Action Alternative. Odor-related effects associated with Environmental Commitments 3, 4, and 6–11 would not be adverse.

CEQA Conclusion: Alternative 4A would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Increases in wetland, tidal, and upland habitats may increase the potential for odors from natural processes. However, the origin and magnitude of odors would be similar to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, implementation of Environmental Commitments 3, 4, and 6–11 are not anticipated to result in additional odor complaints or public nuisance, relative to existing conditions. Odor impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-27: Generation of Cumulative Greenhouse Gas Emissions from Implementation of Environmental Commitments 3, 4, 6–11

NEPA Effects: Effects of Alternative 4A related to the generation of GHG emissions during implementation of Environmental Commitments 3, 4, and 6–11 would be similar to those described for Alternative 4 for the identified commitments. As described under Alternative 4, construction equipment required for earthmoving could generate short-term GHG emissions. The magnitude of emissions would likely be smaller than those associated with Alternative 4 due to the reduced restoration acreage under Alternative 4A.

Implementing Environmental Commitments 3, 4, and 6–11 would affect long-term sequestration rates through land use changes, such as conversion of agricultural land to wetlands, inundation of peat soils, drainage of peat soils, and removal or planting of carbon-sequestering plants. Without additional information on site-specific characteristics associated with each of the restoration components, a complete assessment of GHG flux from Environmental Commitments 3, 4, and 6–11 and a comparison of potential effects relative to Alternative 4 are currently not possible. The effect of carbon sequestration and methane generation would vary by land use type, season, and chemical and biological characteristics. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this effect. However, due to the potential for increases in GHG emissions from construction and land use change, this effect would be adverse.

CEQA Conclusion: The restoration and enhancement actions under Alternative 4A could result in a significant impact if activities are inconsistent with applicable GHG reduction plans, do not contribute to a lower carbon future, or generate excessive emissions, relative to other projects throughout the state. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this impact, but may not be sufficient to reduce to a less-than-significant level. Consequently, this impact is would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-27: Prepare a Land Use Sequestration Analysis to Quantify and Mitigate (as Needed) GHG Flux Associated with Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-27 under Impact AQ-27 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

4.3.19 Noise

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

NEPA Effects: The potential for Alternative 4A to expose noise-sensitive land uses to noise from construction of the water conveyance facilities would be identical to impacts described under Alternative 4. Noise would be generated by heavy-duty equipment operating at the various construction sites, as well as by haul trucks and worker vehicles traveling on local roadways. Construction noise would also affect onsite workers. However, occupational exposure to noise levels in excess of 85 A-weighted decibels (dBA) requires monitoring and mitigation to protect workers. Given that onsite workers would be protected under OSHA requirements, no adverse impacts would occur to workers. Accordingly, this analysis focuses exclusively on potential noise effects to noise-sensitive land uses adjacent to construction activities.

Potential reasonable worst-case noise levels generated at construction work areas were evaluated against the 60 dBA L_{eq} (1hr) daytime (7 a.m. to 10 p.m.) and 50 dBA L_{max} nighttime (10 p.m. to 7 a.m.) construction thresholds. Construction noise along roadways was evaluated against the 12 decibel (dB) traffic noise threshold. As described under Alternative 4, the effect of exposing noise-sensitive land uses to noise increases above established thresholds at intake work areas, conveyance and associated facility work areas, utility construction work areas, borrow/spoil work areas, and truck trips and worker commutes would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to reduce this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion: Construction activities would expose noise-sensitive land uses adjacent to intake, conveyance, forebay, barge facility, utility, and borrow/spoil work areas to noise levels above the 60 dBA L_{eq} (1hr) daytime and 50 dBA L_{max} nighttime threshold. Receptors near haul roads would also be exposed to noise levels in excess of the 12 dB traffic noise threshold. This would be a significant impact. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measures NOI-1a and NOI-1b would reduce noise impacts on sensitive land uses. Although implementation of these measures will reduce the impact, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

NEPA Effects: The potential for Alternative 4A to expose noise-sensitive land uses to vibration and groundborne noise from construction of the water conveyance facilities would be identical to impacts described under Alternative 4. Construction at the intake sites would involve use of impact pile driving, and tunnel construction would involve the use of tunnel boring machines (TBMs) and tunnel locomotives, both of which would cause groundborne vibration in localized areas. Groundborne vibrations from pile driving would be intermittent, and temporary, occurring over a two month period during the in-river work period (June 1 to October 31). Similarly, groundborne noise due to vibrations from tunnel locomotive passbys and TBMs would occur intermittently where tunnels are located under or near residential areas.

Vibration effects from pile driving were evaluated against a threshold of 0.2 inches per second peak particle velocity (in/sec PPV) at residential buildings within 70 feet of pile driving sites. As described under Alternative 4, groundborne vibration from impact pile driving is predicted to exceed vibration thresholds at 78 residential receptors in Sacramento County and 4 residential receptors in San Joaquin County. The effect of exposing sensitive receptors to groundborne vibration would be adverse. Mitigation Measure NOI-2 is available to reduce this effect, but not to a level that would avoid adverse conditions.

Vibration effects from tunneling locomotives and TBMs were evaluated against a threshold of 0.04 in/sec PPV. As described under Alternative 4, groundborne vibrations from the TBMs would not exceed 0.008 in/sec PPV and would therefore not result in adverse vibration effects to nearby sensitive receptors. Similarly, tunnel locomotives would be operated at slow speeds inside of tunnels and would not result in excessive vibrations. Groundborne noise from tunnel locomotive operation during construction is therefore not predicted to exceed groundborne noise thresholds or result in an adverse noise impact on sensitive receptors along the tunnel conveyance.

As outlined in Mitigation Measure NOI-2, the potential for tunneling induced ground vibration effects will be thoroughly analyzed in the preliminary and final design phases of the project, using site-specific geotechnical data and the expected TBM configuration. Potential effects on surface structures and human perception will be evaluated in detail during preliminary design. As additional precautions, and where necessary, a ground vibration monitoring program using seismographs and other high-precision equipment will be implemented during construction to ensure ground vibration is within the required contract limits.

CEQA Conclusion: Groundborne vibrations during tunneling would not exceed 0.008 in/sec PPV and would therefore be less than significant. Likewise, locomotives are not expected to generate significant noise levels because they will travel at low speeds between 5 and 10 miles per hour. However, the impact of exposing residential structures to groundborne vibration during intake construction would be significant as reasonable worst-case modeling indicates that up to 82 residential parcels could be exposed to vibration levels in excess of 0.2 in/sec PPV during intake pile driving. Although Mitigation Measure NOI-2 will reduce the impact, it is not anticipated that feasible measures will be available in all situations to reduce vibration to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

Please see Mitigation Measure NOI-2 under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-3: Exposure of Noise-Sensitive Land Uses to Noise from Operation of Water Conveyance Facilities

NEPA Effects: The number and horsepower of pumping equipment at the intakes and combined pumping plan directly influence the potential for operational noise impacts. Since the number and horsepower of pumping equipment under Alternative 4A would be identical to Alternative 4, operational noise levels under Alternative 4A would be the same as those analyzed for Alternative 4. Since the analysis of Alternative 4 assumed 24 hours per day of pumping regardless of the pumping scenario (e.g., H1) or year (e.g., 2060), impacts would be the same under the ELT and LLT conditions.

Operation of pumping equipment at the intakes and combined pumping plant could result in increases in noise levels affecting nearby communities and residences. Noise would also affect onsite workers, although OSHA monitoring requirements would avoid adverse effects on personnel. Accordingly, this analysis focuses exclusively on potential noise effects on noise-sensitive land uses adjacent to the conveyance facilities.

Potential reasonable worst-case pump noise levels generated during operation of the intake and pump structures were evaluated against the 50 dBA L_{max} daytime (7 a.m. to 10 p.m.) and 45 dBA L_{max} nighttime (10 p.m. to 7 a.m.) operational thresholds. As described under Alternative 4, operational activities would exceed the daytime and nighttime thresholds at noise-sensitive land uses within 2,000 feet and 2,600 feet, respectively, from intake locations. Various residential, recreational, and agricultural receptors would therefore be exposed to adverse noise levels during operation. Mitigation Measure NOI-3 is available to address this effect.

CEQA Conclusion: The impact of exposing noise-sensitive land uses during operations to noise levels above the daytime (50 dBA L_{max}) or nighttime (45 dBA L_{max}) noise thresholds would be considered significant. Based on reasonable worst-case modeling, 70 agricultural parcels would be affected by daytime noise levels in excess of the operational threshold. The nighttime threshold would be exceeded at 110 agricultural parcels. Mitigation Measure NOI-3 would reduce operational noise levels below applicable thresholds, thus resulting in a less-than-significant level.

Mitigation Measure NOI-3: Design and Construct Intake Facilities and Other Pump Facilities Such That Operational Noise Does Not Exceed 50 dBA (One-Hour L_{eq}) during Daytime Hours (7:00 A.M. to 10:00 P.M.) or 45 dBA (One-Hour L_{eq}) during Nighttime Hours (10:00 P.M. to 7:00 A.M.) or the Applicable Local Noise Standard (Whichever Is Less) at Nearby Noise Sensitive Land Uses

Please see Mitigation Measure NOI-3 under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed Environmental Commitments 3, 4, 6-10

NEPA Effects: The potential for Alternative 4A to expose noise-sensitive land uses to noise from implementation of Environmental Commitments 3, 4, and 6–10 would be similar to those described for Alternative 4. Restoration and enhancement activities that require heavy-duty equipment and construction vehicles would generate increases in ambient noise levels. The effect would vary according to the type of construction equipment and techniques used in construction of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the noise environment at the time of implementation.

As described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, the Yolo Bypass Fisheries Enhancement (CM2) would not be completed under Alternative 4A. Similarly, Alternative 4A would only restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6-10 as compared with 152,639 acres under Alternative 4. Therefore, the magnitude of noise-generating activities under Alternative 4A would likely be smaller than those associated with Alternative 4. Nevertheless, receptors within 1,200 feet of an active restoration work area could be exposed to construction noise in excess of the daytime (7 a.m. to 10 p.m.) noise threshold of 60 dBA L_{eq} (1hr). The nighttime threshold of 50 dBA L_{max} would be exceeded within a distance of 2,800 feet. The effect of exposing sensitive land uses to increases in construction noise levels above thresholds would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to address this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion: Noise levels during implementation of Environmental Commitments 3, 4, and 6-10 are expected to vary according to the type of construction equipment and techniques used, but may exceed the daytime noise threshold within 1,200 feet of an active restoration work area and the nighttime threshold within 2,800 feet. The impact of exposing receptors to noise increases above established thresholds would be significant. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

4.3.20 Hazards and Hazardous Materials

Impact HAZ-1: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Construction of the Water Conveyance Facilities

NEPA Effects: The potential under Alternative 4A to create substantial hazards through release of hazardous materials during construction of conveyance facilities would be identical to those impacts described under Alternative 4 and would constitute an adverse effect on the physical environment. Potential effects include routine use of hazardous materials, possible natural gas accumulation in tunnels, contact with existing contaminants, constituents in RTM, effects of electrical transmission lines, conflicts with utilities containing hazardous materials, and routine transport of hazardous materials Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and Trans-1a would be available to reduce these effects.

CEQA Conclusion: During construction of the water conveyance facilities, the potential for direct impacts on construction personnel, the public and/or the environment associated with a variety of hazardous physical or chemical conditions under Alternative 4A would be identical to those described for Alternative 4. Such conditions may arise as a result of the intensity and duration of construction activities at the north Delta intakes, forebays, and conveyance pipelines and tunnels, and the hazardous materials that would be needed in these areas during construction. Potential hazards include the routine use of hazardous materials (as defined by Title 22 CCR Division 4.5); natural gas accumulation in water conveyance tunnels; the inadvertent release of existing contaminants in soil, sediment, and groundwater, or release of hazardous materials from existing infrastructure; disturbance of electrical transmission lines; and hazardous constituents present in RTM. Many of these physical and chemical hazardous conditions would occur in close proximity to the towns of Hood and Courtland during construction of the north Delta intakes. Additionally, the potential would exist for the construction of the water conveyance facilities to indirectly result in the release of hazardous materials through the disruption of existing road, rail, or river hazardous materials transport routes because construction would occur in the vicinity of three hazardous material transport routes, three railroad corridors, and waterways with barge traffic. These impacts are considered significant because the potential exists for substantial hazard to the public or environment to occur related to conveyance facility construction. However, implementation of Mitigation Measures HAZ-1a and HAZ-1b, UT-6a, and UT-6c (described in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS), and TRANS-1a (described in Chapter 19, *Transportation*, of the Draft EIR/EIS), along with environmental commitments to prepare and implement SWPPPs, HMMPs, SPCCPs, SAPs, and a Barge Operations Plan (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would reduce these impacts to a less-than-significant level by identifying and describing potential sources of hazardous materials so that releases can be avoided and materials can be properly handled; detailing practices to monitor pollutants and control erosion so that appropriate measures are taken; implementing onsite features to minimize the potential for hazardous materials to be released to the environment; minimizing risk associated with the relocation of utility infrastructure; and coordinating the transport of hazardous materials to reduce the risk of spills.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please see Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please see Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 1A in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 1A in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 1A in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact HAZ-2: Expose Sensitive Receptors Located within 0.25 Mile of a Construction Site to Hazardous Materials, Substances, or Waste during Construction of the Water Conveyance Facilities

NEPA Effects: The potential under Alternative 4A to expose sensitive receptors, such as parks, schools, and hospitals within 0.25 mile to hazardous materials, hazardous substances or waste during construction would be identical to those impacts described under Alternative 4 and would not have an adverse effect on sensitive receptors because no parks or hospitals are located within 0.25 mile of the construction zone and environmental commitments such as SWPPPs, SPCCPs and HMMPs would be implemented to minimize potential effects on Excelsior Middle School (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

CEQA Conclusion: The potential for exposure of sensitive receptors to hazardous substances or conditions under Alternative 4A would be identical to the impacts described for Alternative 4. There are no parks or hospitals located within 0.25 mile of the water conveyance facilities alignment. However, Excelsior Middle School is located within 0.25 mile of a proposed permanent 230-kV transmission line. Additionally, under this alternative, an operable barrier would be constructed at the head of Old River near the Mossdale Village area of Lathrop, adjacent to land designated for public use and which could include future schools or parks. If a school or park were built prior to the completion of construction of the operable barrier, sensitive receptors would be in close proximity to Alternative 4A construction activities, creating the potential for an impact on those types of sensitive receptors. However, no school or park is currently proposed within 0.25 mile of the proposed operable barrier site.

Construction of the 230-kV transmission line would require the routine use of hazardous materials (e.g., fuels, solvents, oil and grease) because heavy machinery such as cranes, off-road work trucks, and dozers would be required. Consequently, there would be the risk of accidental spills and equipment leaks of these types of hazardous materials during construction of the transmission line. However, the quantities of hazardous materials likely to be used during construction activities are likely to be small. Were hazardous materials to be released inadvertently, spills or equipment leaks would be localized and minimal, and thus there would be no risk to anyone not in immediate proximity to these releases. Further, BMPs to minimize the potential for the accidental release of hazardous materials and to contain and remediate hazardous spills, as part of the SWPPPs, SPCCPs, and HMMPs, would be implemented (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, staff and students at Excelsior Middle School would not be at risk or adversely affected by exposure to hazardous materials, substances, or waste during construction of the water conveyance facilities. This impact would be less than significant because no sensitive receptors within 0.25 mile of a construction zone would be exposed to hazardous materials, substances, or waste. No mitigation is required.

Impact HAZ-3: Potential to Conflict with a Known Hazardous Materials Site and, as a Result, Create a Significant Hazard to the Public or the Environment

NEPA Effects: The potential for conflicts with, or exposure to known hazardous material sites during conveyance facility construction under Alternative 4A would be identical to those identified for Alternative 4 and would not have an adverse effect on the public or the environment because no sites are located within the construction footprint of the water conveyance facilities.

CEQA Conclusion: The potential for conflicts with or exposure to known hazardous material sites during conveyance facility construction under Alternative 4A would be identical to those identified for Alternative 4. Because there are no known sites of concern (SOCs) within the construction footprint of the water conveyance facility for Alternative 4 there would be no conflict with known hazardous materials sites during construction of the water conveyance facilities, and therefore, no related hazard to the public or the environment. Accordingly, there would be no impact. No mitigation is required. The potential for encountering unknown hazardous materials sites during the course of construction is discussed under Impact HAZ-1.

Impact HAZ-4: Result in a Safety Hazard Associated with an Airport or Private Airstrip within 2 Miles of the Water Conveyance Facilities Footprint for People Residing or Working in the Study Area during Construction of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 4A to result in a safety hazard associated with activities within 2 miles of an airport or private airstrip is identical to effects described for Alternative 4. This potential effect is not adverse because, as part of an environmental commitment pursuant to the State Aeronautics Act (described in the Section 24.2.2.17 of Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics to eliminate any potential conflicts prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron and Franklin Field Airports).

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 4A to result in a safety hazard associated with activities within 2 miles of an airport or private airstrip is identical to impacts described for Alternative 4. The use of helicopters for stringing the proposed 230-kV transmission lines and relocating the existing 230-kV and 500-kV transmission lines, and of high-profile construction equipment (200 feet or taller), such as cranes, for installation of pipelines, and potentially pile drivers, such as would be used during the construction of the intakes, have the potential to result in safety hazards to aircraft during takeoff and landing if the equipment is operated too close to runways. Three private airports (Borges-Clarksburg Airport, Spezia Airport, and Flying B Ranch Airport) and two public airports (Byron Airport and Franklin Field Airport) are located within 2 miles of the construction footprint of several features of the water conveyance facilities for Alternative 4, including temporary and permanent transmission lines. Relocation of the existing 230-kV and 500-kV transmission lines is not expected to result in an air safety hazard because the nearest airport to the new location is greater than 3 miles away.

As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as part of an environmental commitment pursuant to the State Aeronautics Act (described in Section 24.2.2.17 in Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron and Franklin Field Airports). These recommendations, which could include limitations necessary to minimize potential problems such as the use of temporary construction equipment, supplemental notice requirements, and marking and lighting high-profile structures, would reduce potential impacts on air safety. This impact would be less than significant because recommendations to avoid conflicts with existing airports located near construction areas would be implemented by DWR prior to construction as required by Caltrans. No mitigation is required.

Impact HAZ-5: Expose People or Structures to a Substantial Risk of Property Loss, Personal Injury or Death Involving Wildland Fires, Including Where Wildlands Are adjacent to Urbanized Areas or Where Residences Are Intermixed with Wildlands, as a Result of Construction, and Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 4A to result in exposure of people or structures to risks associated with wildfire would be identical to the impacts described for Alternative 4. This potential effect is not adverse because no portion of Alternative 4A is located in or near an area designated as a High or Very High Fire Hazard Severity Zone and measures to prevent and control wildland fires would be implemented by DWR during construction, operation, and maintenance of the water conveyance facilities in full compliance with Cal-OSHA standards for fire safety and prevention.

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 4A to result in exposure of people or structures to risks associated with wildfire would be identical to the impacts described for Alternative 4. People or structures would not be subject to a significant risk of loss, injury, or death involving wildland fires during construction or operation and maintenance of the water conveyance facilities because the alternative would comply with Cal-OSHA fire prevention and safety standards; DWR would implement standard fire safety and prevention measures as part of an FPCP (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS); and because the water conveyance facilities would not be located in a High or Very High Fire Hazard Severity Zone. This impact would be less than significant because conditions do not exist near construction areas that would result in exposure of people or structures to significant risk of exposure to wildfire and DWR would implement standard fire safety and prevention measures. No mitigation is required.

Impact HAZ-6: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The potential for operation and maintenance of the water conveyance facilities (excluding water supply operations) under Alternative 4A to result in a substantial hazard to the public or environment would be the same as described for Alternative 4. During routine operation and maintenance of the water conveyance facilities the potential would exist for the accidental release of hazardous materials and other potentially hazardous releases (e.g., contaminated solids and sediment), and for interference with air safety should high-profile equipment be required for maintenance of the proposed transmission lines near an airport. Accidental hazardous materials releases, such as chemicals directly associated with routine maintenance (e.g., fuels, solvents, paints, oils), are likely to be small, localized, temporary and periodic; therefore, they are unlikely to result in adverse effects on workers, the public, or the environment. Further, BMPs and measures implemented as part of SWPPPs, SPCCPs, SAPs and HMMPs would be developed and implemented as part of the project, as described under Impact HAZ-1, and in detail in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, which would reduce the potential for accidental spills to occur and would result in containment and remediation of spills should they occur. Approximately 10,800 cubic yards of dry sediment/solids would be produced annually as a result of maintenance of sedimentation basins and solids lagoons with three intakes operating. Potentially contaminated solids could pose a hazard to the environment if improper disposal occurred. This effect would be considered adverse because of the large volume of sediment/solids that would be handled and the potential for improper disposal. However, Mitigation Measure HAZ-6 would be available to reduce these effects. Under Mitigation Measure HAZ-6 solids from the solids lagoons would be sampled and characterized to evaluate disposal options, and disposed of accordingly at an appropriate, licensed facility.

CEQA Conclusion: The potential for operation and maintenance of conveyance facilities under Alternative 4A to result in a substantial hazard to the public or environment would be identical to the effects described for Alternative 4. The accidental release of hazardous materials (including contaminated solids and sediment) to the environment during operation and maintenance of the water conveyance facilities and the potential interference with air safety through the use of high-profile equipment for maintenance of proposed transmission lines could result in significant impacts on the public and environment because of the large scale of construction and the potential for accidental release of hazardous materials during construction. However, implementation of the BMPs and other activities required by SWPPPs, HMMPs, SAPs, SPCCPs, as well as adherence to all applicable FAA regulations (14 CFR Part 77) and, as part of an environmental commitment pursuant to the State Aeronautics Act (described in the *Regulatory Setting* section of Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), coordination/compliance with Caltrans' Division of Aeronautics when performing work with high-profile equipment within 2 miles of an airport would ensure that impacts are reduced to a less-than-significant level. Contaminated solids could pose a hazard to the environment if improperly disposed of, and would be considered a significant impact because of the large volume of sediment/solids that would be handled and the potential for improper disposal. However, implementation of Mitigation Measure HAZ-6 would reduce this impact to a less-than-significant level by requiring sampling and characterizing solids from the solids lagoons to evaluate options to dispose of material at an appropriate, licensed facility.

Mitigation Measure HAZ-6: Test Dewatered Solids from Solids Lagoons Prior to Reuse and/or Disposal

Please see Mitigation Measure HAZ-6 under Impact HAZ-6 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS.

Impact HAZ-7: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15 and 16

Effects of Alternative 4A related to the potential for release of hazardous materials from implementing these environmental commitments would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, under Alternative 4A the project would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, 6–11 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitment 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 4A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, 6–10, and 11, 12, 15 and 16 at limited locations could result in multiple potentially hazardous effects related to the release of or exposure to hazardous materials or other hazards including increased production, mobilization, and bioavailability of methylmercury; release of existing contaminants (e.g., pesticides in agricultural land); air safety hazards; and wildfires. These effects are considered adverse because of the potential for substantial hazards to occur while constructing restoration actions. However, implementation of Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a and the environmental commitments including implementation of SWPPPS, HMMPs, SPCCPs, SAPs, and fire prevention and fire control BMPs as part of an FPCP (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) are available to reduce/minimize these potential effects.

CEQA Conclusion: The potential for impacts related to the release and exposure of workers and the public to hazardous substances or conditions during construction, operation, and maintenance of Environmental Commitments 3, 4, and 6–11 and Environmental Commitment 16, is considered significant because implementation of these environmental commitments would involve extensive use of heavy equipment during construction and transporting hazardous chemicals during operations and maintenance (e.g., herbicides for nonnative vegetation control). These chemicals could be inadvertently released, exposing construction workers or the public to hazards. Construction of restoration projects on or near existing agricultural and industrial land and/or SOCs may also result in a conflict with or exposure to known hazardous materials, and the use of high-profile equipment (i.e., 200 feet or higher) in close proximity to airport runways could result in safety hazards to air traffic. However in addition to implementation of SWPPPs, HMMPs, SPCCPs, SAPs, and fire prevention and fire control BMPs as part of an FPCP (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a would be implemented to ensure no substantial hazards to the public or the environment would occur from implementation of these environmental commitments and that impacts would be reduced to a less-than-significant level.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please refer to Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS. Implementation of this mitigation measure will result in the avoidance, successful remediation or containment of all known or suspected contaminated areas, as applicable, within the construction footprint, which would prevent the release of hazardous materials from these areas into the environment.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please refer to Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS. Implementation of this measure will ensure that hazardous materials present in or associated with structures being demolished will not be released into the environment.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact HAZ-8: Increased Risk of Bird–Aircraft Strikes during Implementation of Environmental Commitments that Create or Improve Wildlife Habitat

Effects of Alternative 4A related to the potential for increased risk of aircraft bird strikes from implementing restoration actions that improve wildlife habitat would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6–11 as compared with 83,800 acres with Conservation Measures 3–11 under Alternative 4. Therefore, the magnitude of effects under Alternative 4A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of Environmental Commitments 3, 4, and 6–11 under Alternative 4A could result in an increase of aircraft bird strikes in the vicinity of restoration areas that attract waterfowl and other birds in proximity to local airports. This effect is considered adverse because of the potential to affect aircraft safety in the vicinity of restoration projects. Mitigation Measure HAZ-8 is available to reduce this effect.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, and 6–11, because they would create or improve wildlife habitat, could potentially attract waterfowl and other birds to areas in proximity to existing airport flight zones, and thereby potentially result in an increase in bird-aircraft strikes. The potential for this impact is considered significant because of the increased wildlife restoration projects that could occur in the vicinity of Travis Air Force Base; Rio Vista Municipal Airport; Funny Farm Airport; Sacramento International Airport; and Byron Airport. Mitigation Measure HAZ-8 could reduce the severity of this impact by minimizing bird strike hazards, but this impact would not be reduced to a less-than-significant level because of the inherent uncertainty related to bird strike risks for these future projects. Therefore this impact is significant and unavoidable.

Mitigation Measure HAZ-8: Consult with Individual Airports and USFWS, and Relevant Regulatory Agencies

Please see Mitigation Measure HAZ-8 under Impact HAZ-8 in the discussion of Alternative 4 in Chapter 24, *Hazards and Hazardous Materials*, of the Draft EIR/EIS.

4.3.21 Public Health

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 4A construction and operation to increase vector-borne diseases would be the same as described for Alternative 4 because all aspects of the water conveyance facility design, construction, and operation (excluding water supply operations) and maintenance of Alt 4A would be identical to Alt 4. Although the proposed conveyance facilities will increase surface water within the study area at the intakes, intermediate forebay, and Clifton Court Forebay, it is unlikely that these water bodies would provide suitable breeding habitat for mosquitoes given that the water in these forebays would not be stagnant and would generally be too deep to support substantial mosquito habitat. Shallow edges of the forebays could provide some suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of these forebay areas, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity. To further minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs, as necessary, to control mosquitoes and reduce the likelihood that construction and operation of the water conveyance facilities would require an increase in mosquito abatement activities by the local MVCDs (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). BMP activities would be consistent with the CDPH's *Best Management Practices for Mosquito Control* plan (described in Section 25.2.3.4 in the Draft EIR/EIS). Accordingly, Alternative 4A would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. No adverse effects on public health would result because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented.

CEQA Conclusion: The potential for construction and operation of conveyance facilities under Alternative 4A to result in an increase in exposure of people to vector-borne diseases would be identical to the impacts described for Alternative 4. Alternative 4A conveyance facilities that could create new water bodies at the intakes, intermediate forebay, and Clifton Court Forebay have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. However, during operations, the depth, design, and operation of conveyance facilities would prevent the development of suitable mosquito habitat. Specifically, the water bodies would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the sedimentation basins, solids lagoons, the expanded Clifton Court Forebay, the intermediate forebay, and the intermediate forebay inundation area. Therefore, construction and operation of Alternative 4 would not result in a substantial increase in vector-borne diseases. This impact is considered to be less than significant because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

As described in detail in Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS, the analysis of bromide and DOC (among other constituents) for Alternative 4A is based on modeling done for Alternative 4 in the ELT timeframe, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described in Section 4.1.2, *Description of Alternative 4A*, of the RDEIR/SDEIS, Yolo Bypass Improvements are not a component of Alternative 4A and Environmental Commitment 4 would restore approximately 59 acres of tidal wetlands, as opposed to the 65,000 acres contemplated under CM4. As explained in Section 4.3.4, *Water Quality*, in general, the significance of this difference is that the assessment of bromide for Alternative 4A, relative to Existing Conditions and the No Action Alternative (ELT), likely overestimates increases in bromide that could occur, particularly in the west Delta. Regardless, there is uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 4A and the No Action Alternative (ELT).

NEPA Effects:

Disinfection Byproducts

The effects on DOC concentrations in the Delta under Alternative 4A would be similar to Alternative 4. Alternative 4A includes water conveyance operational criteria similar to Alternative 4 (Operational Scenario H), but would be limited to operations within the range of Scenarios H3 and H4, as fully described in Chapter 3, *Description of Alternatives*, of the Draft EIR/EIS and in Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region these effects are included in this assessment. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration and enhancement under this alternative because very little would occur relative to Alternative 4.

The geographic extent of effects related to long-term average DOC concentrations within Delta waters would be similar to that described for Alternative 4 but the magnitude of predicted change and relative frequency of concentration exceedences would be lower. Relative to the No Action Alternative (ELT), Alternative 4A would result in small increases (0.3 mg/L) in long-term average DOC concentrations for the modeled 16-year period and drought period at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1. The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at Contra Costa Pumping Plant #1. The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower. In general, substantial change in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 4A are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed. Further, modeling results for Alternative 4A indicate that there would be predicted improvements in long-term average DOC concentrations at Barker Slough relative to the No Action Alternative (ELT and LLT) (see Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS).

Therefore, changes in DOC concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 4A are not anticipated to contribute to increases in disinfection byproducts (DBPs).

As described in Section 4.3.4, *Water Quality*, of the RDEIR/SDEIS, operations and maintenance of the water conveyance facilities Alternative 4A, relative to the No Action Alternative (ELT and LLT), would result in increases in long-term average bromide concentrations in the South Fork Mokelumne River at Staten Island and the San Joaquin River at Buckley Cove, and small decreases at the other assessment locations. However, there would be an increased frequency of exceedance of the CALFED Drinking Water Program long-term goal of 50 µg/L and 100 µg/L bromide thresholds for protecting against the formation of DBPs in treated drinking water at the South Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations. Therefore, changes in bromide concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 4A are not anticipated to contribute to increases in DBPs.

Trace Metals

The changes in modeled trace metal concentrations of primarily human health and drinking water concern (arsenic, iron, manganese) in the Delta would be similar to those described for Alternative 4 (see Chapter 8, *Water Quality,* Section 8.3.3.9 of the Draft EIR/EIS).

The arsenic criterion was established to protect human health from the effects of long-term chronic exposure, while secondary MCLs for iron and manganese were established as reasonable federal regulatory goals for drinking water quality, and enforceable standards in California. Average concentrations for arsenic, iron, and manganese in the primary source water (Sacramento River, San Joaquin River, and the bay at Martinez) are below these criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and, given that the modeled average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be an expected result under this alternative. Accordingly, no adverse effect on public health related to the trace metals arsenic, iron, or manganese from drinking water sources is anticipated.

Pesticides

The changes in modeled pesticide concentrations in the Delta under Alternative 4A would be similar to those described for Alternative 4 because the changes in average winter and summer flow rates relative to the No Action Alternative (ELT and LLT) are expected to be similar to or less than changes in flow rates under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis. The modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 4A would not be of sufficient magnitude to substantially affect beneficial uses of the Delta. Based on the general observation that San Joaquin River, in comparison to the Sacramento River, is a greater contributor of organophosphate insecticides in terms of greater frequency of incidence and presence at concentrations exceeding water quality benchmarks, modeled increases in Sacramento River fraction at Banks and Jones would generally represent an improvement in export water quality respective to pesticides. Similarly, the flow changes in the LLT under Alternative 4A would not be expected to result in affects on beneficial uses of water in the Delta due to pesticides.

Therefore, it is not anticipated that there would be adverse effects on public health related to pesticides from drinking water sources.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in pesticide concentrations would not increase substantially in magnitude or frequency in the Delta, there would be no adverse effect on public health as a result of operation of the water conveyance facilities.

CEQA Conclusion: Under Alternative 4A, modeled long-term average pesticide levels in the Delta would be similar to or slightly less that described under Alternative 4 and would not be expected to increase substantially such that beneficial use impairments are made measurably worse. Long-term average bromide concentrations would increase in the South Fork Mokelumne River at Staten Island and decrease at all other assessment locations. However, there would be an increased frequency of exceedance of the 50 µg/L and 100 µg/L bromide thresholds for protecting against the formation of DBPs in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations, and therefore would not be expected to contribute substantially to DBP formation. Operations and maintenance activities under Alternative 4A would not cause a substantial long-term change in DOC concentrations in the Delta, although there would be relatively small increases in long-term average DOC concentrations at some interior Delta locations. However, the increases are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC above levels currently employed, and therefore these increases would not be expected to contribute substantially to DBP formation. Further, there would be predicted improvements in long-term average DOC concentrations at Barker Slough relative to Existing Conditions. Average concentrations of trace metals in the Delta are not expected to increase substantially under Alternative 4A in the primary source water. Therefore, this alternative is not expected to cause additional exceedances of applicable water quality objectives by frequency, magnitude, and geographic extent such that significant impacts on any beneficial uses of waters in the affected environment would occur.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in trace metals pesticide concentrations would not increase substantially in magnitude or frequency in the Delta, there would be no significant impact on public health as a result of operation of the water conveyance facilities.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

NEPA Effects: As described in Ch. 8, *Water Quality*, of the Draft EIR/EIS, modeling scenarios included assumptions regarding how certain habitat restoration activities (CM2 and CM4) would affect Delta hydrodynamics. The amount of tidal habitat restoration completed under Alternative 4A

(Environmental Commitment 4) would be substantially less than under Alternative 4 CM4. To the extent that restoration actions alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes due to operation of the water conveyance facilities.

Three intakes would be constructed and operated under Alternative 4A. Sediment-disturbing activities during construction and maintenance of these intakes and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. In-channel construction activities, such as pile driving during the construction of cofferdams at the intakes and pier construction at the barge unloading facilities, which would occur over a period of 5 months, would result in the localized disturbance of river sediment. In addition, maintenance of the three proposed north Delta intakes and the intermediate forebay would entail periodic dredging for sediment removal at these locations. Sediment accumulation in both the northern and southern portion of the expanded Clifton Court Forebay is expected to be minimal in the ELT period as the need for dredging is anticipated to be every 50 years given the design. However, it is anticipated that there may be some sediment accumulation at the inlet structure of the northern portion of Clifton Court Forebay. Therefore, while overall sediment accumulation in this forebay is not expected to be substantial, some dredging may be required at the inlet structure to maintain an even flow path.

Pesticides

Legacy pesticides, such as organochlorines, have low water solubility; they do not readily volatilize and have a tendency to bond to particulates (e.g., soil and sediment), settle out into the sediment, and not be transported far from the source. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree. Therefore, no significant adverse effect on public health would result from construction.

Numerous pesticides are currently used throughout the affected environment. While some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence of their presence in waters affected by SWP and CVP operations (i.e., organophosphate pesticides, such as diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative. Thus, changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. The effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to or slightly less than those described for the Alternative 4. Alternative 4A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides.

Methylmercury

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter

8, Section 8.1.3.9, *Mercury*, of the Draft EIR/EIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 4A are expected to be small. The greatest annual average methylmercury concentration for drought conditions would be 0.166 ng/L for the San Joaquin River at Buckley Cove (all scenarios) which was slightly lower than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases in mercury concentrations based on long-term annual average concentrations for mercury at the Delta locations, but they would be different relative to the No Action Alternative (ELT). Under Operational Scenario H3 (Equation 2—see Chapter 8, *Water Quality*, of the Draft EIR/EIS) there would be 11% to 12% percent increases at Staten Island and Rock Slough relative to the No Action Alternative (ELT) in all modeled years. Under Operational Scenario H4 there would be an 11% decrease relative to the No Action Alternative (ELT) for drought years. These changes are expected to be within the uncertainty inherent in the modeling approach (see Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS for a discussion of the uncertainty associated with bioaccumulation models), and would likely not be measurable in the environment. Therefore, modeled changes in mercury in the Delta and in fish tissues due to operation of Alternative 4A would not be expected to adversely affect public health. In the LLT, the primary difference would be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of Alternative 4A and, therefore, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

In summary, operation of the water conveyance facilities under Alternative 4A would not alter bioaccumulative pesticide concentrations or mercury concentrations in the Delta such that there was an effect on public health. As such, there would be no adverse effect.

CEQA Conclusion: Operation of the water conveyance facilities under Alternative 4A is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially relative to the Existing Conditions (see Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS), no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury.

The effects of Alternative 4A on bioaccumulative pesticide levels in the Delta would be similar to or slightly less than those described for the Alternative 4. Alternative 4A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree.

For these reasons, there would be no significant impact on public health due to mercury or bioaccumulative pesticides as a result of construction of or operation of the water conveyance facilities under Alternative 4A.

Impact PH-4: Expose Substantially More People to Transmission Lines Generating New Sources of EMFs as a Result of the Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 4A transmission line construction and operation to expose people to new sources of EMFs would be identical to impacts described under Alternative 4. As described for Alternative 4, this effect would not be adverse because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or new permanent transmission lines constructed and operated under Alternative 4A.

CEQA Conclusion: The potential for Alternative 4A transmission line construction and operation to expose people to new sources of EMFs would be identical to impacts described under Alternative 4. Under Alternative 4A, the majority of proposed temporary (69 kV and 230 kV) and permanent (230 kV) transmission lines would be located within the rights-of-way of existing transmission lines; any new temporary or permanent transmission lines not within the right-of-way of existing transmission lines would, for the most part, be located in sparsely populated areas generally away from existing sensitive receptors. None of the proposed temporary or permanent transmission lines would be within 300 feet of sensitive receptors. Further, the temporary transmission lines would be removed when construction of the water conveyance facility features is completed, so there would be no potential permanent effects. Therefore, these transmission lines would not substantially increase people's exposure to EMFs. This impact is considered to be less than significant because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or permanent transmission lines constructed and operated under Alternative 4A. No mitigation is required.

Impact PH-5: Increase in Vector-Borne Diseases as a Result of Implementing Environmental Commitments 3, 4, 6-11

Effects of Alternative 4A related to the potential for increase in vector-borne diseases from implementing these Environmental Commitments would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6–10 as compared with 83,800 acres under Alternative 4. Conservation Measures 2 and 5 would not be implemented as part of this alternative. Therefore, the potential for vector-borne disease effects under Alternative 4A would likely be less than the potential associated with Alternative 4.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, and 6-11 under Alternative 4A would involve protecting and restoring wetland habitat that could potentially increase suitable mosquito habitat within the study area. This potential effect would not be adverse because the total wetland restoration acreage implemented under Alternative 4A would be substantially less than under Alternative 4, habitat creation would generally not be located near densely populated areas, and management plans under Environmental Commitment 11, *Natural Communities Enhancement and Management*, would be performed in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, would be incorporated into Alternative 4A and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. This consultation would occur when specific restoration and enhancement projects and locations are identified.

CEQA Conclusion: The potential for impacts related to increases of vector-borne disease from mosquitos during construction, operation, and maintenance of portions of Environmental Commitment 3, 4, and 6–11 is considered less than significant because the total wetland restoration acreage implemented under Alternative 4A would be substantially less than under Alternative 4, habitat creation would generally not be located near densely populated areas, and management plans under Environmental Commitment 11 *Natural Communities Enhancement and Management*, would be performed in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, would be incorporated into Alternative 4A and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. No mitigation is required.

Impact PH-6: Substantial Increase in Recreationists' Exposure to Pathogens as a Result of Implementing the Restoration Environmental Commitments

Effects of Alternative 4A related to the potential for increase in recreationists' exposure to pathogens from implementing portions of the habitat restoration environmental commitments would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 15,548 acres of habitat under Environmental Commitments 3, 4, and 6–11 as compared with 83,800 acres under Alternative 4. Conservation Measures 2 and 5 would not be implemented as part of this alternative. Therefore, the potential for exposure of recreationists to pathogens under Alternative 4A would likely be substantially less than the potential associated with Alternative 4.

NEPA Effects: The study area currently supports habitat types, such as tidal habitat, upland wetlands, and agricultural lands that produce pathogens as a result of the biological productivity in these areas (e.g., migrating birds, application of fertilizers, waste products of animals). The study area does not currently have pathogen concentrations that rise to the level of adversely affecting beneficial uses of recreation. However, as described for Alternative 4, any potential increase in pathogens associated with the proposed habitat restoration and enhancement would be localized and within the vicinity of the actual restoration. This localized increase is not expected to be of sufficient magnitude and duration to result in adverse effects on recreationists because these areas would generally not support livestock and most areas would not have public access.

CEQA Conclusion: The potential for an increase in recreationists' exposure to pathogens under Alternative 4A is considered less than significant because of the reduced amount of restored habitat conducive to pathogens that would be implemented under this alternative compared to Alternative 4, the localized nature of pathogens, and because the rapid die-off of pathogens in water would not create sufficient magnitudes of pathogen generation that could affect recreational beneficial uses. No mitigation is required.

Impact PH-7: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Implementing Environmental Commitments 4 and 10

Effects of Alternative 4A related to the potential to mobilize contaminants known to bioaccumulate (pesticides and methylmercury) from implementing portions of the restoration environmental commitments would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 4A would restore up to 1,067 acres of habitat under Environmental Commitments 4 and 10 as compared with 66,200 acres under Alternative 4. Conservation Measures 2 and 5 would not be implemented as part of this alternative. Therefore, the potential for mobilization of contaminants under Alternative 4A would likely be substantially less than the potential associated with Alternative 4.

NEPA Effects: The primary concern with habitat restoration regarding constituents known to bioaccumulate is the potential for mobilizing contaminants sequestered in sediments of the newly inundated floodplains and marshes. The mobilization depends on the presence of the constituent and the biogeochemical behavior of the constituent to determine whether it could re-enter the water column or be reintroduced into the food chain. This potential effect would not be adverse because the total tidal and nontidal habitat restoration acreage implemented under Alternative 4A would be substantially less than under Alternative 4;bioaccumulation of pesticides and/or methylmercury in the tidal and nontidal restoration areas are not expected to substantially affect public health because of the limited extent of restored habitat under Alternative 4A; the localized nature of pesticide bioaccumulation; and because current OEHHA standards would be enforced. Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats.

CEQA Conclusion: The potential for public health impacts related to mobilization of pesticides and methylmercury in habitat restoration areas related to Environmental Commitment s 4 and 10 is considered less than significant because the total wetland restoration acreage implemented under Alternative 4A would be substantially less than under Alternative 4A. Bioaccumulation of pesticides and/or methylmercury in the tidal and nontidal restoration areas are not expected to substantially affect public health because of the limited extent of restored habitat under Alternative 4A; the localized nature of pesticide bioaccumulation; and because current OEHHA standards would be enforced. Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats. No mitigation is required.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Any modified reservoir operations under Alternative 4A are not expected to promote *Microcystis* production upstream of the Delta relative to the No Action Alternative (ELT and LLT) since large reservoirs upstream of the Delta are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*. Further, in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, bloom development would be limited by high water velocity and low hydraulic residence times. These conditions would not be expected to change under Alternative 4A relative to the No Action Alternative (ELT and LLT)

Conditions in the Export Service Areas with implementation of water supply operations under Alternative 4A are not expected to become more conducive to *Microcystis* bloom formation relative to the No Action Alternative (ELT and LLT) because the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms.

As indicated in Section 4.3.4, *Water Quality,* of this RDEIR/SDEIS, there was not modeling available that adequately accounted for the effects of operation of the water conveyance facilities and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the Delta for Alternative 4A. Accordingly, the hydrodynamic effects of Alternative 4A on *Microcystis* were determined qualitatively and the effects discussed for the Delta are related entirely to operations and maintenance and not the hydrodynamic effects of the restoration actions. Although there is uncertainty, water supply operations under Alternative 4A are not expected to increase water residence times or ambient water temperatures throughout the Delta, including Banks and Jones pumping plants, relative to the No Action Alternative (ELT and LLT), and therefore Delta waters are not expected to be adversely affected by *Microcystis* blooms.

CEQA Conclusion: Relative to Existing Conditions, operation of the water conveyance facilities under Alternative 4A is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta because large reservoirs upstream are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*, and high water velocity and low hydraulic residence times in the upstream area limit the development of *Microcystis* blooms.

The potential for *Microcystis* blooms in the Export Service Areas under Alternative 4A would be less than under Alternative 4, but source waters to the south Delta intakes could be affected by *Microcystis* due to an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased water residence times in the Delta would be mostly related to tidal habitat restoration and improvements to the Yolo Bypass, which are assumed to occur separate from Alternative 4A, as well as to climate change and sea level rise. The combined effect of these factors on increasing *Microcystis* in source waters to the south Delta intakes would likely be a greater influence than that of Alternative 4A operations.

Water supply operations under the two Alternative 4A scenarios could result in localized increases in Delta residence times in some locations and decreased residence times in other Delta locations. As indicated in Section 4.3.4, *Water Quality,* of this RDEIR/SDEIS, there is substantial uncertainty regarding the extent that Alternative 4A operations and maintenance would result in a net increase in water residence times relative to Existing Conditions. Regardless of this uncertainty, it is likely that these potential effects under Alternative 4A would be relatively small compared to the combined effects of tidal habitat restoration and Yolo Bypass improvements unrelated to Alternative 4A, and sea level rise and climate change. Climate change in the ELT is expected to result in a 1.3-2.5°F increase in ambient Delta water temperatures relative to Existing Conditions. Given the combined effects of restoration activities unrelated to Alternative 4A, climate change, and sea level rise on increased water residence time, as well as the effects of climate change on Delta water temperatures, it is possible that *Microcystis* blooms in the Delta would increase in frequency, magnitude, and geographic extent, relative to Existing Conditions. However, although there is considerable uncertainty regarding this impact, while long-term water quality degradation may occur and, thus, impacts on beneficial uses could occur, these impacts are not related to implementation of Alternative 4A. Therefore, the effects on *Microcystis* due to operations under Alternative 4A would be less than significant. No mitigation is required.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing Environmental Commitment 4.

***NEPA Effects*:** Under Alternative 4A, Yolo Bypass Fisheries Enhancement would not occur, unlike under Alternative 4. However, improvements in the Yolo Bypass, as well as restoration of 8,000 acres of tidal habitat, would be implemented under a plan separate and distinct from Alternative 4A (see Section 4.1.2, *Description of Alternative 4A*, of this RDEIR/SDEIS). These activities are assumed to occur under both Alternative 4A and the No Action Alternative. Similar to Alternative 4 (under CM 4), there would be tidal habitat restoration in the Delta under Alternative 4A with implementation of Environmental Commitment 4. However, the 59 acres of tidal habitat restored under this alternative would be substantially fewer than under Alternative 4. As discussed in Section 4.3.4, *Water Quality,* of this RDEIR/SDEIS, implementation of Environmental Commitment 4 under Alternative 4A would have negligible effects in terms of the potential for creating conditions conducive to *Microcystis* bloom in the Delta relative to what could result from the development of 8,000 acres of tidal habitat and improvements in the Yolo Bypass in the ELT, which could increase water temperatures and hydraulic residence times relative to the No Action Alternative (LLT). Therefore, implementation of Environmental Commitment 4 under Alternative 4A would not be adverse because it would not increase *Microcystis* bloom formation.

CEQA Conclusion: Implementation of Environmental Commitment 4 (*Tidal Natural Communities Restoration*) under Alternative 4A would result in 59 acres of tidal restoration within the Delta. This would have a negligible effect on creating conditions conducive to *Microcystis* bloom formation, particularly relative to the development of 8,000 acres of tidal habitat and improvements to the Yolo Bypass in the ELT—activities separate and distinct from Alternative 4A. These activities would create shallow backwater areas that could result in a measureable increase in water temperatures and water residence times in the Delta, and therefore *Microcystis*, relative to Existing Conditions. Thus, implementation of Environmental Commitment 4 under Alternative 4A would be less than significant.

4.3.22 Minerals

Impact MIN-1: Loss of Availability of Locally Important Natural Gas Wells as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The locations of producing natural gas wells within the Alternative 4A construction footprint would be the same as indicated for Alternative 4. There are no producing wells within the construction footprint, the temporary construction work areas or the east-west transmission line alignment option.

Because no producing wells within the construction footprint would be permanently abandoned, construction of Alternative 4A would not result in reduced natural gas production in the study area. Alternative 4 would not affect any locally important natural gas wells or result in the loss of any portion of the area's natural gas production and the effects would not be adverse.

CEQA Conclusion: Because no natural gas wells would occur in the construction footprint there would not be any loss in active natural gas wells or change in the availability of natural gas production. The construction of Alternative 4A would not affect natural gas wells or gas production. No mitigation is required.

Impact MIN-2: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The extent of construction and permanent footprint and resulting loss of extraction potential for natural gas fields would be the same as described under Alternative 4. Alternative 4A water conveyance facilities would permanently reduce the land surface available for vertical extraction of natural gas from directly underlying gas fields, however most of the affected gas fields could be accessed from other overlying areas. Similarly, effects on potential gas extraction resulting from construction work areas would be small and temporary and would not prevent recovery of natural gas. Therefore, there would be no short or long-term adverse effect on natural gas extraction potential from construction of Alternative 4A.

CEQA Conclusion: Although the Alternative 4 conveyance facilities would reduce the land surface available for vertical extraction of natural gas from underlying gas fields, the proportion of these gas fields affected would be small (less than approximately 3% of the areal extent of natural gas field areas intersected). Additionally, there would be no substantial loss of existing production or permanent loss of access to the resource because the gas fields would continue to be accessible using conventional or directional drilling techniques. Accordingly, this impact would be less than significant. No mitigation is required.

Impact MIN-3: Loss of Availability of Locally Important Natural Gas Wells as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 4A would include moving water, both in infrastructure that would be constructed under this alternative and in the natural channels. These operations would not cause additional effects on natural gas wells beyond those related to water conveyance construction. Maintenance of the water conveyance facilities under Alternative 4A would be the same as discussed for Alternative 4. These activities would not affect natural gas wells or resource recovery. Accordingly, the operation and maintenance associated with the water conveyance facilities under Alternative 4A would not result in adverse effects on access to or use of existing active wells. Accordingly, there would be no adverse effect on natural gas wells from operation and maintenance of Alternative 4A.

CEQA Conclusion: The operation and maintenance associated with the water conveyance facilities under Alternative 4A would have no impact on access to natural gas wells, either for operating and maintaining existing active wells, or modifying plugged inactive wells, because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance, and similar activities would not cause the abandonment of wells, eliminate access to wells, or reduce production. Therefore, this impact would be less than significant. No mitigation is required.

Impact MIN-4: Loss of Availability of Natural Gas Fields as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 4A would include moving water, both in infrastructure that would be constructed under this alternative and in the natural channels. These operations would not cause additional effects on access to natural gas fields beyond those related to water conveyance construction. Maintenance of the water conveyance facilities under Alternative 4A would be the same as discussed for Alternative 4. These activities would not affect access to natural gas fields. Accordingly, the operation and maintenance associated with the water conveyance facilities under Alternative 4A would not result in adverse effects on access to or use of existing active wells, or accessing plugged inactive wells. Accordingly, there would be no adverse effect from operation and maintenance.

CEQA Conclusion: The operation and maintenance associated with the water conveyance facilities under Alternative 4A would have no impact on access to natural gas wells, either for operating and maintaining existing active wells, or modifying plugged inactive wells, because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance, and similar activities would not cause the abandonment of wells, eliminate access to wells, or reduce production. Therefore, this impact would be less than significant. No mitigation is required.

Impact MIN-5: Loss of Availability of Locally Important Natural Gas Wells as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

The type of effects on locally important natural gas wells associated with Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar to those described for Alternative 4. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, environmental commitments occurring under Alternative 4A would affect much less land within the Plan Area when compared to Alternative 4. Therefore, the magnitude of effects of Alternative 4A on mineral resources within the Plan Area would be smaller than those disclosed under Alternative 4.

NEPA Effects: Because locations for these activities have not been determined, the extent of the effect of implementing restoration actions on locally important natural gas wells cannot be precisely determined. It is anticipated that restoration actions expected under Alternative 4A would result in adverse effects on locally important natural gas wells however to a lesser degree than under Alternative 4 because less land would be restored. Similar to Alternative 4, natural gas wells located in areas that would be permanently inundated could remain productive with the use of protective cages or platforms. However, for those instances, modification and maintenance of wells may not be cost effective. It is likely that any producing wells in proposed permanent inundation areas would need to be abandoned because modifications to these wells would not be feasible.

The number of active wells directly affected would vary, depending on the specific lands inundated by Environmental Commitments 4 and 10. The active wells that would be affected could be maintained in place if they were in seasonally inundated locations. In permanently flooded areas, the active wells could be replaced using conventional or directional drilling techniques at a location outside the inundation zone to maintain production. The likelihood of this replacement would depend on the availability of land for lease and the cost of the new construction. If a large number of wells had to be abandoned and could not be redrilled, there could be a locally adverse effect related to permanent elimination of a substantial portion of a county's active natural gas wells. Mitigation Measure MIN-5A is available to address this effect.

Natural gas wells in areas that would remain uplands could remain operational and unaffected if they are avoided when restoration activities are implemented and access to the gas well can be maintained. Maintaining access to an oil or gas well is defined by the California Department of Conservation as (1) maintaining rig access to the well, and (2) not building over, or in close proximity to, the well (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources 2007).

CEQA Conclusion: Although the number of natural gas wells likely to be affected may be a small percentage of the total wells in the study area, and some wells may be relocated using conventional or directional drilling, there is potential to affect a significant number of locally important gas wells. Consequently, this impact is considered significant. Because implementation of Mitigation Measure MIN-5A cannot assure that all or a substantial portion of a county's existing natural gas wells will remain accessible after implementation of this alternative, this impact is significant and unavoidable.

Mitigation Measure MIN-5: Design Environmental Commitments 4 and 10 to Avoid Displacement of Active Natural Gas Wells to the Extent Feasible

During final design of Environmental Commitments 4 and 10, the project proponents will avoid permanent inundation of or construction over active natural gas well sites where feasible to minimize the need for well abandonment or relocation.

Impact MIN-6: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Because locations of restoration actions occurring under Alternative 4A have not been determined, the extent of the effect of implementing these actions on natural gas fields within the Plan Area cannot be precisely determined. It is anticipated that restoration actions expected under Alternative 4A would result in adverse effects on the potential to extract natural gas from these fields however to a lesser degree than under Alternative 4 because less land would be restored. Similar to Alternative 4, some natural gas fields could be permanently inundated resulting in potential losses in production. However, most natural gas fields would still be accessible from outside the inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of inundation and the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low, there remains the potential for a locally adverse effect on access to natural gas fields because the resource may be permanently covered (inundated) or otherwise become inaccessible to recovery. Mitigation Measure MIN-6 is available to lessen this effect.

CEQA Conclusion: The areal extent of lands overlying study area natural gas fields that would be inundated by through restoration actions depends on final footprints for these measures. Most of these natural gas fields would still be accessible from outside the inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of inundation and the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low to moderate, there is potential for a locally significant impact on access to natural gas fields if they are permanently covered (inundated) such that the resource cannot be recovered. Implementation of Mitigation Measure MIN-6 would reduce this impact, but not to a less-than-significant level. Because implementation of Mitigation Measure MIN-6 cannot assure that all or a substantial portion of existing natural gas fields will remain accessible after implementation of this alternative, this impact is significant and unavoidable.

Mitigation Measure MIN-6: Design Environmental Commitments 4 and 10 to Maintain Drilling Access to Natural Gas Fields to the Extent Feasible

During final design of actions to offset the impacts of constructing and operating the water conveyance facilities, the project proponents will identify means to maintain access to natural gas fields that could be adversely affect by implementing Environmental Commitments 4 and 10 where feasible. These could include preserving non-inundated lands either over or adjacent to natural gas fields adequate in size to allow drilling to occur. These measures will ensure that drilling access to natural gas fields is maintained to the greatest extent practicable.

Impact MIN-7: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: Because there are no permitted resource extraction mines (including aggregate mines) and no identified MRZs in the Alternative 4A footprint, including within the footprint for the east-west transmission line alignment option, there would be no effect on the availability of aggregate resources.

CEQA Conclusion: Because there are no permitted mines or MRZs in the construction footprint for Alternative 4A, including within the footprint for the east-west transmission line alignment option, there would be no impact. No mitigation is required.

Impact MIN-8: Loss of Availability of Known Aggregate Resources as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The demand for construction materials, including aggregates and borrow materials for Alternative 4A would be identical to Alternative 4. The principal demands for construction material would come from the three intakes and associated facilities, the nearly 40 miles of concrete pipeline tunnels, and forebays. This demand would not result in a substantial depletion of construction-grade aggregate within the six regional aggregate production study areas, would not cause remaining supplies to be inadequate for future development, and would not substantially contribute to the need for the development of new aggregate resources. Accordingly, it would not have an adverse effect on the availability of known aggregate resources or borrow materials over the water conveyance facilities construction period.

CEQA Conclusion: The use of large amounts of construction aggregate over the 9-year construction period would not result in a substantial depletion of construction-grade aggregate from the study area, would not cause remaining supplies to be inadequate for future development, and would not contribute to the need for development of new aggregate sources. Consequently, although a substantial amount of available aggregate material may be used under Alternative 4A, the impact on aggregate resources would be less than significant. No mitigation is required.

Borrow is not a defined mineral resource and is usually developed on an as-needed basis. Consequently, the amount of borrow required for this alternative would not be a significant impact. No mitigation is required.

Impact MIN-9: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 4A would include moving water, both within infrastructure that would be constructed and the natural channels. Adverse effects would only occur if operations prevented access to a locally important aggregate resource site; this is not expected to occur because there are no aggregate mines or MRZs in the area where the alternative would operate. Accordingly, operation of Alternative 4A would not block access to existing mines or identified MRZs and similar to Alternative 4, there would be no effect. Similarly, routine facilities maintenance activities such as painting, cleaning, and structure repair, landscape maintenance, road work, and periodic replacement of erosion protection on the levees and embankments would not cover or block access to existing mines or identified MRZs because there are no aggregate mines or MRZs in the area where the alternative would operate. Additionally, operations and maintenance would not increase the existing project footprint so they could not have any effect even if aggregate mines or MRZs did exist. Accordingly, the operation and maintenance of the water conveyance facilities under Alternative 4A would not have effects on the availability of aggregate resource sites.

CEQA Conclusion: The operation and maintenance associated with Alternative 4A would have no impact on the availability of aggregate resource sites because none exist within the areas affected by Alternative 4A operations and operations and maintenance would not increase the alternative's footprint. No mitigation is required.

Impact MIN-10: Loss of Availability of Known Aggregate Resources as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 4A would include moving water, both within infrastructure that would be constructed and natural channels. Similar to Alternative 4, no aggregate resources are required for operations so there would be no effect and only small amounts of aggregate and riprap would be required for maintenance of structure foundations, levees, stream banks, and access roads associated with major project features such as intakes, pumping plants, and the head of Old River barrier. As discussed under Alternative 4, the demand for these materials could be easily met locally. Accordingly, operation and the use of a small amount of aggregate material for the maintenance of the water conveyance facilities under Alternative 4A would not result in adverse effects.

CEQA *Conclusion:* Operation of the water conveyance facilities under Alternative 4A would not affect any aggregate resources because operation involves moving water through the conveyance infrastructure and no aggregate resources are required for operations. A small amount of aggregate material would be used for maintenance of Alternative 4A which would be available from local sources. Operation and maintenance would not cause substantial depletion or loss of availability, and would not cause remaining supplies to be inadequate to meet future demands and require developing new sources. Therefore this impact would be less than significant. No mitigation is required.

Impact MIN-11: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The environmental commitments that would have the potential to affect important aggregate resource sites are those that would inundate large areas of land. The loss of important aggregate resource sites under Alternative 4A would be similar to that described under Alternative 4. However, the potential for loss of important aggregate resource sites would be less than Alternative 4 because much less land would be restored within the Plan Area and over a much shorter period. Nevertheless, the potential for inundation and loss of this aggregate resource sites would remain under Alternative 4A and is considered an adverse effect. Mitigation Measure MIN-11 is available to reduce this effect.

CEQA *Conclusion:* As described under Alternative 4, an active mine on Decker Island may fall within the inundation footprints associated with implementing restoration actions associated with tidal natural communities and nontidal marsh. Although less acreage would be restored under Alternative 4A, restoration actions could result in inundation of aggregate resources. Although the impact is expected to be less than under Alternative 4, the potential loss would remain a significant impact because it would eliminate the potential to recover aggregate resources. Mitigation Measure MIN-11 is designed to reduce the impact to less than significant.

Mitigation Measure MIN-11: Purchase Affected Aggregate Materials for Use in Project Construction

The project proponents will purchase the permitted aggregate volume of affected mines for construction use so that the available aggregate will not be lost. The resulting mined site(s) should be considered for integration into the restoration design of any environmental commitment that affects the site(s). For example, the mined site(s) could be reshaped to provide aquatic or intertidal habitat of varying depths and configurations.

Impact MIN-12: Loss of Availability of Known Aggregate Resources as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Restoration actions occurring under Alternative 4A have the potential to reduce the availability of important aggregate resources. When compared to Alternative 4, loss of aggregate resources under Alternative 4A would be less because the total acreage of restoration occurring with the Plan Area would be substantially less. Similar to Alternative 4, aggregate and riprap would be used for levee, berm, access road, and rock revetment construction, and rock would be placed for erosion control and stability at levee breaches and toe drain earthworks. The amounts of aggregate and riprap necessary for these activities cannot be calculated at this time because of the programmatic nature and general design of the restoration actions. However, the amount needed would be used over a period of years and would be expected to be within the available resources of the study area and adjacent aggregate resource study areas discussed in Section 26.1.2.1, *Aggregate Resources* and identified in Table 26-1 of the Draft EIR/EIS. There would be no depletion (loss of availability) of regional aggregate supplies substantial enough to cause remaining supplies to be inadequate for future development or to require development of new aggregate sources to meet future demand. Therefore, the use of aggregate material for the restoration actions under Alternative 4A would not cause an adverse effect on the availability of aggregate resources.

CEQA Conclusion: Restoration actions occurring under Alternative 4A would use small amounts of aggregate for levee, berm, and access road construction, and placement of rock revetments or riprap for erosion control and stability at level breaches and toe drain earthworks. The amounts of aggregate are unknown but would be within the available resources of the study area or adjacent aggregate resource study areas. Because implementing environmental commitments would not use an amount of aggregate that would cause remaining supplies to be inadequate to meet future demands and require developing new sources, this impact would be less than significant. No mitigation is required.

4.3.23 Paleontological Resources

Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result of Construction of Water Conveyance Facilities

The construction of water conveyance facilities and the extent of destruction of unique or significant paleontological resources under Alternative 4A would be identical to those described under Alternative 4. Construction activities that could result in adverse effects on paleontological resources include excavation for new intakes, pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an operable barrier at the head of Old River, other water facility components, roads, and borrow sites. The depth, extent, and location of excavation and other ground-disturbing activities vary greatly across the Plan Area and are provided in the description of the extent of impacts on paleontological resources in Alternative 4 and summarized in Table 27-14 of the Draft EIR/EIS.

NEPA Effects: The ground-disturbing activities that occur in geologic units sensitive for paleontological resources have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the Society of Vertebrate Paleontology (SVP) (2010) would represent an adverse effect because conveyance facility construction could directly or indirectly destroy unknown paleontological resources in geologic units known to be sensitive for these resources.

The shallow excavation and grading in surficial Holocene deposits that would take place for the construction of roads could be addressed through implementation of Mitigation Measures PALEO-1b and PALEO-1d.

Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the surface-related ground disturbance activities associated with Alternative 4A. However, while these measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring activities because they would be conducted deep underground and could not be monitored. Moreover, although boring material could be examined by monitors, such work would be subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

Excavation for new intakes, pumping plants, new/expanded forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for Alternative 4A would most likely destroy unique or significant paleontological resources and would constitute an adverse effect under NEPA.

CEQA Conclusion: Construction of water conveyance facilities proposed under Alternative 4A could cause the destruction of unique paleontological resources. The ground-disturbing activities associated with Alternative 4A would occur in geologic units sensitive for paleontological resources and could therefore have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact under CEQA.

Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels necessary for Alternative 4A would most likely destroy unique or significant paleontological resources in the Plan Area and would potentially cause a significant and unavoidable impact.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated with the Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Ground-disturbing activities associated with restoration actions under Alternative 4A would result in impacts that would be similar in nature to those described under Alternative 4. However, the extent of these impacts would be much less under Alternative 4A because less ground-disturbing activity would occur. The environmental committments are described in Section 4.1.2.3, *Environmental Commitments*, of this RDEIR/SDEIS and include natural communities protection and restoration, tidal natural communities restoration, channel margin enhancement, riparian natural community restoration, vernal pool and alkali seasonal wetland complex restoration, and nontidal marsh restoration. Land-disturbing activities would be required to implement each of the conservation and stressor reduction measures.

NEPA Effects: If fossils are present in the Plan Area, they could be damaged during excavation required to implement the conservation and stressor reduction components. The greater the extent of excavation, the greater the potential effect, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be an adverse effect.

Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-disturbing environmental commitments. Mitigation Measures PALEO-1a through PALEO-1d would address all deeper ground-disturbing environmental commitments.

CEQA Conclusion: Ground-disturbing activities associated with implementing the conservation and stressor reduction components under Alternative 4A could affect paleontological resources. If fossils are present in the Plan Area, they could be damaged during excavation associated with these environmental commitments. The greater the extent of excavation, the greater the potential impact, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact.

Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing environmental commitments and Mitigation Measures PALEO-1a through PALEO-1d for all deeper ground-disturbing environmental commitments ensure that unique or significant paleontological resources in the alternative footprint are systematically identified, documented, avoided or protected from damage where feasible, or recovered and curated so they remain available for scientific study and would reduce these impacts to a less-than-significant level.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1b under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1c under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1d under Impact Paleo-1 in the discussion of Alternative 4 in Chapter 27, *Paleontological Resources*, of the Draft EIR/EIS.

4.3.24 Environmental Justice

As described in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS some of the resource topics were not considered in the assessment of disproportionate impacts on minority or low-income populations. For the reasons described in Section 28.5.3.1, *Issues Not Analyzed in Detail*, of the Draft EIR/EIS, these resources were also not evaluated as part of the Alternative 4A environmental justice impact assessment. The resource topics not evaluated for a disproportionate impact on minority or low income populations are geology and seismicity, hazards and hazardous materials, mineral resources, water supply, surface water, groundwater, water quality, soils, fish and aquatic resources, terrestrial biological resources, agricultural resources, recreation, transportation, energy, air quality, and paleontological resources.

4.3.24.1 Land Use

The potential impact on minority and low-income populations resulting from changes in land use for Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 13.3.3.9 of the Draft EIR/EIS identifies effects caused by incompatibility with local land uses, potential for physical division of established communities, and incompatibility with land use policies, By itself, incompatibility with land use policies is not a physical effect on the environment, and, therefore, does not have the potential to result in a disproportionate effect on a minority or low-income populations. Chapter 13, *Land Use*, Section 13.3.3.9, of the Draft EIR/EIS also addresses the potential for an alternative to result in the relocation of residents, or a physical effect on existing structures, with the consequence that adverse effects on the physical environment would result. The following adverse effects are relevant to this analysis:

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

The extent of land use changes attributable to construction of Alternative 4A that could affect minority and low-income populations would be the same as disclosed for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As discussed in detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS, a disproportionate effect on minority populations would occur because construction of Intakes 2, 3, and 5 would result in the displacement of residential structures and permanent structures within census blocks where the minority population is greater than 50%.

4.3.24.2 Socioeconomics

The potential impact on minority and low-income communities associated with changes in socioeconomic conditions for Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 13.3.3.9 of the Draft EIR/EIS identified effects on agricultural economics and local employment conditions associated with constructing and operating the water conveyance facility and implementing environmental commitments. These impacts have the potential to disproportionately affect environmental justice populations. The following adverse effects are relevant to this analysis:

Impact ECON-1: Temporary Effects on Regional Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Impact ECON-7: Permanent Regional Economic Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Land use changes that could affect minority and low-income populations for Alternative 4A would be the same as indicated for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As discussed in greater detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the majority of farm-related employment is represented by minority populations, including those of Hispanic origin, and potentially low-income, loss of agriculture land and loses of associated employment is expected to result in a disproportionate effect on minority populations. While a net increase in employment would occur during construction of the water conveyance facility, it is expected that most new construction jobs would not likely be filled by displaced agricultural workers because the skills required are not comparable. This effect would, therefore, remain adverse because job losses would disproportionately accrue to a minority population.

4.3.24.3 Aesthetics and Visual Resources

The potential impact on minority and low-income communities associated with changes in visual resources for Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 17.3.3.9 in the Draft EIR/EIS addresses impacts on aesthetics and visual resources in the study area. The impacts on aesthetics and visual resources have the potential to disproportionately affect environmental justice populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of CM2–CM21

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Mitigation Measure AES-4a: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-intensity and Lights off Policy

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

The changes in the visual character of the study area that could affect minority and low-income communities under Alternative 4A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As described in detail under Alternative 4, changes in the visual character of the study area would occur as a result of the following:

- Landscape scars left behind from spoil borrow and RTM areas, transmission lines, concrete batch plants and fuel stations, and launching, retrieval, ventilation shafts sites.
- Constructing industrial facilities (i.e., Sacramento River intakes, intermediate forebay, expanded Clifton Court Forebay and pumping plant) in the study area.

The change in visual character as a result of the construction of the water conveyance facilities would be evident from the communities of Walnut Grove, Clarksburg, and Hood as well as rural residences located along the entire alignment. Because of the concentration of minority and low income populations in these communities as well as along the entire alignment, a change in visual character of the study area would disproportionately affect these populations. For these reasons, although mitigation is available to reduce the severity of these effects, this effect would be adverse.

Similar to Alternative 4, implementing conservation and stressor reduction measures as part of Alternative 4A, would result in impacts on the study area's visual quality and character. However because the precise location of the conservation and stressor reduction measures are unknown, this impact is not carried forward for further analysis of environmental justice effects.

4.3.24.4 Cultural Resources

The potential impact on minority and low-income communities associated with changes to cultural resources Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 18.3.5.9 of the Draft EIR/EIS addresses cultural resources in the study area. The impacts on cultural resources have the potential to disproportionately affect minority or low-income populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-7: Effects of Environmental Commitments on Cultural Resources

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Mitigation Measure CUL-3: Implement an Archaeological Cultural Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains If Such Resources Are Discovered during Construction

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of CM2–CM21

The impact that the loss of cultural resources from within the study area could have on minority and low-income populations under Alternative 4A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As discussed in greater detail under Alternative 4, the loss or damage to prehistoric cultural resources would result in a disproportionate effect on Native American populations and potentially other minorities. Despite the required mitigation measures and Native Consultation processes, construction of Alternative 4A is likely to result in adverse effects on prehistoric archaeological resources and human remains because the scale of the construction activities makes avoidance of all eligible resources infeasible. The effect on minority populations that may ascribe significance to cultural resources in the Delta would remain disproportionate even after mitigation because mitigation cannot guarantee that all resources would be avoided, or that effects on affected resources would be reduced. For these reasons this effect would be adverse because the effect would disproportionately accrue to a minority population.

4.3.24.5 Public Services and Utilities

The potential impact on minority and low-income communities associated with changes to the availability of public services and utilities under Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 20.3.3.9 of the Draft EIR/EIS addresses potential effects on utility infrastructure and public service providers, such as fire stations and police facilities. The following adverse effects on public services and utilities are relevant to the analysis:

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed CM2–CM11

The impacts on public services and utilities located within the study area that could disproportionately affect minority and low-income populations under Alternative 4A would be the same as indicated disclosed under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As discussed in greater detail under Alternative 4, the impact of constructing the proposed water conveyance facilities on public services and utilities would not result in a disproportionate effect on minority or low income populations because relocation of an existing known utility would affect the entire service area of that utility. This effect would not be anticipated to result in a disproportionate effect on a minority or low-income population.

4.3.24.6 Noise

The potential impact on minority and low-income communities associated with noise occurring under Alternative 4A would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 23.4.3.9 of the Draft EIR/EIS identifies the following adverse effects associated with new sources of noise and vibration that would be introduced into the study area under Alternative 4. The following adverse effects and mitigation measure are relevant to this analysis.

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed CM2–CM21

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

The impacts of noise and vibration generated during construction of the water conveyance facilities and resulting effects on minority and low-income communities occurring under Alternative 4A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be identical between the two alternatives. As discussed in greater detail under Alternative 4, constructing the water conveyance facilities would generate nose in exceedance of daytime and nighttime noise standards in areas zoned as sensitive land uses including residential, natural/recreational, agricultural residential, and schools. Similarly, ground borne vibration from impact pile driving would exceed vibration thresholds in areas zoned for residential, including agricultural residential. This effect of noise and vibration generated during construction would remain adverse after application of mitigation. Because the alignment of the water conveyance facility is proximate to census blocks and block groups where meaningfully greater minority and low-income populations occur it is expected that generation of noise and vibration in exceedance of thresholds would result in a potentially disproportionate effect on minority and low-income populations.

Impacts of implementing conservation and stressor reduction components (Environmental Commitments 3, 4, 6–12, 15, and 16) under Alternative 4A would be expected to be similar to impacts of implementing CM2–CM11 under Alternative 4. However, because fewer acres would be restored under Alternative 4A, it is expected that noise and vibration generated would be less when compared to Alternative 4. Nevertheless, it would be difficult to analyze potential disproportionate effects on environmental justice population because similar to CM3–CM11, the location of the conservation and stressor reduction components are not known. However, because of the distribution of minority and low-income populations in the study area, there is a potential for noise and vibration impacts to disproportionately affect these populations.

4.3.24.7 Public Health

Section 4.3.21, *Public Health*, of this RDEIR/EIS, identifies the potential for construction, operation, and maintenance of Alternative 4A to mobilize or increase constituents known to bioaccumulate. The following adverse effects are relevant to this analysis.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

The amount of tidal habitat restoration completed under Alternative 4A (Environmental Commitment 4) would be substantially less than under Alternative 4 CM4. To the extent that restoration actions alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes due to operation of the water conveyance facilities. Three intakes would be constructed and operated under Alternative 4A, similar to Alternative 4. Sediment-disturbing activities during construction and maintenance of the intake and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. The effects of Alternative 4A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to or slightly less than those described for the Alternative 4. Alternative 4A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments.

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter 8, Section 8.1.3.9, *Mercury,* in Appendix A of the RDEIR/SDEIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 4A are expected to be small. The greatest annual average methylmercury concentration for drought conditions would be 0.166 ng/L for the San Joaquin River at Buckley Cove (all scenarios) which was slightly lower than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases in mercury concentrations based on long-term annual average concentrations for mercury at the Delta locations, but they would be different relative to the No Action Alternative (ELT). Under Operational Scenario H3 (Equation 2—see Chapter 8, *Water Quality*, of the Draft EIR/EIS) there would be 11% to 12% percent increases at Staten Island and Rock Slough relative to the No Action Alternative (ELT) in all modeled years. Under Operational Scenario H4 there would be an 11% decrease relative to the No Action Alternative (ELT) for drought years. These changes are expected to be within the uncertainty inherent in the modeling approach (see Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS for a discussion of the uncertainty associated with bioaccumulation models), and would likely not be measurable in the environment. In the LLT, the primary difference would be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of Alternative 4A and, therefore, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

> Because some of the affected species of fish in the Delta are pursued during subsistence fishing by minority and low-income populations, this increase creates the potential for mercury-related health effects on these populations. Asian, African-American, and Hispanic subsistence fishers pursuing fish in the Delta already consume fish in quantities that exceed the US Environmental Protection Agency reference dose of 7 micrograms (μg) per day total (Shilling et al. 2010:5). This reference dose is set at 1/10 of the dose associated with measurable health impacts (Shilling et al. 2010:6). The highest rates of mercury intake from Delta fish occur among Lao fishers (26.5 μg per day, Shilling et al. 2010:6). Increased mercury was modeled based upon increases modeled for one species: largemouth bass. These effects are considered unmitigable (see Chapter 8, *Water Quality,* Mitigation Measure WQ-13).

> The associated increase in human consumption of mercury caused by these alternatives would depend upon the selection of the fishing location (and associated local fish body burdens), and the relative proportion of different Delta fish consumed. Different fish species would suffer bioaccumulation at different rates associated with the specific species, therefore the specific spectrum of fish consumed by a population would determine the effect of increased mercury body burdens in individual fish species. These confounding factors make demonstration of precise impacts on human populations infeasible. However, because minority populations are known to practice subsistence fishing and consume fish exceeding US EPA reference doses, any increase in the fish body burden of mercury may contribute to an existing adverse effect. Because subsistence fishing is specifically associated with minority populations in the Delta compared to the population at large this effect would be disproportionate on those populations for Alternative 4A. This effect would be adverse.

4.3.24.8 Summary of Environmental Justice Effects under Alternative 4A

Alternative 4A would result in disproportionate effects on minority and low-income communities resulting from land use, socioeconomics, aesthetics and visual resources, cultural resources, noise, and public health effects. Mitigation and environmental commitments are available to reduce these effects; however, effects would remain adverse. For these reasons, effects on minority and low-income populations would be disproportionate and adverse.

4.3.25 Climate Change

This section is organized differently from the other sections above because analyzing how Alternative 4A would affect the Delta's resiliency and adaptability to climate change is a fundamentally different analysis than those presented in other resource analyses. Whereas the other sections are organized to identify effects of Alternative 4A and how to mitigate any significant impacts, this section's function is to analyze and disclose how Alternative 4A would affect the Delta's resiliency and adaptability to expected climate change. While climate change is already ongoing and would occur under the ELT timeframe, effects of Alternative 4A on the resiliency and adaptability would be greater under LLT conditions as climate change effects are expected to be more pronounced[6]. Nevertheless, an assessment of conditions under the ELT timeframe is provided below.

[6] The ELT timeframe is modeled at 2025. The LLT timeframe is modeled at 2060.

As described in Draft EIR/EIS Chapter 29, *Climate Change,* Section 29.6.1.1, impact analyses evaluated potential sea level increases of 6 inches (15 centimeters) in 2025, which is relevant to the early long-term timeframe considered for the purposes of Alternative 4A. Expected changes in precipitation and hydrology were also evaluated including earlier runoff as a result of warmer temperatures causing more precipitation to fall as rain instead of snow and the remaining snow melting earlier. These hydrologic changes will make water management more challenging and more constrained in the future and are expected to result in more years of critical dryness. DWR's modeling of future conditions suggests that with current management and operations, level of demand, and current climate, major CVP and SWP reservoirs could reach dead storage levels (the level below which water cannot be released) and that the likelihood of these critical conditions will increase substantially as the climate warms. In these instances, there would be critical water shortages leading to potentially extreme impacts on agriculture, municipal, industrial, and ecological water uses.

Alternative 4A would provide resiliency and adaptation benefits over the No Action/No Project alternative for dealing with the combined effect of increases in sea level rise and changes in upstream hydrology. As shown in Table B.1-3 in Appendix B of this RDEIR/SDEIS, implementation of this alternative would result in Delta exports that could range from slightly lower (less than 1% decrease under Scenario H3) to somewhat higher (11% increase under Scenario H4) than those under the No Action Alternative (ELT). Alternative 4A includes dual conveyance facilities, allowing water to be moved through the Delta when conditions permit and allowing water to be diverted from the Sacramento River in the northern Delta when conditions do not permit through Delta conveyance. The location of the north Delta diversion facility is further inland making it less vulnerable to salinity intrusion. Even with substantial sea level rise and critically dry upstream conditions, salinity could be repelled from this location. By establishing an alternative diversion point for Delta exports, a great deal of Delta management flexibility is added. Currently, management of the Delta is constrained by requirements to maintain X2 at specific locations during certain times of the year to ensure water diversions have low salinity and to ensure that critical fish populations stay outside of the entrapment zone. Alternative 4A would allow the Delta to be managed in a number of different ways, including maintaining salinity as it is currently managed or allowing salinity to fluctuate more freely in the Delta as it did prior to the development of upstream reservoirs. This added flexibility would allow managers more options for adaptively managing the Delta so that conditions can be optimized to provide benefits across all Delta water uses and habitat conditions. Alternative 4A would also provide more reliable water supplies, which will provide additional resilience and adaptability to increases in water demand as a result of higher temperatures and increased evapotranspiration and evaporation.

In addition to added water management flexibility created by proposed water conveyance facilities, Alternative 4A includes Environmental Commitments 3, 4, 12, 15, and 16 that provide for actions that will improve habitat in certain areas and reduce the effects of stressors, though to a substantially smaller geographic extent than proposed under Alternative 4. By enhancing, restoring, and protecting habitat, Alternative 4A would increase resilience and adaptability to the climate changes described above by increasing the amount of habitat that is available during periods of high stress such as very high or low freshwater inflow or very high salinity intrusion. By creating a wider variety of water management options and restoring habitat, Alternative 4A can also help buffer potential negative effects of increased water temperatures thereby adding resiliency to increased water temperatures. More detail on existing temperature conditions in watersheds within the Delta and water temperature effects on aquatic habitat as well as biological and biochemical processes, and how managed flows influence water temperatures can be found in Chapter 11, Fish and Aquatic Resources.

Similarly, in consideration of terrestrial species, protection and restoration of a variety of natural communities will increase the patch size and connectivity of habitats. Increasing patch size will tend to increase population sizes of native species, which provides more resilience against a changing climate. Increasing connectivity allows more genetic exchange among populations and movement to more suitable habitats as environmental conditions change. By reducing stressors on the Delta ecosystem through predator control at the north Delta intakes and Clifton Court Forebay and installation of a nonphysical fish barrier at Georgiana Slough, Alternative 4A will contribute to the health of the ecosystem and of individual species populations making them stronger and more resilient to the potential variability and extremes caused by climate change.

As described for Alternative 4, Alternative 4A would not be anticipated to add resiliency to existing levees; levee fragility would remain high and increase with time as in the No Action/No Project Alternative. However, Alternative 4A would provide additional adaptability to catastrophic failure of Delta levees. By providing an alternate conveyance route around the Delta, this alternative provides a mechanism to continue making water deliveries to SWP/CVP contractors and local and in-Delta water users with conveyance interties even if the Delta were temporarily disrupted by a catastrophic levee failure.

Construction and operation of the proposed water conveyance facilities and implementation of environmental commitments under Alternative 4A would not affect the ability of agencies to implement plans and proactive measures associated with climate change resiliency (see Draft EIR/EIS Chapter 29, *Climate Change,* Section 29.7 for a discussion of individual plans and policies). Accordingly, the project would be compatible with these federal and state plans to address climate change.

4.3.26 Growth Inducement and Other Indirect Effects

4.3.26.1 Direct Growth Inducement

Construction Jobs

Construction of Alternative 4A would require a peak of approximately 2,278[7] construction workers over a fourteen-year period. It is estimated that approximately 30 percent of these workers would come from out of state (due to the specialized nature of some of the jobs) and reside temporarily in the vicinity. Assuming the peak number of construction jobs (assumed to occur in year four of the eight-year period, as discussed in Chapter 16, *Socioeconomics*), this would mean approximately 752 workers coming from out of state. Construction would occur in the Delta area roughly between Sacramento and Stockton, and it is expected that the remaining approximately 3,100 workers would be drawn from the labor force of the five Delta counties in the project vicinity—Contra Costa, Sacramento, San Joaquin, Solano, and Yolo. The 1,526 jobs expected to be drawn from the local labor pool represents approximately 7% of the number of construction jobs in four of the five counties (Sacramento, San Joaquin, Solano, and Yolo)[8] in 2009, according to the California Department of Employment (California Employment Development Department 2011). While this is not an inconsequential percentage of construction jobs in 2009, the 1,526 project construction jobs is substantially less than the 13,000 construction jobs that were *lost* in the previous year (from 2008 to 2009) (California Employment Development Department 2011), due to the ongoing economic downturn.

With respect to the 752 workers who are assumed would be from out of state, according to the 2010 decennial census, there were almost 20,000 vacant residential units for rent in the five Delta counties in 2010 and, in the cities of Sacramento and Stockton alone, there were 4,052 vacant residential units for rent (U.S. Census Bureau 2011). All these jurisdictions except Yolo County had residential rental vacancy rates higher than the 5% rate considered optimal to allow normal turnover and renter mobility.[9] The cities of Sacramento and Stockton alone had a combined total of 12,591 vacant residential units for rent and rental vacancy rates of 8.3% and 9.4%, respectively. In addition to the available rental housing units, there are recreational vehicle and mobile home parks and numerous hotels and motels within the five-county region to accommodate any construction workers. Given the availability of housing in the project vicinity, out-of-state workers would be readily accommodated by existing housing; therefore the influx of these workers during project construction would not induce substantial new housing development.

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[7] Based on the estimated construction workforce presented in Chapter 16, *Socioeconomics*, Table 16-19.

[8] Information on construction employment for Contra Costa County is not included in the industry employment by county data provided by the California Employment Development Department; therefore the construction employment numbers discussed here do not include Contra Costa County. In addition the only annual average industry employment data provided for San Joaquin and Solano counties is for the Stockton Metropolitan Statistical Area (MSA) and the Vallejo-Fairfield MSA, respectively; consequently the job information for the four counties presented here is likely to be understated to some degree, although it is assumed the MSAs reflect county employment trends and are the major employment centers in their respective counties.

[9] According to the Association of Bay Area Governments (ABAG), in the Bay Area a 5% vacancy rate is considered necessary to permit ordinary mobility in rental housing (i.e., normal housing turnover and mobility on the part of renters), and a 2% vacancy rate is considered necessary to permit ordinary mobility in for-sale housing (Association of Bay Area Governments ND:1-18.) Rental vacancy rates in four of the five Delta counties ranged from 6.8% to 8.3%; Yolo County's rental vacancy rate was 5%.

Permanent Jobs

Alternative 4A would require approximately 129 permanent operations and maintenance workers, who would be anticipated to live in the Delta region. This number represents about 0.02% of the total nonfarm jobs and 0.4% of the transportation, warehousing, and utilities jobs in the five Delta counties (California Employment Development Department 2011). It is therefore likely that this small number of new jobs would readily be filled by the local labor force and would not induce additional growth in the area. Assuming some or all of the jobs were specialized and required workers from outside the local labor pool, given the availability of housing in the project vicinity, these workers would be readily accommodated by existing housing; therefore the influx of these workers during project operation would not induce substantial new housing development.

4.3.26.2 Indirect Growth Inducement Associated with Facility Construction and Operation

Access Roads within the Plan Area

Construction of Alternative 4A water conveyance facilities will be identical to Alternative 4. In general, construction of roads in relatively undeveloped areas has the potential to induce growth by facilitating access to such areas by removing lack of roadway infrastructure as an obstacle to growth. The temporary access roads would be removed following construction and the land would be returned to its pre-project conditions; therefore temporary roads would not have the potential to induce future development. The permanent access roads would remain and, given the nature of the Plan Area, would largely be located on agricultural or open space lands. However, existing roads, including Highways 84, 160, and 4, are located close to much of the proposed alignments and facility sites, and the majority of the permanent access roads would be short segments providing a direct route between an existing road and a given project facility; therefore the new permanent roads would not provide access to substantial areas of agricultural or undeveloped lands not already served by area roads. No changes are proposed to the land use or zoning designations of land within the Plan Area; although the construction of proposed project facilities (including the permanent access roads) would remove the specific facility sites from agricultural production or other current land use, as discussed in Chapters 13 and 14, adjacent lands would continue to be designated for their current land uses. Therefore, the construction of the relatively limited segments of permanent access roads would not induce urban development.

Flood Risk Reduction

Actions under Alternative 4A are not anticipated to have any substantial impact or change on potential for flooding within the Plan Area and downstream areas (RDEIR/SDEIS Section 4.3.2 *Surface Water*). Alternative 4A would not result in an increase in potential risk for flood management compared to Existing Conditions when the changes due to sea level rise and climate change are eliminated from the analysis. Peak monthly flows under Alternative 4A in the locations considered in the analysis done were similar to or less than those that would occur under Existing Conditions without the changes in sea level rise and climate change; or the increased peak monthly flows would not exceed the flood capacity of the channels at these locations. It is not expected that there will be changes to land use or zoning designations within the Plan Area and therefore, no large-scale or substantial development would be expected to occur. There is not anticipated to have any indirect effect on growth.

4.3.26.3 Indirect Growth Inducement Potential: Summary of Modeling Results

The following sections highlight changes in SWP and CVP deliveries associated with the project alternatives based on modeling conducted using CALSIM II, focusing on changes in municipal and industrial (M&I) deliveries (also referred to as urban deliveries). Figure 4.3.1-26 summarizes overall changes in SWP deliveries to both agricultural and M&I contractors for Alternative 4A (H3 and H4) relative to Existing Conditions (the CEQA baseline) and the No Action Alternative (ELT) (which reflects with sea level rise and climate change (i.e., effects of precipitation and snowpack). Figure 4.3.1-25 summarizes changes in CVP deliveries under Alternative 4A (H3 and H4) relative to Existing Conditions as well as the No Action Alternative (ELT).

Note that the CALSIM II model was designed to evaluate water deliveries for the project as a whole, and was not designed to provide delivery allocation at the contractor level. Under circumstances of reduced SWP and CVP deliveries, CALSIM II tends to allocate water first to contractors in the northern portion of the project and then to contractors in the south. This results in an uneven distribution of reductions, with contractors in the south receiving larger reductions than contractors in the north. Consequently, where reduced deliveries are projected (Alternative 4A (Scenario H4)), some contractors (and therefore hydrologic regions) are projected to experience much larger decreases than others. This discrepancy is for the most part an artifact of the algorithm used in the model. Although system constraints may still lead to differences in distribution of reductions, these reductions in deliveries are likely to be more evenly distributed across the regions than CALSIM II has predicted. For more information on the modeling of water deliveries using the CALSIM II model, see Chapter 5, *Water Supply*, and Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

For purposes of analyzing the project's potential to induce growth, this analysis focuses on the net increase in annual average deliveries; all information on water deliveries presented below is for average annual deliveries in normal hydrologic years. The SWP modeling results reflected in the tables and figures presented in this section include Table A water as well as Article 21 water.[10]

This analysis does not address potential effects of redistribution of SWP water supply among SWP water contractors that might occur from an SWP contract amendment or funding agreements for implementing the project, other than as possible multi-year or permanent agricultural to urban water transfer of SWP water. A SWP contract amendment or funding agreement could include provisions for allocating benefits, such as a more reliable water supply, to contractors who pay for the project and could create the potential for redistributing SWP water. At this time, because a specific SWP amendment or funding agreement has not been developed, it would be too speculative pursuant to Section 15145 of the State CEQA Guidelines to evaluate changes in SWP water

[10] Article 21 water is interruptible water allocated under certain conditions. Water supply under Article 21 becomes available only during wet months of the year (December through March). A SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of SWP; therefore not all SWP contractors can take advantage of this additional supply. Article 21 is a section of the contract between DWR and the water contractor that permits delivery of water in excess of delivery of SWP Table A. It is apportioned to contractors that request it in the same proportion as their SWP Table A water. Article 21 water is allocated under certain conditions: (a) SWP's share of San Luis Reservoir is full or projected to fill in the near term; (b) other SWP reservoirs are full or at their storage targets, or conveyance capacity to fill these reservoirs is maximized; (c) releases from upstream reservoirs plus unregulated inflow exceed the water supply needed to meet Sacramento Valley in-basin uses; (d) SWP Table A deliveries are being fully met; and (e) Banks Pumping Plant has spare capacity (California Department of Water Resources 2008b:32,39).

distribution at this time. If the SWP amendment or agreement, after it is developed, may have potential to have an environmental effect not already contemplated in the BDCP EIR/EIS, DWR would prepare additional analysis.

Alternative 4A

As described in Section 4.1, *Introduction*, of this RDEIR/SDEIS, facility construction under Alternative 4A would be identical to Alternative 4 and operational criteria would be similar. The addition of new north Delta intakes as well as changes to Delta regulatory requirements under Alternative 4A would provide operational flexibility that would allow the SWP and CVP to increase Delta exports compared to operations under existing conditions, and the Early Long Term. Water supply and conveyance operations would follow the guidelines described as Scenario H3 or H4, which variously include or exclude implementation of fall X2 and/or enhanced spring outflow. Alternative 4A and the Early Long Term also assume that there would be an increase in M&I water rights demands north of the Delta, which would increase overall system demands and reduce the amount of CVP water available for export south of the Delta.

Consequently, SWP M&I deliveries under Alternative 4A are projected to increase due to increased capacity for Delta exports, while in some cases CVP deliveries south of Delta are projected to decrease due to increased water rights demands north of Delta. Consequently, SWP M&I deliveries under Alternative 4 are projected to increase due to increased Delta exports, while in some cases CVP deliveries are projected to decrease due to increased water rights demands. See Section 4.3.1., *Water Supply*, of this RDEIR/SDEIS for more detail on changes in Delta exports and SWP and CVP deliveries under Alternative 4A.

Changes in Deliveries to the Hydrologic Regions

SWP. Compared to Existing Conditions, Alternative 4A would increase (H3) or decrease (H4) deliveries to all hydrologic regions depending on the range of spring outflow requirements. Exceptions would be the San Joaquin River region, which would experience an increase (H4) or no change in deliveries (H3). South Coast would either receive the largest net increase in deliveries (up to 87 TAF of Table A deliveries under H3) or the largest net decrease in deliveries (a decrease of up to 170 TAF of Table A deliveries under H4) among the regions.

Compared to the No Action Alternative ELT, Alternative 4A is expected to show less extreme of an effect (less increase or less decrease) than the results shown in Table 30-16 in the Public Draft EIR/EIS at the No Action Alternative (2060). Alternative 4A would be expected to increase (H3) or decrease (H4) deliveries to all hydrologic regions depending on the range of spring outflow requirements. Exceptions would be for the San Joaquin River region, which would experience no change in deliveries (H3 and H4) and the Tulare Lake region which could possibly receive an increase (H4). Compared to No Action Alternative ELT, under Scenario H3 and H4, South Coast would receive the largest net increase in deliveries (Table A deliveries) among the regions.

CVP. The operational scenarios under Alternative 4A would not change M&I deliveries for the Sacramento River, South Coast, South Lahontan and Colorado River regions because there are no affected CVP contractors located in these regions. Compared to Existing Conditions, Scenarios H3 and H4 would decrease deliveries to the other hydrologic regions; San Francisco Bay is projected to receive the largest potential decrease (5 TAF) among the affected hydrologic regions. For more information, refer to Table 30-17 in the Public Draft EIR/EIS.

Compared to the No Action Alternative ELT, Alternative 4A is expected to show less extreme of an effect (less increase or less decrease) than the results shown in Table 30-17 in the Public Draft EIR/EIS at the No Action Alternative (2060). Scenario H3 and H4 would increase deliveries to the other hydrologic regions. San Francisco Bay is projected to receive the largest potential increase among the affected hydrologic regions.

Alternative 4A Compared to Existing Conditions, Early Long Term.

SWP. Compared to the Existing Conditions ELT, Alternative 4A is expected to show less extreme of an effect (less increase or less decrease) than the results contained in the Alternative 4 discussion which looks at Alternative 4A conditions at 2060. By 2025, total deliveries to all SWP contractors are projected to decrease by 9% or increase by 5% at ELT and would remain similar or decrease by 13% at LLT relative to Existing Conditions depending upon the range of spring Delta outflow requirements. Under Alternative 4A, by 2025, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would decrease (11%) and increase (8%) at ELT and would decrease (17%) and increase (3%) at LLT depending upon range of spring outflow requirements, relative to Existing Conditions. Under Alternative 4A, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would decrease (12%) and increase (8%) at ELT and would decrease (17%) and increase (2%) at LLT depending upon range of spring outflow requirements. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

CVP. By 2025, total deliveries to all CVP contractors are projected to increase by up to 3% relative to Existing Conditions at ELT and up to 2% at LLT. Under Alternative 4A, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 4% at ELT and by up to 9% at LLT.

Alternative 4 Compared to No Action Alternative Early Long Term

SWP. Compared to the No Action Alternative ELT, Alternative 4A is expected to show less extreme of an effect (less increase or less decrease) than the results contained in the Alternative 4 discussion which looks at Alternative 4A conditions at 2060. By 2025, under average annual total SWP deliveries to all SWP contractors are projected to increase by 12% (H3) or decrease by about 3% (H4) relative to the No Action Alternative ELT depending upon the range of spring outflow requirements. Under Alternative 4A, average annual total south of Delta SWP deliveries as compared to No Action Alternative (ELT), would decrease (by about 4%) or increase (by about 16%) depending upon range of spring outflow requirements.

CVP. By 2025, deliveries under Scenarios H3 and H4 to all CVP M&I contractors are projected to increase by up to 3% relative to the No Action Alternative ELT and up to 2% at LLT. Under Alternative 4A, average annual total south of Delta CVP deliveries as compared to No Action Alternative (ELT), would increase by about 5%.

Comparison of Water Deliveries with California Water Plan Projected Demand [11]

As explained in Section 4.1.2.2, *Water Conveyance Facility Operations*, of this RDEIR/SDEIS, operational components of the water conveyance facilities under Alternative 4A would be similar, but not identical, to those described under Scenario H in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. However, Alternative 4A is analyzed at a shorter timeframe. Anticipated water deliveries would also be similar as those observed under Alternative 4. Under Alternative 4, total SWP deliveries to all regions would increase under two scenarios and would decrease under two other scenarios compared to Existing Conditions. Under Scenario H3, total SWP deliveries to all regions would increase by approximately 201 TAF, and under Scenario H4, total SWP deliveries to all regions would decrease by approximately 295 TAF. Total CVP M&I deliveries to all regions would decrease under both Alternative 4A scenarios: under Scenario H3 they would decrease by 10 TAF, and under Scenario H4 CVP M&I deliveries would decrease by 10 TAF compared to Existing Conditions. CVP agricultural deliveries would decrease by 215 TAF under Scenario H3, and would decrease by 243 TAF under Scenario H4.

Based on the information above, under Alternative 4A Scenario H3, net SWP and CVP deliveries would decrease by 2025. This decrease in supply is in contrast to projected increases in demand for the hydrologic regions assuming the Current Trends demand scenario. Under Alternative 4A Scenario H4, net SWP and CVP deliveries would decrease by 2025 compared to Existing Conditions. This decrease in supply is in contrast to projected increases in demand for the hydrologic regions assuming the Current Trends demand scenario.

4.3.26.4 Potential for Increases in Water Deliveries to Agricultural Contractors to Remove Obstacles to Growth

Alternative 4A would have a similar effect as Alternatives 1A through 9. However, since Alternative 4A includes a smaller package of habitat restoration as part of its environmental commitment, significantly more agricultural land would continue to be used for agricultural purposes. As described in Chapter 5, *Water Supply*, and shown in Table 30-14, deliveries to agricultural contractors are projected to increase under some alternatives. To the extent that the lack of sufficient, reliable water supplies currently poses a constraint to agricultural production, then increased reliable supplies have the potential to support increased agricultural production. Increased reliability of supplies (e.g., increased supplies to agricultural contractors during dry years) may support additional agricultural production. Where and how such increases would occur likely could vary from one farming interest to another. Increased agricultural production could support an increase in seasonal and permanent on-farm employment as well as increased economic activity in the larger agricultural industry (associated with agricultural inputs, processing, transport, etc.). The ability of local labor pools to support seasonal and permanent increases in employment would likely vary from region to region.

[11] As described in Section 30.1.1.3, of the Draft EIR/EIS, the California Water Plan is updated every five years. The latest California Water Plan was released in 2009 and contains projections to the year 2050. It is not expected that there will be substantial changes in demand trends between 2050 and 2060 that would impact the comparison of the year 2050 projections from the California Water Plan with modeling projections for the BDCP at the "Late Long Term" BDCP planning horizon (year 2060).

4.3.26.5 Potential for Increases in Water Deliveries to Urban Contractors to Remove Obstacles to Growth

Operations under Alternative 4A would be identical to those analyzed under Alternative 4. However, Alternative 4A is analyzed at a shorter timeframe. Anticipated water deliveries would also be similar as those observed under Alternative 4.

For Alternative 4, Scenarios H3 and H4, growth potential supported by the project in the South Coast region represents the largest percentage of projected increase in population from 2010 to 2060 among the regions: 5.3% compared to Existing Conditions and 10.1% compared to the No Action Alternative for Scenario H3; and 6.2% compared to Existing Conditions and 7.5% compared to the No Action Alternative for Scenario H4.

The South Coast, San Francisco Bay, South Lahontan, and Colorado River regions are the regions that could realize the largest increases in population due to increases in M&I deliveries (Tables 30-20 and 30-21). However, Alternative 4A (Scenarios H3 and H4) are unlikely to result in an increase of deliveries significant enough that it would foster additional growth in these areas.

It is anticipated that Alternative 4A would create a similar effect.

Comparison of Project Growth Potential with Growth Forecasts from Regional Planning Agencies

This section compares the population growth potentially supported by M&I deliveries in these regions to the growth forecasts of the respective regional planning agencies. These four regions account for 93 to 99% of the potential population supported by deliveries in 2060 compared to Existing Conditions, and 89 to 90% of the potential population supported by deliveries in 2060 compared to the No Action Alternative for five of the six alternatives[12] that provide increased deliveries. Because deliveries to the other regions that would receive increases (Sacramento River, Central Coast, and Tulare Lake) would not support substantial potential population overall or compared to the population increases projected for each region, the growth potential of the project in these regions is limited. Therefore, this discussion focuses on the four regions that would receive the largest M&I increase.

[12] Under Alternative 9 these four regions account for 59% of total deliveries compared to the No Action Alternative (2060). However, because deliveries under this alternative are relatively small its potential to support population growth in any region receiving deliveries is limited: Alternative 9 would support less than 1% of the population increase projected to occur in the eight hydrologic regions between 2010 and 2060 and no more than 3% of the projected population increase in any particular hydrologic region.

4.3.27 References

4.3.1 Water Supply

None.

4.3.2 Surface Water

None.

4.3.3 Groundwater

None.

4.3.4 Water Quality

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4.3.7 Fish and Aquatic Resources

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4.3.9 Land Use

None.

4.3.10 Agricultural Resources

None.

4.3.11 Recreation

None.

4.3.12 Socioeconomics

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4.3.13 Aesthetics and Visual Resources

None.

4.3.14 Cultural Resources

None.

4.3.15 Transportation

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4.3.16 Public Services and Utilities

None.

4.3.17 Energy

None.

4.3.18 Air Quality and Greenhouse Gases

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4.3.19 Noise

None.

4.3.20 Hazards and Hazardous Materials

None.

4.3.21 Public Health

None.

4.3.22 Minerals

None.

4.3.23 Paleontological Resources

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4.3.25 Climate Change

None.

4.3.26 Growth Inducement and Other Indirect Effects

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4.4 Impacts of Alternative 2D

4.4.1 Water Supply

Facilities construction under Alternative 2D would be identical to that described under Alternative 4, except this alternative would include two additional intakes. Alternative 2D water conveyance operations would be similar to the operations that would occur under Alternative 2A.

Model simulation results for Alternative 2A Early Long-Term (ELT) are summarized in Tables B.1-4 and B.1-5 in Appendix B of the RDEIR/SDEIS. Model simulation results for Alternative 2D at Late Long-term (LLT) which are similar to the Alternative 2A (LLT), are summarized in Tables 5-7 through 5-9 in the Draft EIR/EIS.

As indicated in Section 5.3.2, *Determination of Effects*, of Draft EIR/EIS, NEPA adverse effect and CEQA significant impact conclusions are not provided for the impacts discussed in this water supply section.

4.4.1.1 Summary of Water Supply Operations under Alternative 2D

Change in Delta Outflow

Changes in long-term average Delta outflow under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-4 and B.1-5 in Appendix B and Figures 4.4.1-1 through 4.4.1-3 in this RDEIR/SDEIS.

Changes in long-term average Delta outflow under Alternative 2D (LLT) (similar to Alternative 2A [LLT]) as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-7 through 5-9 of the Draft EIR/EIS.

Late-fall and winter outflows remain similar or show minor reductions in Alternative 2D compared to No Action Alternative. In the spring months, outflow would decrease under Alternative 2D as compared to No Action Alternative. SWP and CVP exports in summer months would increase and result in lower outflow as compared to No Action Alternative. In the fall months, outflow under Alternative 2D as compared to No Action Alternative would be similar because of the Fall X2 requirement in wet and above-normal years, and increased or similar outflow in September and October months of all year types because of OMR flow requirements and export reductions.

Long-term average and wet year peak outflows would increase in winter months with a corresponding decrease in spring months because of the shift in system inflows caused by climate change and increased Delta exports as compared to Existing Conditions. In other year types, Alternative 2D would result in higher or similar outflow because of the spring outflow requirements. In summer and fall months, Alternative 2D would result in similar or higher outflow because of changes in export patterns and OMR flow requirements and export reductions in fall months, and also because of the Fall X2 requirements in wet and above normal years. The incremental changes in Delta outflow between Alternative 2D and Existing Conditions would be a function of both the facility and operations assumptions (including north Delta intakes capacity of 15,000 cfs, less negative OMR flow requirements, enhanced spring outflow and/or Fall X2 requirements) and the reduction in water supply availability due to increased north of Delta urban demands, sea level rise and climate change.

Delta outflow under Alternative 2D would likely decrease in winter, spring and summer months, and remain similar or increase in other months, compared to the conditions without the project.

Results for the range of changes in Delta Outflow under Alternative 2D (LLT), which are similar to Alternative 2A (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Figures 4.4.1-4 through 4.4.1-10 and Tables B.1-4 and B.1-5 in Appendix B of this RDEIR/SDEIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 4.4.1-11 through 4.4.1-14 for completeness.

Changes in May and September reservoir storage under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of Draft EIR/EIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 of Draft EIR/EIS for completeness.

Results for changes in SWP and CVP reservoir storages under Alternative 2D at LLT, which are similar to Alternative 2A (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

Trinity Lake

Under Alternative 2D, average annual end of September Trinity Lake storage as compared to No Action Alternative would remain similar in most years at ELT, and decrease (3%) at LLT.

Under Alternative 2D, average annual end of September Trinity Lake storage as compared to Existing Conditions would decrease by 9% at ELT and 19% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2D and the results show that average annual end of September Trinity Lake storage could remain similar or decrease under Alternative 2D as compared to the conditions without the project.

Shasta Lake

Under Alternative 2D, average annual end of September Shasta Lake storage as compared to No Action Alternative would remain similar in most of the years at ELT, and decrease (3%) at LLT.

Under Alternative 2D, average annual end of September Shasta Lake storage as compared to Existing Conditions would decrease by 9% at ELT and 20% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2D and the results show that average annual end of September Shasta Lake storage could remain similar or decrease under Alternative 2D as compared to the conditions without the project.

Lake Oroville

Under Alternative 2D, average annual end of September Lake Oroville storage as compared to No Action Alternative would increase by up to 4% at ELT and 6% at LLT.

Under Alternative 2D, average annual end of September Lake Oroville storage as compared to Existing Conditions would decrease by 18% at ELT and 28% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2D and the results show that average annual end of September Lake Oroville storage could increase under Alternative 2D as compared to the conditions without the project.

Folsom Lake

Under Alternative 2D, average annual end of September Folsom Lake storage as compared to No Action Alternative would decrease by about 2%.

Under Alternative 2D, average annual end of September Folsom Lake storage as compared to Existing Conditions decrease by up to 17% at ELT and 29% at LLT. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2D and the results show that average annual end of September Folsom Lake storage could decrease under Alternative 2D as compared to the conditions without the project.

San Luis Reservoir

Under Alternative 2D, average annual end of September San Luis Reservoir storage as compared to the No Action Alternative would mostly decrease, due to changes in export patterns.

Under Alternative 2D, average annual end of September San Luis Reservoir storage as compared to Existing Conditions would decrease. This decrease primarily would occur due to changes in export patterns, sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 2D and the results show that average annual end of September San Luis Reservoir storage would generally decrease under Alternative 2D as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Figures 4.4.1-15 through 4.4.1-18 and Tables B.1-4 and B.1-5 in Appendix B of this RDEIR/SDEIS.

Changes in average annual Delta exports under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-7 through 5-9, of Draft EIR/EIS.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 2D change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative.

Delta exports would increase in wetter years and either remain similar or decrease in drier years under Alternative 2D as compared to exports under No Action Alternative because of the additional capability to divert water at the north Delta intakes.

Total long-term average annual Delta exports under Alternative 2D would increase at ELT and decrease by up to 1% at LLT as compared to exports under Existing Conditions reflecting changes in operations due to less negative OMR flows, implementation of Fall X2 and/or spring outflow under Alternative 2D, and sea level rise and climate change.

The incremental change in Delta exports under Alternative 2D as compared to No Action Alternative would be caused by the facility and operations assumptions of Alternative 2D. Delta exports would increase in wetter years and remain similar or decrease in the drier years under Alternative 2D as compared to the conditions without the project.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 2D, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 2D water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes under Alternative 2D provides operational flexibility compared to deliveries under Existing Conditions and the No Action Alternative.

Changes in SWP and CVP Deliveries under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-4 and B.1-5 in Appendix B and Figures 4.4.1-22 through 4.4.1-28.

Changes in SWP and CVP Deliveries under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of Draft EIR/EIS.

Results for SWP and CVP deliveries under Alternative 2D (LLT), which are similar to Alternative 2A (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS.

Total CVP Deliveries

Under Alternative 2D, average annual total CVP deliveries as compared to No Action Alternative, would increase by up to 3% at ELT and by up to 2% at LLT. Under Alternative 2D, average annual total south of Delta CVP deliveries as compared to No Action Alternative, would increase by up to 5%.

Under Alternative 2D, average annual total CVP deliveries as compared to Existing Conditions, would increase by up to 2% at ELT and decrease by up to 1% at LLT. Under Alternative 2D, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 2% at ELT and by up to 6% at LLT.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change. Therefore, average annual total CVP deliveries and average annual total CVP south of Delta deliveries would increase under Alternative 2D scenarios as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Under Alternative 2D, average annual CVP north of Delta agricultural deliveries would increase by up to 4% at ELT and by up to 2% at LLT as compared to No Action Alternative.

Under Alternative 2D, average annual CVP north of Delta agricultural deliveries as compared to Existing Conditions, would decrease by up to 17% at ELT and by up to 30% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP north of Delta agricultural deliveries would generally increase under Alternative 2D as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Under Alternative 2D, average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would increase by up to 13% at ELT and by up to 14% at LLT.

Under Alternative 2D, average annual CVP south of Delta agricultural deliveries as compared to Existing Conditions would decrease by up to 1% at ELT and 14% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP south of Delta agricultural deliveries would increase under Alternative 2D as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 2D as compared to deliveries under the No Action Alternative.

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 2D at ELT as compared to deliveries under the Existing Conditions. Under Alternative 2D at LLT, CVP Settlement Contract deliveries during dry and critical years as compared to Existing Conditions would decrease. This is due to Shasta Lake storage declining to dead pool more frequently, as described previously, under increased north-of Delta demands and climate change and sea level rise conditions. As described in the methods section of Chapter 5, *Water Supply*, in the Draft EIR/EIS, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 2D.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would remain similar. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 2D would be similar to the deliveries under the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Under Alternative 2D, average CVP north of Delta M&I deliveries as compared to No Action Alternative would remain similar of result in minor increase.

Under Alternative 2D, average annual CVP north of Delta M&I deliveries as compared to Existing Conditions would increase by up to 88% at ELT and 82% at LLT. However, this increase primarily would occur because there would be an increase in north of Delta M&I water rights demands under Alternative 2D and No Action Alternative as compared to demands under Existing Conditions.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would remain similar or show minor increase under Alternative 2D as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would remain similar or increase under Alternative 2D as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Under Alternative 2D, average CVP south of Delta M&I deliveries as compared to No Action Alternative, would increase by about 4%.

Under Alternative 2D, average annual CVP south of Delta M&I deliveries as compared to Existing Conditions would decrease by up to 1% at ELT and by up to 7% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would remain similar or increase under Alternative 2D as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase under Alternative 2D as compared to the conditions without the project.

Total SWP Deliveries

Under Alternative 2D, average annual total SWP deliveries as compared to No Action Alternative, would increase (by about 15%). Under Alternative 2D, average annual total south of Delta SWP deliveries as compared to No Action Alternative, would increase (by about 21%).

Under Alternative 2D, average annual total SWP deliveries as compared to Existing Conditions, would increase (8%) at ELT and increase (3%) at LLT. Under Alternative 2D, average annual total south of Delta SWP deliveries as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that under Alternative 2D average annual total SWP deliveries would increase. Therefore, average annual total SWP deliveries and average annual total SWP south of Delta deliveries under Alternative 2D would show an increase as compared to the conditions without the project.

SWP Table A Deliveries

Under Alternative 2D, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative (ELT), would increase (by about 16%). Under Alternative 2D, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative (ELT), would increase (by about 16%).

Under Alternative 2D, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT. Under Alternative 2D, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would increase (10%) at ELT and would increase (4%) at LLT. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries under the No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that under Alternative 2D average annual total SWP Table A deliveries with Article 56 (without Article 21) would increase.

SWP Article 21 Deliveries

Under Alternative 2D, average annual total SWP Article 21 deliveries as compared to No Action Alternative, would increase by about 231%.

Under Alternative 2D, average annual total SWP Article 21 deliveries as compared to Existing Conditions, would increase by up to 10% at ELT and by up to 1% at LLT. However, this decrease primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase under Alternative 2D as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 2D as compared to the conditions without the project.

SWP Feather River Service Area

Under Alternative 2D, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to No Action Alternative would increase or remain similar.

Under Alternative 2D, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to Existing Conditions, would decrease by up to 4% at ELT and by up to 5% at LLT. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 2D in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase or remain similar under Alternative 2D as compared to the deliveries under No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would remain similar under Alternative 2D as compared to the conditions without the project.

NEPA Effects: SWP and CVP deliveries under Alternative 2D as compared to deliveries under No Action Alternative would increase or remain similar. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries under Alternative 2D, are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects,* and other sections addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 2D would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north of Delta water demands that would occur under No Action Alternative and Alternative 2D and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would generally increase or remain similar under Alternative 2D as compared to deliveries under conditions in 2025 and 2060 without Alternative 2D if sea level rise and climate change conditions are considered the same under both scenarios (Alternative 2D and No Action Alternative). SWP and CVP deliveries under Alternative 2D would generally increase or remain similar as compared to deliveries under Existing Conditions without the effects of increased north of Delta water demands, sea level rise, and climate change. Some reductions in the SWP south of Delta deliveries could occur under Alternative 2D with higher spring outflow requirements. Indirect effects of changes in water deliveries including potential effects on urban areas caused by changes in SWP and CVP water supply deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects,* and other sections addressing specific resources.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 2D increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to the No Action Alternative. Alternative 2D would change the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to Existing Conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would change as well, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Under Alternative 2D as compared to Existing Conditions, the frequency of years in which cross-Delta transfers would increase, and the average annual volume of those transfers would increase. Under Alternative 2D as compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would occur would decrease.

Alternative 2D provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including criteria guiding the operation of water conveyance facilities under Alternative 2D.

NEPA Effects: Alternative 2D would decrease water transfer demand compared to existing conditions. Alternative 2D would decrease conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to No Action Alternative. Prior to approval, each transfer must go through NEPA review and be evaluated by the export facility agency, and may also be subject to CEQA review and/or SWRCB process. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, and other sections addressing specific resources.

CEQA Conclusion: Alternative 2D would increase water transfer demand compared to existing conditions. Alternative 2D would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, and other sections addressing specific resources.

4.4.2 Surface Water

Facilities construction under Alternative 2D would be identical to those described under Alternative 4. Except this alternative would include two additional intakes. Alternative 2D water conveyance operations would be similar to the operations that would occur under Alternative 2A.

Model simulation results for Alternative 2D Early Long-term (ELT), which are represented by Alternative 2A (ELT), are summarized in Tables B.2-7 through B.2-12 in Appendix B of the RDEIR/SDEIS. Model simulation results for Alternative 2D at Late Long-term (LLT) which are similar to Alternative 2A (LLT), are summarized in Tables 6-2 through 6-9 in the Draft EIR/EIS.

Section 6.3.2, *Determination of Effects*, of Draft EIR/EIS describes criteria used for the NEPA adverse effect and CEQA significant impact determinations.

SWP CVP Reservoir Storage and Related Changes to Flood Potential

Impact SW-1: Changes in SWP or CVP Reservoir Flood Storage Capacity

Reservoir storage in Shasta Lake, Folsom Lake, and Lake Oroville during the October through June period is compared to the flood storage capacity of each reservoir to identify the number of months where the reservoir storage is close to the flood storage capacity.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-12 in Appendix B of this RDEIR/SDEIS.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Tables 6-2 through 6-7 of Draft EIR/EIS.

NEPA Effects: Under Alternative 2D, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be similar (or show no more than 10% increase) under the No Action Alternative.

A comparison with storage conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that reservoir storages would not be consistently high during October through June under Alternative 2D as compared to the conditions under the No Action Alternative. Therefore, Alternative 2D would not result in adverse effects on reservoir flood storage capacity as compared to the conditions without the project.

CEQA Conclusion: Under Alternative 2D, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be less than under Existing Conditions. These differences represent changes under Alternative 2D, increased demands from Existing Conditions to No Action Alternative, and changes due to sea level rise and climate change. Alternative 2D would not cause consistently higher storages in the upper Sacramento River watershed during the October through June period. Accordingly, Alternative 2D would result in a less-than-significant impact on flood management. No mitigation is required.

Highest Monthly Flows in Sacramento and San Joaquin Rivers and Related Changes to Flood Potential

Impact SW-2: Changes in Sacramento and San Joaquin River Flood Flows

Changes in highest monthly flows under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-9 in Appendix B and Figures 4.4.2-1 through 4.4.2-15 of this RDEIR/SDEIS.

Changes in highest monthly flows under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 6-8 through 6-22 and Tables 6-2 through 6-4 of the Draft EIR/EIS.

Sacramento River at Bend Bridge

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would increase by about 2% of the channel capacity (100,000 cfs) as compared to the flows under Existing Conditions. The increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Sacramento River at Bend Bridge as compared to the conditions without the project.

Sacramento River at Freeport

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would decrease by about 1% of the channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Sacramento River at Freeport as compared to the conditions without the project.

San Joaquin River at Vernalis

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar to (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the San Joaquin River at Vernalis as compared to the conditions without the project.

Sacramento River at Location Upstream of Walnut Grove (downstream of north Delta intakes)

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would decrease by about 12% of channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 2D.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would decrease by about 12% of channel capacity (110,000 cfs) as compared to the flows under Existing Conditions. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 2D.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Sacramento River upstream of Walnut Grove as compared to the conditions without the project.

Trinity River Downstream of Lewiston Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would increase by about 4% of channel capacity (6,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Trinity River downstream of Lewiston Lake as compared to the conditions without the project.

American River Downstream of Nimbus Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar to (or show less than 1% change with respect to the channel capacity: 152,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would increase by no more than approximately 1% of the channel capacity (152,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the American River at Nimbus Dam as compared to the conditions without the project.

Feather River Downstream of Thermalito Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would remain similar as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would increase by about 1% of channel capacity (210,000 cfs) or remain similar as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Feather River at Thermalito Dam as compared to the conditions without the project.

Yolo Bypass at Fremont Weir

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D would increase no more than approximately 1% of the channel capacity (343,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 2D at ELT would increase no more than 1% of the channel capacity (343,000 cfs) and at LLT would increase no more than 2% of the channel capacity (343,000 cfs) as compared to the flows under the Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 2D as compared to the No Action Alternative. Therefore, Alternative 2D would not result in adverse impacts on flow conditions in the Yolo Bypass at Fremont Weir as compared to the conditions without the project.

NEPA Effects: Overall, Alternative 2D would not result in an increase in potential risk for flood management compared to the No Action Alternative. Highest monthly flows under Alternative 2D in the locations considered in this analysis either were similar to or less than the highest monthly flows that would occur under the No Action Alternative; or the increase in highest monthly flows would be less than the flood capacity for the channels at these locations.

Therefore, Alternative 2D would not result in adverse effects on flood management.

***CEQA Conclusion*:** Alternative 2D would not result in an increase in potential risk for flood management compared to Existing Conditions when the changes due to sea level rise and climate change are eliminated from the analysis. Highest monthly flows under Alternative 2D in the locations considered in this analysis either were similar to or less than those that would occur under Existing Conditions without the changes in sea level rise and climate change; or the increased highest monthly flows would not exceed the flood capacity of the channels at these locations. Accordingly, Alternative 2D would result in a less-than-significant impact on flood management. No mitigation is required.

Reverse Flows in Old and Middle River

Impact SW-3: Change in Reverse Flow Conditions in Old and Middle Rivers

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 2D (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-9 in Appendix B and Figure 4.3.2-16 in this RDEIS/SDEIS.

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 2D (LLT) [similar to Alternative 2A (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figure 6-23 and Tables 6-2 through 6-4 of Draft EIR/EIS.

Reverse flow conditions for Old and Middle River flows would be reduced in all months under Alternative 2D on a long-term average basis except in April, compared to reverse flows under both Existing Conditions and the No Action Alternative. Compared to flows under the No Action Alternative, Old and Middle River flows would be generally less positive in April.

NEPA Effects: A comparison with reverse flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 2D without the effects of sea level rise and climate change. The results show that reverse flow conditions under Alternative 2D would be reduced in all months on a long-term average basis except in April as compared to No Action Alternative. In April the reverse flow conditions would be generally greater than 1% under Alternative 2D as compared to No Action Alternative. The effects to beneficial use of the surface water for water supplies and aquatic resources, is described in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*.

***CEQA Conclusion*:** Alternative 2D would provide positive changes related to reducing reverse flows in Old and Middle Rivers in May through March and negative changes in the form of increased reverse flow conditions in April, compared to Existing Conditions. The increase (more negative) in reverse flow conditions is generally greater than 1% as compared to Existing Conditions. The significance of the impact to beneficial use of the surface water for water supplies and aquatic resources, and appropriate Mitigation Measures for those impacts to beneficial uses is described in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*.

Impact SW-4: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Conveyance Facilities

NEPA Effects: Effects associated with construction and operations of facilities under Alternative 2D would be similar to those described under Alternative 1A with the exception of elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 2D as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 2D.

Alternative 2D would involve excavation, grading, stockpiling, soil compaction, and dewatering that would result in temporary and long-term changes to drainage patterns, drainage paths, and facilities that would in turn, cause changes in drainage flow rates, directions, and velocities. Construction of cofferdams could impede river flows at the intake locations, but would not increase water surface elevations upstream by more than 0.10 feet during flood events. Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. Mitigation Measure SW-4 is available to address effects of runoff and sedimentation.

***CEQA Conclusion*:** Alternative 2D could result in alterations to drainage patterns, stream courses, and runoff; and potential for slightly increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. Although intakes have been designed and located on-bank to minimize changes to river flow characteristics, some localized water elevation changes would occur upstream and adjacent to each cofferdam at the intake sites due to facility location within the river. These localized surface elevation changes would not exceed an increase of 0.10 feet at any intake location even under flood flow conditions. Potential impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, and from changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A

Impact SW-5: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Habitat Restoration Area Facilities under Environmental Commitments 3, 4, and 6–11

NEPA Effects: Alternative 2D would include construction of the restoration area facilities under Environmental Commitments 3, 4, 6, 7, 8, 9, 10, and 11.

Riparian habitat restoration is anticipated to occur primarily in association with the restoration of tidal marsh habitat, and channel margin habitat. The restored vegetation has the potential of increasing channel roughness, which could result in increases in channel water surface elevations, including under flood flow conditions, and in decreased velocities. Modified channel geometries could increase or decrease channel velocities and/or channel water surface elevations, including under flood flow conditions. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. The specific permits/decisions/approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations.

CEQA Conclusion**:** Alternative 2D would include construction of the restoration area facilities under Environmental Commitments 3, 4, and 6–11. Alternative 2D could result in alterations to drainage patterns, stream courses, and runoff; and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. These impacts are considered significant. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. The specific permits/decisions/ approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A

Impact SW-6: Create or Contribute Runoff Water Which Would Exceed the Capacity of Existing or Planned Stormwater Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff

Effects associated with construction and operations of facilities under Alternative 2D would be similar to those described under Alternative 1A with the exception of elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 2D as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A.

NEPA Effects: Paving, soil compaction, and other activities would increase runoff during facilities construction and operations. Construction and operation of dewatering facilities and associated discharge of water would result in localized increases in flows and water surface elevations in receiving channels. These activities could result in adverse effects if the runoff volume exceeds the capacities of local drainages. As noted below in the CEQA Conclusion section, compliance with permit design requirements would avoid adverse effects on surface water quality and flows from dewatering activities. The use of dispersion facilities would reduce the potential for channel erosion. Mitigation Measure SW-4 is available to address adverse effects.

CEQA Conclusion**:** Alternative 2D actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board and CVFPB (See Section 6.2.2.4 of the Draft EIR/EIS). Alternative 2D would include provisions to design the dewatering system in accordance with these permits to avoid significant impacts on surface water quality and flows. However, increased runoff could occur from facilities sites during construction or operations and could result in significant impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A

Impact SW-7: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to the Construction of New Conveyance Facilities

NEPA Effects: Effects associated with construction of conveyance facilities under Alternative 2D would be identical to those described under Alternative 1A with the exception of elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 2D as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 2D.

Alternative 2D would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with USACE CVFPB, and DWR requirements to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 of the Draft EIR/EIS. Additionally, DWR would consult with local reclamation districts to ensure that construction activities would not conflict with reclamation district flood protection measures. Determination of design flood elevations would need to consider sea level rise to reduce impacts.

***CEQA Conclusion*:** Alternative 2D would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with the requirements of USACE, CVFPB, and DWR to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 of the Draft EIR/EIS. If the design flood elevations did not consider sea level rise to reduce impacts, these impacts are considered significant. Mitigation Measure SW-7 would reduce this impact to a less-than-significant level.

Mitigation Measure SW-7: Implement Measures to Reduce Flood Damage

Please see Mitigation Measure SW-7 under Impact SW-7 in the discussion of Alternative 1A

Impact SW-8: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to Habitat Restoration under Environmental Commitments 3, 4, and 6–11

Tidal marsh habitat, and channel margin habitat could increase flood potential due to impacts on adjacent levees. The newly flooded areas would have larger wind fetch lengths (unobstructed distance which wind can travel over water and potentially develop large waves caused by wind force not tidal force) compared to the existing fetch lengths of the adjacent leveed channels. An increase in fetch length would result in increases in wave height and velocities that reach the existing levees along adjacent islands and floodplains. These potential increases in wave action could also reach the land-side of the remaining existing levees around the restoration area. In accordance with existing requirements of the USACE, CVFPB, and DWR, Alternative 2D would be designed to avoid increased flood potential as compared to Existing Conditions or No Action Alternative.

NEPA Effects: Alternative 2D would not result in an increase to exposure of people or structures to flooding due to the operation of the Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees, which would be considered an adverse effect. This impact could become more substantial with sea level rise and climate change. Mitigation Measure SW-8 would reduce this potential adverse effect.

***CEQA Conclusion*:** Alternative 2D would not result in an increase to exposure of people or structures to flooding due to the construction or operations of Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW-8 would reduce this potential impact to a level of less than significant.

Mitigation Measure SW-8: Implement Measures to Address Potential Wind Fetch Issues

Please see Mitigation Measure SW-8 under Impact SW-8 in the discussion of Alternative 1A

Impact SW-9: Place within a 100-Year Flood Hazard Area Structures Which Would Impede or Redirect Flood Flows, or Be Subject to Inundation by Mudflow

Effects associated with construction and operations of facilities under Alternative 2D would be identical those described under Alternative 1A with the exception of elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 2D as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. The measures included in Alternative 1A to avoid adverse effects would be included in Alternative 2D. As described under Impact SW-1, Alternative 2D would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass as described under Impact SW-2. Alternative 2D would include measures, including Mitigation Measure SW-4, to address potential issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities.

NEPA Effects: Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These effects are considered adverse. Mitigation Measure SW-4 is available to address these potential effects.

***CEQA Conclusion*:** Alternative 2D would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the Environmental Commitments because the project proponents would be required to comply with the requirements of USACE CVFPB, and DWR to avoid increased flood potential as described in Section 6.2.2.4 of the Draft EIR/EIS. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, as well as changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

4.4.3 Groundwater

4.4.3.1 Delta Region

Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. Facilities construction under Alternative 2D would be similar to those described for Alternative 4, but with a larger footprint due to two additional intakes.

Impact GW-1: During Construction, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

Construction activities under Alternative 2D would be similar to those under Alternative 4. The impacts on groundwater levels resulting from dewatering activities are dependent on the local hydrogeology and the depth and duration of dewatering required. Because all of the pump stations associated with the intakes are located in areas of similar geology and hydrogeology, and the dewatering configurations are identical for each of the facilities, it would be expected that the impacts of construction activities on local groundwater levels and associated well yields would be similar. The only difference would be associated with the number of intakes used. This alternative would use five intakes instead of only three intakes used in Alternative 4. Dewatering activities would result in increased groundwater level impacts and potentially more wells being affected.

NEPA Effects: Similarly to the impacts described under Alternative 4, the sustainable yield of some wells might temporarily be affected by the lower water levels resulting from construction dewatering under Alternative 2D, such that they are not able to support existing land uses. The construction of conveyance features would result in effects on groundwater levels and associated well yields that would be temporary. These effects are considered adverse. It should be noted that these estimated impacts reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis.

CEQA Conclusion: Similarly to the impacts described under Alternative 4, wells in the vicinity of the construction dewatering areas under Alternative 2D could experience significant reductions in yield, if they are shallow wells and may not be able to support existing land uses. The temporary impact on groundwater levels and associated well yields is considered significant because construction-related dewatering might affect the amount of water supplied by shallow wells located near the construction sites. Mitigation Measure GW-1 identifies a monitoring procedure and options for maintaining an adequate water supply for land owners that experience a reduction in groundwater production from wells within the impacted areas due to construction-related dewatering activities. It should be noted that these estimated impacts reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis. Implementing Mitigation Measure GW-1 would help address these effects; however, the impact may remain significant because replacement water supplies may not meet the preexisting demands or planned land use demands of the affected party. In some cases this impact might temporarily be significant and unavoidable until groundwater elevations recover to pre-construction conditions which could require several months after dewatering operations cease.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A.

Impact GW-2: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

See Impact GW-2 under Alternative 4; operations under Alternative 2D would be similar to those under Alternative 4.

NEPA Effects: The new Intermediate Forebay and the expanded Clifton Court Forebay would be constructed to comply with the requirements of the DSD which include design features intended to minimize seepage under the embankments. In addition, the forebays will include a seepage cutoff wall installed to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 2D would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 4.

Operation of the tunnel would have no impact on existing wells or yields given the facilities would be located more than 100 feet underground and would not substantially alter groundwater levels in the vicinity.

CEQA Conclusion: The new Intermediate Forebay and the expanded Clifton Court Forebay will include design features intended to minimize seepage under the embankments and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 2D would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 4, which would not reduce the yields of nearby wells.

Operation of the tunnel would have no impact on existing wells or yields given these facilities would be located over 100 feet underground and would not substantially alter groundwater levels in the vicinity.

Therefore, this impact would be less than significant. No mitigation is required.

Impact GW-3: Degrade Groundwater Quality during Construction and Operation of Conveyance Facilities

See Impact GW-3 under Alternative 4; the construction and operations activities under Alternative 2D would be similar to those under Alternative 4, with potentially a higher magnitude, because five intakes would be constructed (instead of three).

NEPA Effects: Dewatering would temporarily lower groundwater levels and cause small changes in groundwater flow patterns near the intake pump stations along the Sacramento River, Intermediate Forebay, and Clifton Court Forebay. Since no significant regional changes in groundwater flow directions are anticipated, and the inducement of poor-quality groundwater into areas of better quality is unlikely, it is anticipated that there would be no change in groundwater quality for

Alternative 2D. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality. There would be no adverse effect.

CEQA Conclusion: No significant groundwater quality impacts are anticipated during construction activities. Because of the temporary and localized nature of construction dewatering, the potential for the inducement of the migration of poor-quality groundwater into areas of higher quality groundwater will be low. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality.

No significant groundwater quality impacts are anticipated in most areas of the Delta during the implementation of Alternative 2D, because changes to regional patterns of groundwater flow are not anticipated. However, degradation of groundwater quality near the Suisun Marsh area are likely, due to the effects of saline water intrusion caused by slightly rising sea levels. Effects due to climate change are provided for informational purposes only and do not lead to mitigation. This impact would be less than significant. No mitigation is required.

Impact GW-4: During Construction of Conveyance Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-4 under Alternative 4; construction activities under Alternative 2D would be similar to those under Alternative 4, with a higher magnitude, because five intakes would be constructed (instead of three).

NEPA Effects: In the absence of seepage cutoff walls intended to minimize local changes to groundwater flow, the lowering of groundwater levels due to construction dewatering would temporarily affect localized shallow groundwater flow patterns during and immediately after the construction dewatering period. For the Byron Tract Forebay site, only a portion of the shallow groundwater flow will be directed inward toward the dewatering operations. Forecasted temporary changes in shallow groundwater flow directions and areas of impacts are minor near the intakes. Therefore, agricultural drainage during construction of conveyance features is not forecasted to result in adverse effects under Alternative 2D. In some instances, the lowering of groundwater levels in areas that experience near-surface water level conditions (or near-saturated root zones) would be beneficial. There would be no adverse effect.

CEQA Conclusion: The forecasted changes in shallow groundwater flow patterns due to construction dewatering activities in the Delta are localized and temporary and are not anticipated to cause significant impacts on agricultural drainage. This impact would be less than significant. No mitigation is required.

Impact GW-5: During Operations of New Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-5 under Alternative 4; operations under Alternative 2D would be similar to those under Alternative 4.

NEPA Effects: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 2D would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, where groundwater recharge from surface water would result in groundwater level increases, similar to Alternative 4. If existing agricultural drainage systems adjacent to the forebay are not adequate to accommodate the additional drainage requirements, operation of the forebay could interfere with agricultural drainage in the Delta.

CEQA Conclusion: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 2D would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, caused by groundwater recharge from surface water, and could cause significant impacts to agricultural drainage where existing systems are not adequate to accommodate the additional drainage requirements, similar to Alternative 4. Implementation of Mitigation Measure GW-5 is anticipated to reduce this impact to a less-than-significant level in most instances, though in some instances mitigation may be infeasible due to factors such as costs that would be imprudent to bear in light of the fair market value of the affected land. The impact is therefore significant and unavoidable as applied to such latter properties.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-6: Deplete Groundwater Supplies or Interfere with Groundwater Recharge Alter Local Groundwater Levels Reduce the Production Capacity of Preexisting Nearby Wells, or Interfere with Agricultural Drainage as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Implementation of the environmental commitments under Alternative 2D could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*). Effects associated with the implementation of those environmental commitments be considered adverse. The implementation of Mitigation Measure GW-5 would help address these effects by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed.

CEQA Conclusion: Implementation of the environmental commitments under Alternative 2D could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*). Impacts associated with the implementation of those environmental commitments would result in significant impacts. This impact would be reduced to a less-than-significant level in most instances, with the implementation of Mitigation Measure GW-5 by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-7: Degrade Groundwater Quality as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 2D would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in an adverse effect on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 would help reduce this impact, but the impact would remain significant and unavoidable.

CEQA Conclusion: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 2D would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in significant impacts on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 is available to address this effect. Nonetheless, because it is not possible to completely avoid this impact, it is considered significant and unavoidable.

Mitigation Measure GW-7: Provide an Alternate Source of Water

Please see Mitigation Measure GW-7 under Impact GW-7 in the discussion of Alternative 1A.

4.4.3.2 SWP/CVP Export Service Areas

Impact GW-8: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

The groundwater resource impacts of Alternative 2D will be similar to those under Alternative 2A, but with the magnitude of the impacts proportional to the change in the quantity of CVP and SWP surface water supplies delivered to the SWP/CVP Export Service Areas compared to the No Action Alternative at ELT.

Table 4.3.3-1 below shows the long-term average SWP and CVP deliveries for Alternative 2D compared to existing conditions and the No Action Alternative at early long-term. See Table 7-7 in Chapter 7, *Groundwater* of the Draft EIR/EIS for long-term average SWP and CVP surface water deliveries at LLT.

Table 4.3.3-1. Long-Term State Water Project and Central Valley Project Deliveries to Hydrologic Regions Located South of the Delta at Early Long-Term

	Long-Term Average State Water Project and Central Valley Project Deliveries at Early Long Term(TAF/year)		
Alternative	San Joaquin and Tulare Hydrologic Region	Central Coast Hydrologic Region	Southern California Hydrologic Region
Existing Conditions	2,964	47	1,647
No Action Alternative (ELT)	2,682	43	1,580
Alternative 2D ELT	3,025	51	1,813

NEPA Effects: In the San Joaquin and Tulare Hydrologic Region, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 2D at ELT are expected to be higher than the exports under the No Action Alternative at early long-term. Increases in surface water deliveries attributable to project operations from the implementation of Alternative 2D are anticipated to result in a corresponding decrease in groundwater use in the San Joaquin and Tulare Export Service Areas as compared to the No Action Alternative (ELT), as discussed in Section 4.2.4 of this RDEIR/SDEIS. Higher groundwater levels associated with reduced overall groundwater use would result in a beneficial effect on groundwater levels. Similarly, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 2D at LLT are expected to be higher than the exports under the No Action Alternative at late long-term.

The total long-term average annual SWP deliveries to Southern California areas under Alternative 2D would be greater than those under the No Action Alternative (ELT) as well as at LLT. Therefore, implementation of Alternative 2D would result in a corresponding decrease in groundwater use. There would be no adverse effects on groundwater levels because of the anticipated decreases in groundwater pumping due to an increase in surface water deliveries.

***CEQA Conclusion**:* For the San Joaquin and Tulare Service Areas, total long-term average surface water deliveries under Alternative 2D at ELT would be higher compared to Existing Conditions. Increases in surface water deliveries attributable to project operations from the implementation of Alternative 2D are anticipated to result in a corresponding decrease in groundwater use in the San Joaquin and Tulare Export Service Areas as compared to the Existing Conditions. Higher groundwater levels associated with reduced overall groundwater use would result in less-than-significant impacts on groundwater levels. Total long-term average surface water deliveries under Alternative 2D at LLT in the San Joaquin Valley and Tulare Basin would be lower compared to Existing Conditions, largely because of effects due to climate change, sea level rise, and increased water demand north of the Delta.

The total long-term average annual SWP deliveries to Southern California areas under Alternative 2D at ELT and at LLT would be greater than those under Existing Conditions. Therefore, implementation of Alternative 2D would result in a corresponding decrease in groundwater use.

Impacts on groundwater levels would be less than significant because of the anticipated decreases in groundwater pumping due to an increase in surface water deliveries.

Impact GW-9: Degrade Groundwater Quality

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 2D are expected to increase as compared to the No Action Alternative (ELT) and at LLT. Increased surface water deliveries could result in a decrease in groundwater use. The decreased groundwater use is not anticipated to alter regional patterns of groundwater flow in these service areas. Therefore, it is not anticipated this would result in an adverse effect on groundwater quality in these areas because similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater as might occur with increased pumping. Similarly, long-term average annual SWP supplies to Southern California are anticipated to increase under Alternative 2D compared to the No Action Alternative at ELT and at LLT, and therefore, groundwater pumping is anticipated to decrease, which would not alter regional groundwater flow patterns. As a result, adverse effects on groundwater quality are not anticipated in this region because similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 2D with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin and in Southern California. Therefore, no significant groundwater quality impacts are anticipated in these areas during the implementation of Alternative 2D because it is not anticipated to alter regional groundwater flow patterns. Therefore, this impact is considered less than significant because groundwater levels and flow patterns would not change compared to Existing Conditions, and similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater.

Impact GW-10: Result in Groundwater Level–Induced Land Subsidence

Groundwater level-induced land subsidence has the highest potential to occur in the San Joaquin and Tulare Export Service Areas, based on historical data, if groundwater pumping substantially increases due to the Alternatives.

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 2D are expected to increase as compared to the No Action Alternative (ELT) as well as at LLT. Increased surface water deliveries could result in a decrease in groundwater pumping. The decreased groundwater pumping would result in higher groundwater levels, and therefore, the potential for groundwater level-induced land subsidence is reduced under Alternative 2D. Operations under Alternative 2D would not result in an adverse effect on the potential for groundwater level-induced land subsidence in these areas because groundwater levels would not decline such that compaction of unconsolidated materials in the unconfined aquifer would occur.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 2D with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin. Therefore, the potential for groundwater level-induced land subsidence is anticipated to be less than significant in these areas during the implementation of Alternative 2D because it is not anticipated to result in a decline in groundwater levels such that compaction of unconsolidated materials in the unconfined aquifer would occur.

4.4.4 Water Quality

The water quality changes described for Alternative 2D reflect assumed water conveyance facilities operations. The water quality changes described for Alternative 2D are also affected by assumptions regarding the extent of habitat restoration to be implemented. As described in Section 4.1.3 of this RDEIR/SDEIS, Alternative 2D does not include the full suite of conservation actions included in Alternative 4. Aside from the water conveyance facilities, the most important differences from a water quality perspective are:

- CM2 – Yolo Bypass Improvements: this is included in Alternative 4, but not included in Alternative 2D; and
- CM4 – Tidal Natural Communities Restoration: includes 65,000 acres in Alternative 4, but would be significantly less under Alternative 2D.

This results in somewhat different patterns of water withdrawals from the Delta, and potentially somewhat different effects on water quality and aquatic habitat conditions in the Plan Area than analyzed for Alternative 4. As described in Section 4.1.3, *Description of Alternative 2D*, of this RDEIR/SDEIS, actions associated with Alternative 4 that are not proposed to be implemented under Alternative 2D would continue to be pursued as part of existing, but separate, projects and programs associated with the 2008 USFWS and 2009 NMFS BiOps (e.g., 8,000 acres of tidal habitat restoration and Yolo Bypass improvements), California EcoRestore and the 2014 California Water Action Plan.

The analysis of boron, bromide, chloride, DOC, EC, and nitrate under Alternative 2D in the ELT is based on modeling conducted for Alternative 2 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described above, Yolo Bypass Improvements are not a component of Alternative 2D and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the modeling. In general, the significance of this difference is that the assessment of bromide, chloride, and EC for Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT), likely overestimates increases in bromide, EC, and chloride that could occur, particularly in the west Delta. Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 2D and the No Action Alternative (ELT).

Due to the reduced suite of environmental commitments in Alternative 2D compared to Alternative 4 (in particular, significantly less tidal restoration), there generally are fewer significant impacts identified for Alternative 2D than for Alternative 4.

Impact WQ-1: Effects on Ammonia Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), substantial point and non-point sources of ammonia-N do not exist upstream of the SRWTP at Freeport in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Thus, like Alternative 4, operation of the water conveyance facilities under Alternative 2D would have negligible, if any, effect on ammonia concentrations in the rivers and reservoirs upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT). Any negligible increases in ammonia-N concentrations that could occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to ammonia.

Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), a substantial decrease in Sacramento River ammonia concentrations is expected under Alternative 2D relative to Existing Conditions, due to planned lowering of ammonia in the SRWTP effluent discharge, and this is expected to decrease ammonia concentrations for all areas of the Delta that are influenced by Sacramento River water. Concentrations of ammonia at locations not influenced notably by Sacramento River water would change little relative to Existing Conditions, due to the similarity in San Joaquin River and San Francisco Bay concentrations and the lack of expected changes in either of these concentrations. Thus, Alternative 2D would not result in substantial increases in ammonia concentrations in the Plan Area, relative to Existing Conditions.

Relative to the No Action Alternative (ELT and LLT), the primary mechanism that could potentially alter ammonia concentrations under Alternative 2D is decreased flows in the Sacramento River, which would lower dilution available to the SRWTP discharge. This flow change would be attributable only to operations of the water conveyance facilities, since the same assumptions regarding SRWTP discharge ammonia concentrations, water demands, climate change, and sea level rise apply to both Alternative 2D and the No Action Alternative (ELT and LLT). A simple mass balance calculation was performed to calculate ammonia concentrations downstream of the SRWTP discharge (i.e., downstream of Freeport) under Alternative 2D and the No Action Alternative (ELT) to assess the effects of the flow changes. Monthly average CALSIM II flows at Freeport and the upstream ammonia concentration (0.04 mg/L-N; Central Valley Water Board 2010a:5) were used, together with the SRWTP permitted average dry weather flow (181 mgd) and seasonal ammonia limitations (1.5 mg/L-N in Apr–Oct, 2.4 mg/L-N in Nov–Mar), to estimate the average change in ammonia concentrations downstream of the SRWTP. Table 4.4.4-1 in this RDEIR/SDEIS shows monthly average and long-term annual average predicted concentrations under Alternative 2D. As Table 4.4.4-1 shows, average monthly ammonia concentrations in the Sacramento River downstream of Freeport (upon full mixing of the SRWTP discharge with river water) under Alternative 2D and the No Action Alternative (ELT) are expected to be similar. In comparison to the No Action Alternative (ELT), minor increases in monthly average ammonia concentrations would occur during January through March, July through September, and November under Alternative 2D. Minor decreases in ammonia concentrations are expected for Alternative 2D in June and October. A minor increase in the annual average concentration would occur under Alternative 2D, compared to the No Action Alternative (ELT). Relative to the No Action Alternative (LLT), Alternative 2D is expected to result in similar minor increases in Sacramento River ammonia concentration, because the increased water demands, climate change, and sea level rise in the LLT would occur under both alternatives, and neither would affect ammonia sources or loading. The estimated concentrations in the Sacramento River downstream of Freeport under Alternative 2D would be similar to existing source water concentrations for the San Francisco Bay and San Joaquin River. Consequently, changes in source water fraction anticipated under Alternative 2D, relative to the No Action Alternative (ELT and LLT), are not expected to substantially increase ammonia concentrations at any Delta locations.

Ammonia concentrations downstream of Freeport in the Sacramento River under Alternative 2D would be similar to those under Alternative 4 (see Table 8-67 in Appendix A of the RDEIR/SDEIS). As stated for Alternative 4, any negligible increases in ammonia concentrations that could occur at certain locations in the Delta under Alternative 2D would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to ammonia.

Table 4.4.4-1. Estimated Ammonia (mg/L as N) Concentrations in the Sacramento River Downstream of the Sacramento Regional Wastewater Treatment Plant for the No Action Alternative Early Long-term (ELT) and Alternative 2D

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Average
No Action Alternative (ELT)	0.076	0.082	0.068	0.060	0.057	0.060	0.058	0.062	0.067	0.060	0.067	0.063	0.065
Alternative 2D	0.075	0.086	0.068	0.061	0.058	0.061	0.058	0.062	0.062	0.062	0.070	0.067	0.066

SWP CVP Export Service Areas

As discussed above, for areas of the Delta that are influenced by Sacramento River water, including Banks and Jones pumping plants, ammonia-N concentrations are expected to decrease under Alternative 2D, relative to Existing Conditions (in association with less diversion of water influenced by the SRWTP). Like Alternative 4, this decrease in ammonia-N concentrations for water exported via the south Delta pumps is not expected to result in an adverse effect on beneficial uses or substantially degrade water quality of exported water, with regard to ammonia. Furthermore, as discussed above, for all areas of the Delta, including Banks and Jones pumping plants, ammonia concentrations are not expected to be substantially different under Alternative 2D relative to the No Action Alternative (ELT and LLT). Thus, any negligible increases in ammonia concentrations that could occur at Banks and Jones pumping plants would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade water quality at these locations, with regard to ammonia.

NEPA Effects: In summary, ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas are not expected to be substantially different under Alternative 2D relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on ammonia are considered to be not adverse.

CEQA Conclusion: The magnitude and direction of changes in ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas would be approximately the same as expected under Alternative 4, relative to Existing Conditions. There would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 2D relative to Existing Conditions. As such, Alternative 2D is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because ammonia concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-2: Effects on Ammonia Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Although this may decrease ammonia loading to the Delta from agriculture, increased biota in those areas as a result of restored habitat may increase ammonia loading originating from flora and fauna. Ammonia loaded from organisms is expected to be converted rapidly to nitrate by established microbial communities. Thus, these land use changes would not be expected to substantially increase ammonia concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect ammonia sources or loading. Based on these findings, the effects on ammonia from the implementation Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D are determined to not be adverse.

CEQA Conclusion**:** Land use changes that would occur from the environmental commitments are not expected to contribute substantially increase ammonia concentrations, because the amount of area to be converted would be small relative to existing habitat, and any resulting ammonia would likely be rapidly converted to nitrate. Thus, there would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. As such, implementation of these environmental commitments would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Because ammonia concentrations would not be expected to increase substantially from implementation of these environmental commitments, no long-term water quality degradation would be expected to occur and, thus, no significant impact on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-3: Effects on Boron Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 2D there would be no expected change to the sources of boron in the Sacramento River and east-side tributary watersheds and, thus, resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of boron in the rivers and reservoirs of these watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease by 1%, relative to Existing Conditions (in association with the different operational components of Alternative 2D in the ELT, climate change, and increased water demands) (Table Bo-1 in Appendix B of this RDEIR/SDEIS). The reduced flow relative to Existing Conditions would result in possible increases in long-term average boron concentrations of up to about 0.5% relative to the Existing Conditions. Flows would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial boron increases relative to the No Action Alternative (ELT). The increased boron concentrations, relative to Existing Conditions, under Alternative 2D in the ELT would not increase the frequency of exceedances of any applicable objectives or criteria and would not be expected to cause further degradation at measurable levels in the lower San Joaquin River, and thus would not cause the existing impairment there to be discernibly worse. Consequently, Alternative 2D in the ELT would not be expected to cause exceedance of boron objectives/criteria or substantially degrade water quality with respect to boron, and thus would not adversely affect any beneficial uses of the Sacramento River, the east-side tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 2D in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect boron sources in these areas.

Delta

Effects of water conveyance facilities on boron under Alternative 2D in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased boron concentrations at western Delta locations associated with restoration Environmental Commitments under Alternative 2D because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-4. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 2D would result in increased long-term average boron concentrations for the 16-year period modeled at most of the interior Delta locations (increases up to 9% at the S. Fork Mokelumne River at Staten Island, 12% at Franks Tract, and 14% at Old River at Rock Slough) (Table Bo-9 in Appendix B of this RDEIR/SDEIS). The long-term average boron concentrations at most of the western Delta assessment locations would not change measurably. The long-term annual average and monthly average boron concentrations, for either the 16-year period or drought period modeled, would never exceed the 2,000 μg/L human health advisory objective (i.e., for children) or the 500 μg/L agricultural objective at the majority of assessment locations, which represents no change from the Existing Conditions and No Action Alternative (ELT) (Table Bo-8 in Appendix B of this RDEIR/SDEIS). A small increase in the frequency of exceedances 500 μg/L agricultural objective at the Sacramento River at Mallard Island (i.e., as much as 4% in the drought period relative to the No Action Alternative [ELT]) would not be anticipated to substantially affect agricultural diversions which occur primarily at interior Delta locations. Minor reductions in long-term average assimilative capacity of up to 1% at interior Delta locations (i.e., Old River at Rock Slough) would occur with respect to the 500 μg/L agricultural objective (Table Bo-11 in Appendix B of this RDEIR/SDEIS). However, because the absolute boron concentrations would still be well below the lowest 500 μg/L objective for the protection of the agricultural beneficial use under Alternative 2D, the levels of boron degradation would not be of sufficient magnitude to substantially increase the risk of exceeding objectives or cause adverse effects to municipal and agricultural water supply beneficial uses, or any other beneficial uses, in the Delta (Figure Bo-2 in Appendix B of this RDEIR/SDEIS).

Effects of Alternative 2D in the Delta in the LLT, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to those described above for the ELT. Boron concentrations may be higher at western Delta locations due to greater effects of climate change on sea level rise that would occur in the LLT; however, these effects are independent of the alternative. Further, boron is of concern in waters diverted for agricultural use, which primarily occurs in the interior Delta, and based on Delta source water characteristics (see Table 8-42 in Appendix A of the RDEIR/SDEIS), boron concentrations in the interior Delta would be expected to remain suitable for agricultural use.

SWP/CVP Export Service Areas

Under the Alternative 2D, long-term average boron concentrations would decrease at the Banks pumping plant (as much as 24%) and at Jones pumping plant (as much as 27%) relative to Existing Conditions, and the reductions would be similar compared to No Action Alternative (ELT) (Table Bo-9 in Appendix B of this RDEIR/SDEIS) as a result of export of a greater proportion of low-boron Sacramento River water. Commensurate with the decrease in exported boron concentrations, boron concentrations in the lower San Joaquin River may be reduced and would likely alleviate or lessen any expected increase in boron concentrations at Vernalis associated with flow reductions (see discussion of Upstream of the Delta), as well as locations in the Delta receiving a large fraction of San Joaquin River water. Reduced export boron concentrations also may contribute to reducing the existing CWA Section 303(d) impairment in the lower San Joaquin River and associated TMDL actions for reducing boron loading. These same effects on boron at the Banks and Jones pumping plants would be expected in the LLT, because the primary effect of climate change on sea level rise and boron concentrations is expected in the western Delta.

Maintenance of SWP and CVP facilities under Alternative 2D would not be expected to create new sources of boron or contribute towards a substantial change in existing sources of boron in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 2D would result in relatively small increases in long-term average boron concentrations in the Delta, not measurably increase boron levels in the lower San Joaquin River, and reduce boron levels in water exported to the SWP/CVP export service areas. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality.

CEQA Conclusion: Based on the above assessment, any modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to Existing Conditions, would not be expected to result in a substantial adverse change in boron levels upstream of the Delta. Small increases in boron levels predicted for interior Delta locations in response to a shift in the Delta source water percentages would not be expected to cause exceedances of objectives, or substantial degradation of these water bodies. Alternative 2D maintenance also would not result in any substantial increases in boron concentrations in the affected environment. Boron concentrations would be reduced in water exported from the Delta to the CVP/SWP Export Service Areas, thus reflecting a potential improvement to boron loading in the lower San Joaquin River.

Boron is not a bioaccumulative constituent, thus any increased concentrations under Alternative 2D would not result in adverse boron bioaccumulation effects to aquatic life or humans. Relative to Existing Conditions, Alternative 2D would not result in substantially increased boron concentrations such that frequency of exceedances of municipal and agricultural water supply objectives would increase. The levels of boron degradation that may occur under Alternative 2D would not be of sufficient magnitude to cause substantially increased risk for adverse effects to municipal or agricultural beneficial uses within the affected environment. Long-term average boron concentrations would decrease in Delta water exports to the SWP and CVP service area, which may contribute to reducing the existing CWA Section 303(d) impairment of agricultural beneficial uses in the lower San Joaquin River. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-4: Effects on Boron Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Effects on boron from implementation of environmental commitments under Alternative 2D would be the same as those described for Alternative 4A.

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 2D present no new direct sources of boron to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. Habitat restoration activities in the Delta, while involving increased land and water interaction within these habitats, would not be anticipated to contribute boron which is primarily associated with source water inflows to the Delta (i.e., San Joaquin River, agricultural drainage, and Bay source water). Moreover, some habitat restoration would occur on lands within the Delta currently used for irrigated agriculture, thus replacing agricultural land uses with restored habitats. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated boron concentrations, which would be considered an improvement compared to the No Action Alternative (ELT and LLT). Consequently, as they pertain to boron, implementation of the environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 2D would not present new or substantially changed sources of boron to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. As such, their implementation would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or other criteria would be exceeded in water bodies of the affected environment located upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas or substantially degrade the quality of these water bodies, with regard to boron. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-5: Effects on Bromide Concentrations Resulting from Facilities Operations and Maintenance Upstream of the Delta

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 2D in the ELT there would be no expected change to the sources of bromide in the Sacramento River and east-side tributary watersheds. Thus, changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of bromide in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial bromide increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River, which is the beneficial use most sensitive to elevated bromide concentrations. Consequently, Alternative 2D in the ELT would not be expected to adversely affect the MUN beneficial use, or any other beneficial uses, of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta due to changes in bromide concentrations.

Effects of Alternative 2D in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect bromide sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-6. See Chapter 8, Section 8.3.1.3, *Plan Area* in Appendix A of the RDEIR/SDEIS for more information regarding the modeling methodology.

Estimates of bromide concentrations at Delta assessment locations were generated using a mass balance approach, and using relationships between EC and chloride and between chloride and bromide and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area* in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in bromide at Delta assessment locations based on both approaches.

Based on the mass balance modeling approach for bromide, relative to Existing Conditions, Alternative 2D long-term average bromide concentrations would increase in the S. Fork Mokelumne River at Staten Island, and decrease at all other assessment locations (Table Br-3 in Appendix B of this RDEIR/SDEIS). Average bromide concentrations at Staten Island would increase from 50 µg/L under Existing Conditions to 64 µg/L (28% increase) for the modeled 16-year hydrologic period (1976–1991). However, multiple interior and western Delta assessment locations would have an increased frequency of exceedance of 50 µg/L, which is the CALFED Drinking Water Program goal for bromide as a long-term average applied to drinking water intakes (Table Br-3 in Appendix B of this RDEIR/SDEIS). These locations are the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The greatest increase in frequency of exceedance of the CALFED Drinking Water Program long-term goal of 50 μg/L would occur in the S. Fork Mokelumne River (26% increase) and Sacramento River at Emmaton (6% increase). The increase in frequency of exceedance of the 50 μg/L threshold at the other locations would be 2% or less. Similarly, these locations would have an increased frequency of exceedance of 100 μg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts (Table Br-3 in Appendix B of this RDEIR/SDEIS). The greatest increase in frequency of exceedance of 100 μg/L would occur at Franks Tract (7% increase). The increase in frequency of exceedance of the 100 μg/L threshold at the other locations would be 4% or less.

Changes in long-term average bromide concentrations and changes in threshold exceedance frequencies relative to the No Action Alternative (ELT) are generally of similar magnitude to those previously described relative to Existing Conditions (Table Br-3 in Appendix B of this RDEIR/SDEIS). However, unlike the Existing Conditions comparison, relative to the No Action Alternative (ELT), long-term average bromide concentrations at Buckley Cove would increase under Alternative 2D, although the increases would be relatively small (<1%).

Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent with the discussion above, and assessment of bromide using these modeling results lead to the same conclusions as are presented above for the mass balance approach (Tables Br-4 in Appendix B of this RDEIR/SDEIS).

Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT). Also, the magnitude of bromide concentration increases at Mallard Slough and in the San Joaquin River at Antioch during their historical months of use, relative to Existing Conditions and the No Action Alternative (ELT), would be generally similar to those described for Alternative 4 (Tables Br-5 and Br-6 in Appendix B of this RDEIR/SDEIS), and the frequency of exceedance of bromide thresholds would be similar (Tables Br-3 and Br-4 in Appendix B of this RDEIR/SDEIS). As described for Alternative 4, the use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The effects of Alternative 2D in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion.

SWP/CVP Export Service Areas

Under Alternative 2D, long-term average bromide concentrations at the Banks and Jones pumping plants, based on the mass balance modeling approach, would decrease. Long-term average bromide concentrations for the modeled 16-year hydrologic period at the pumping plants would decrease by as much as 46% relative to Existing Conditions and 42% relative to the No Action Alternative (ELT) (Table Br-3 in Appendix B of this RDEIR/SDEIS). As a result, less frequent exceedances of the 50 μg/L and 100 μg/L assessment thresholds would occur and an overall improvement in SWP/CVP

Export Service Areas water quality would occur respective to bromide. Commensurate with the decrease in exported bromide, an improvement in lower San Joaquin River bromide would also occur since bromide in the lower San Joaquin River is principally related to irrigation water deliveries from the Delta. Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide are consistent with the mass balance results, and assessment of bromide using these modeling results leads to the same conclusions (Table Br-4 in Appendix B of this RDEIR/SDEIS).

The effects of Alternative 2D in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above, because the sea level rise that could occur in the LLT would not be expected to result in substantial bromide contributions to the water exported at Banks and Jones pumping plants.

Maintenance of SWP and CVP facilities under Alternative 2D would not be expected to create new sources of bromide or contribute towards a substantial change in existing sources of bromide in the affected environment. Maintenance activities would not be expected to cause any substantial change in bromide such that MUN beneficial uses, or any other beneficial use, would be adversely affected anywhere in the affected environment.

NEPA Effects**:** In summary, the operations and maintenance activities under Alternative 2D, relative to the No Action Alternative (ELT and LLT) would result in an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and San Joaquin River at Buckley Cove; there would be decreases in long-term average bromide concentrations at the other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island would be less than the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts, and the increase in the San Joaquin River at Buckley Cove would be minimal (<1%). Thus, these increased bromide concentrations are not expected to result in adverse affects to MUN beneficial uses, or any other beneficial use, at these locations. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion**:** While greater water demands under Alternative 2D would alter the magnitude and timing of reservoir releases north and east of the Delta, these activities would have negligible, if any, effect on the sources of bromide, and ultimately the concentration of bromide in the Sacramento River, the San Joaquin River, the eastside tributaries, and the various reservoirs of the related watersheds, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS).

Under Alternative 2D there would be an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and decrease at all other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island (64 μg/L) would be less than the 100 μg/L believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts. Further, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), the use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and thus has historically been opportunistic and opportunity to use these intakes would remain. Thus, these increased bromide concentrations would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The assessment of effects on bromide in the SWP/CVP Export Service Areas is based on assessment of changes in bromide concentrations at Banks and Jones pumping plants. Long-term average bromide concentrations at the Banks and Jones pumping plants are predicted to decrease by as much as 46% relative to Existing Conditions and there would be less frequent exceedance of bromide concentration thresholds.

Based on the above, Alternative 2D would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide. Alternative 2D would not result in any substantial change in long-term average bromide concentration or exceed 50 and 100 µg/L assessment threshold concentrations by frequency, magnitude, and geographic extent that would result in adverse effects on any beneficial uses within affected water bodies. Bromide is not a bioaccumulative constituent and thus concentrations under this alternative would not result in bromide bioaccumulating in aquatic organisms. Increases in exceedances of the 100 µg/L assessment threshold concentration would be 7% or less at all locations assessed, which is considered to be less than substantial long-term degradation of water quality. The levels of bromide degradation that may occur under the Alternative 2D would not be of sufficient magnitude to cause substantially increased risk for adverse effects on any beneficial uses of water bodies within the affected environment. Bromide is not CWA Section 303(d) listed and thus the minor increases in long-term average bromide concentrations would not affect existing beneficial use impairment because no such use impairment currently exists for bromide. Based on these findings, this impact is less than significant. No mitigation is required.

Impact WQ-6: Effects on Bromide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new sources of bromide to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Such replacement or substitution of land use activity would not be expected to result in new or increased sources of bromide to the Delta. Therefore, as they pertain to bromide, implementation of these environmental commitments would not be expected to adversely affect MUN beneficial use, or any other beneficial uses, of the affected environment.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable bromide concentration changes.

In summary, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D relative to the No Action Alternative (ELT and LLT), would have negligible, if any, effects on bromide concentrations. Therefore, the effects on bromide from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D would not present new or substantially changed sources of bromide to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution would not be expected to substantially increase or present new sources of bromide. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, effects on bromide concentrations throughout the affected environment, would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide, and would not cause changes in bromide concentrations that would result in significant impacts on any beneficial uses within affected water bodies. Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of significant impacts on beneficial uses, would not cause greater bioaccumulation of bromide, and would not further impair any beneficial uses due to bromide concentrations because no uses are currently impaired due to bromide levels. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-7: Effects on Chloride Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 2D on chloride concentrations in reservoirs and rivers upstream of the Delta would be the similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Chloride loading in these watersheds would remain unchanged and resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of chloride in the rivers and reservoirs of these watersheds. There would be no expected change to the sources of chloride in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of chloride in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial chloride increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, Alternative 2D in the ELT would not be expected to cause exceedances of chloride objectives/criteria or substantially degrade water quality with respect to chloride, and thus would not adversely affect any beneficial uses of the Sacramento River, the eastside tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 2D in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect chloride sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-8. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Estimates of chloride concentrations at Delta assessment locations were generated using a mass balance approach and EC-chloride relationships and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in chloride at Delta assessment locations based on both approaches.

Modeling of chloride using both the mass balance approach and EC-chloride relationship predicts that Alternative 2D in the ELT would result in similar or reduced long-term average chloride concentrations, relative to Existing Conditions, for the 16-year period modeled at all assessment locations except for the S. Fork Mokelumne River at Staten Island. The increase in long-term average chloride concentration at Staten Island would be 4 mg/L (25%) based on the mass balance modeling and 2 mg/L (10%) based on the EC-chloride relationship (Tables Cl-16 and Cl-17 in Appendix B of this RDEIR/SDEIS). These increases are extremely small in absolute terms and relative to applicable water quality objectives, and are within the estimated modeling uncertainty. The results differ from Alternative 4, under which there would be increased long-term average chloride concentrations also at the North Bay Aqueduct at Barker Slough. The change in long-term average chloride concentrations relative to the No Action Alternative (ELT) would be similar to those relative to Existing Conditions.

The following outlines the modeled chloride changes relative to the applicable objectives and beneficial uses of Delta waters.

Municipal Beneficial Uses Relative to Existing Conditions

Estimates of chloride concentrations generated using EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses on a basis of the percent of years the chloride objective is exceeded for the modeled 16-year period. The objective is exceeded if chloride concentrations exceed 150 mg/L for a specified number of days in a given water year at Antioch and Contra Costa Pumping Plant #1. The modeled frequency of objective exceedance would decrease at the Contra Costa Pumping Plant #1 from 6.7% of years under Existing Conditions to 0% of years under Alternative 2D in the ELT (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Evaluation of the 250 mg/L Bay-Delta WQCP objective for chloride utilized results from both the mass balance approach and EC-chloride relationship. The basis for the evaluation was the predicted number of days the objective would be exceeded for the modeled 16-year period.

Based on the mass balance approach, there would be a decreased frequency of exceedance of the 250 mg/L objective under Alternative 2D, relative to Existing Conditions, at all locations except in the Sacramento River at Mallard Island and the Sacramento River at Emmaton. In the Sacramento River at Mallard Island, the frequency of objective exceedance would increase from 85% under Existing Conditions to 86% under Alternative 2D for the entire period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). In the Sacramento River at Emmaton, there would be an increase in chloride objective exceedance during the drought period modeled, from 55% to 57%.

The mass balance results also indicate reduced assimilative capacity with respect to the 250 mg/L objective during certain months and at certain locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in March and April of up to 17% for the 16-year period modeled, and 55% for the drought period modeled (Table Cl-18 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced, in February through June, by up to 4% for the entire period modeled and 6% for the drought period modeled. These estimates include the effect of climate change and sea level rise, as well as the alternative. Comparisons to the No Action Alternative (ELT) below provide an assessment of the effect of the alternative alone.

When utilizing the EC-chloride relationship to model chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity would be similar to that discussed when utilizing the mass balance modeling approach (Tables Cl-3 and Cl-19 in Appendix B of this RDEIR/SDEIS). However, the EC-chloride relationships generally predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

CWA Section 303(d) Listed Water Bodies–Relative to Existing Conditions

Tom Paine Slough in the southern Delta is on the state's CWA Section 303(d) list for chloride with respect to the secondary MCL of 250 mg/L. Monthly average chloride concentrations at the Old River at Tracy Road for the 16-year period modeled, which represents the nearest DSM2-modeled location to Tom Paine Slough, would be generally similar under Alternative 2D in the ELT relative to Existing Conditions, and thus, would not be further degraded on a long-term basis (Figure Cl-5 in Appendix B of this RDEIR/SDEIS).

Suisun Marsh also is on the state's CWA Section 303(d) list for chloride in association with the Bay-Delta WQCP objectives for maximum allowable salinity during the months of October through May, which establish appropriate seasonal salinity conditions for fish and wildlife beneficial uses. With respect to Suisun Marsh, the monthly average chloride concentrations for the 16-year period modeled would generally increase under Alternative 2D in the ELT relative to Existing Conditions in March through May at the Sacramento River at Mallard Island (Figure Cl-6 in Appendix B of this RDEIR/SDEIS) and at Collinsville (Figure Cl-7 in Appendix B of this RDEIR/SDEIS), and increase substantially in October through May at Montezuma Slough at Beldon's Landing (i.e., over a doubling of concentration in December through February) (Figure Cl-8 in Appendix B of this RDEIR/SDEIS). However, modeling of Alternative 2D assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results for Suisun Marsh, but EC levels were still somewhat higher than EC levels under Existing Conditions for several locations and months. Although chloride was not specifically modeled in these sensitivity analyses, it is expected that chloride concentrations would be nearly proportional to EC levels in Suisun Marsh. Additionally, although these analyses were only conducted at the LLT, they are expected to generally also apply to the ELT. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions (see Appendix 8H, Attachment 1 in Appendix A of the RDEIR/SDEIS for more information on these sensitivity analyses). Since Alternative 2D in the ELT includes operation of the gates, and includes very little tidal restoration area, it is anticipated that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 2D in the ELT would be very similar to Existing Conditions. For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

Municipal Beneficial Uses Relative to No Action Alternative (ELT)

Similar to the assessment conducted for Existing Conditions, estimates of chloride concentrations generated from EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses. For Alternative 2D in the ELT, the modeled frequency of objective exceedance would not change at the Contra Costa Pumping Plant #1--the No Action Alternative (ELT) and Alternative 2D in the ELT all would have 0% exceedance (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Based on the mass balance approach, the frequency of exceedance of the 250 mg/L objective under Alternative 2D in the ELT would be the same, or would decrease, at all locations relative to the No Action Alternative (ELT) (Table Cl-2 in Appendix B of this RDEIR/SDEIS). Estimates of long-term use of assimilative capacity using the mass balance results indicated the potential for reduced assimilative capacity with respect to the 250 mg/L objective for certain months and locations. Calculations using the long-term monthly and annual average concentrations showed that in the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in April of 20% for the drought period modeled (Table Cl-18 in Appendix B of this RDEIR/SDEIS). The same approach showed that assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced in March through June, by up to 4%, and in October by 13%, for the entire period modeled. During the drought period modeled, there would be reductions of assimilative capacity of 2% in June and 61% in September (Table Cl-18 in Appendix B of this RDEIR/SDEIS). However, this approach used long-term average chloride concentrations, which can be heavily influenced by changes in a small number of years when chloride concentrations would already be very high. Additionally, when long term averages are just below the objective, very small changes in chloride that are within the modeling uncertainty can result in very high estimates of use of assimilative capacity. To further investigate the potential for water quality degradation with respect to chloride, the concentrations of chloride during individual water years was examined.

This further examination was limited to the mass balance approach, since when utilizing the EC-chloride relationship to model monthly average chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity were similar to that discussed for the mass balance modeling approach (Tables Cl-3 and Cl-19 in Appendix B of this RDEIR/SDEIS). However, utilizing the EC-chloride relationships generally predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

Figure Cl-18 shows chloride concentrations in April during the five-year drought period (1987–1991) at Antioch, where Table Cl-18 in Appendix B of this RDEIR/SDEIS indicated 20% use of assimilative capacity. The figure shows that during three of the five years, chloride concentrations increased relative to the No Action Alternative (ELT) and decreased in the other two years. The absolute differences estimated are fairly small and may be within modeling uncertainty. Figures Cl-

19 and Cl-20 show a box and whisker plot and exceedance plot for April at Antioch for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that while the median chloride concentration is slightly increased relative to the No Action Alternative (ELT), the maximum, 25th percentile, and 75th percentile values are all decreased. Based on this analysis, long-term degradation is not expected at Antioch in April during drought years.

Figure Cl-21 shows chloride levels in September at Contra Costa Pumping Plant #1 during the drought period (1987–1991), where Table Cl-18 in Appendix B of this RDEIR/SDEIS indicated 61% use of assimilative capacity. In general, changes in chloride concentrations relative to the No Action Alternative (ELT) are fairly small, and may be within modeling uncertainty. Figures Cl-22 and Cl-23 show a box and whisker plot and exceedance plot for September at Contra Costa Pumping Plant #1 for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that the median chloride concentration is slightly decreased relative to the No Action Alternative (ELT), and chloride concentrations are generally similar to the No Action Alternative (ELT) throughout the range seen. The 61% use of assimilative capacity was shown because long term averages were just below the criterion, so a very small increase in chloride (that is probably within the modeling uncertainty) resulted in a very high estimate of use of assimilative capacity. Similar results are shown in Figure Cl-24, Cl-25, and Cl-26 for October at Contra Costa Pumping Plant #1. Median concentrations decreased slightly, and the exceedance plot shows generally similar concentrations throughout the range seen. Figure Cl-24 shows that while some years see increased concentrations (e.g., 1978, 1989), other years see decreased concentrations (e.g., 1980, 1982). Based on this analysis, long-term degradation is not expected at Contra Costa Pumping Plant #1 in September during drought years, or October on a long-term average basis.

Furthermore, sensitivity analyses conducted of Alternative 4 Scenario H3 without restoration areas indicated lower chloride levels in the western Delta than with the restoration areas. It is thus likely that modeling of Alternative 2D that does not include restoration areas would show lower levels of chloride at Antioch in April, and at Contra Costa Pumping Plant #1 in September and October than is shown herein using the Alternative 2 (ELT) modeling.

Based on the low level of water quality degradation estimated for the western Delta, and the lack of exceedance of water quality objectives, Alternative 2D is not expected to have substantial adverse effects on municipal and industrial beneficial uses in the western Delta.

CWA Section 303(d) Listed Water Bodies–Relative to No Action Alternative (ELT)

With respect to the state's CWA Section 303(d) listing for chloride, Alternative 2D would generally result in similar changes to those discussed for the comparison to Existing Conditions. Monthly average chloride concentrations at Tom Paine Slough would not be further degraded on a long-term basis, based on changes that would occur in Old River at Tracy Road (Figure Cl-5 in Appendix B of this RDEIR/SDEIS). Modeling indicated that monthly average chloride concentrations at source water channel locations for the Suisun Marsh would increase substantially in some months during October through May relative to the No Action Alternative (ELT) (Figures Cl-6, Cl-7, and Cl-8 in Appendix B of this RDEIR/SDEIS), but the results of sensitivity analyses performed indicate that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 2D in the ELT would be very similar to the No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, chloride concentrations under Alternative 2D could be less than under the

No Action Alternative (ELT). For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

The effects of Alternative 2D in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in chloride in the west Delta. Small increases in chloride concentrations may occur in some areas, but it is not expected that these increases would cause exceedance of Bay-Delta WQCP objectives of cause substantial long-term degradation that would impact municipal and industrial beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 2D in the ELT, long-term average chloride concentrations at the Banks and Jones pumping plants, based on the mass balance analysis of modeling results for the 16-year period, would decrease relative to Existing Conditions. Chloride concentrations would be reduced by 45% at Banks pumping plant (Table Cl-16 in Appendix B of this RDEIR/SDEIS). At Jones pumping plant, chloride concentrations would be reduced 43% (Table Cl-16 in Appendix B of this RDEIR/SDEIS). The frequency of exceedances of applicable water quality objectives would decrease relative to Existing Conditions, for both the 16-year period and the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). The chloride concentration changes relative to the No Action Alternative (ELT) would be similar. Consequently, water exported into the SWP/CVP Export Service Areas would generally be of similar or better quality with regard to chloride relative to Existing Conditions and the No Action Alternative (ELT). Results of the modeling approach which utilized a EC-chloride relationship are consistent these results, and assessment of chloride using these modeling output results in the same conclusions as for the mass balance approach (Tables Cl-3 and Cl-17 in Appendix B of this RDEIR/SDEIS).

Commensurate with the reduced chloride concentrations in water exported to the SWP/CVP Export Service Area, reduced chloride loading in the lower San Joaquin River would be anticipated which would likely alleviate chloride concentrations at Vernalis.

The effects of Alternative 2D in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be very similar to effects in the ELT.

Maintenance of SWP and CVP facilities would not be expected to create new sources of chloride or contribute towards a substantial change in existing sources of chloride in the affected environment. Maintenance activities would not be expected to cause any substantial change in chloride such that any long-term water quality degradation would occur, thus, beneficial uses would not be adversely affected anywhere in the affected environment.

NEPA Effects**:** In summary, relative to the No Action Alternative (ELT and LLT), Alternative 2D would not result in substantially increased chloride concentrations in the Delta on a long-term average that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: Chloride is not a constituent of concern in the Sacramento River watershed upstream of the Delta, thus river flow rate and reservoir storage reductions that would occur under Alternative 2D relative to Existing Conditions, would not be expected to result in a substantial adverse change in chloride levels. Additionally, relative to Existing Conditions, Alternative 2D would not result in reductions in river flow rates (i.e., less dilution) or increased chloride loading such that there would be any substantial increase in chloride concentrations upstream of the Delta in the San Joaquin River watershed.

Relative to Existing Conditions, Alternative 2D would not result in substantially increased chloride concentrations in the Delta on a long-term average basis that would result in adverse effects on the municipal and industrial water supply beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use.

Chloride concentrations would be reduced under Alternative 2D in water exported from the Delta to the SWP/CVP Export Service Areas thus reflecting a potential improvement to chloride loading in the lower San Joaquin River.

Chloride is not a bioaccumulative constituent, thus any increased concentrations under the Alternative 2D would not result in substantial chloride bioaccumulation impacts on aquatic life or humans. Alternative 2D maintenance would not result in any substantial changes in chloride concentration upstream of the Delta or in the SWP/CVP Export Service Areas

Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-8: Effects on Chloride Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D would present no new direct sources of chloride to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Consequently, as they pertain to chloride, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated chloride concentrations, which would be considered an improvement relative to the No Action Alternative (ELT and LLT). Therefore, the effects on chloride from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Implementation of the Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D would not present new or substantially changed sources of chloride to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. Replacement of irrigated agricultural land uses in the Delta with habitat restoration may result in some reduction in discharge of agricultural field drainage with elevated chloride concentrations, thus resulting in improved water quality conditions. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-9: Effects on Dissolved Oxygen Resulting from Facilities Operations and Maintenance

As described in detail for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), DO levels are primarily affected by water temperature, flow velocity, turbulence, amounts of oxygen demanding substances present (e.g., ammonia, organics), and rates of photosynthesis (which is influenced by nutrient levels), respiration, and decomposition. Water temperature and salinity affect the maximum DO saturation level (i.e., the highest amount of oxygen the water can dissolve). Flow velocity affects the turbulence and re-aeration of the water (i.e., the rate at which oxygen from the atmosphere can be dissolved in water). High nutrient content can support aquatic plant and algae growth, which in turn generates oxygen through photosynthesis and consumes oxygen through respiration and decomposition.

As described for Alternative 4, amounts of oxygen demanding substances present (e.g., ammonia, organics) in the reservoirs and rivers upstream of the Delta, rates of photosynthesis (which is influenced by nutrient levels/loading), and respiration and decomposition of aquatic life is not expected to change sufficiently under Alternative 2D to substantially alter DO levels relative to Existing Conditions or the No Action Alternative (ELT and LLT). Further, the rivers upstream of the Delta are well oxygenated and experience periods of supersaturation (i.e., when DO level exceeds the saturation concentration). Because these are large, turbulent rivers, any reduced DO saturation level that would be caused by an increase in temperature under Alternative 2D would not be expected to cause DO levels to be outside of the range seen historically. Flow changes that would occur under Alternative 2D would not be expected to have substantial effects on river DO levels; likely, the changes would be immeasurable. This is because sufficient turbulence and interaction of river water with the atmosphere would continue to occur to maintain water saturation levels (due to these factors) at levels similar to that of Existing Conditions and the No Action Alternative (ELT and LLT).

Also as described for Alternative 4, salinity changes would generally have relatively minor effects on Delta DO levels. Further, the relative degree of tidal exchange of flows and turbulence, which contributes to exposure of Delta waters to the atmosphere for reaeration, would not be expected to substantially change relative to Existing Conditions or the No Action Alternative (ELT and LLT), such that these factors would reduce Delta DO levels below objectives or levels that protect beneficial uses. Similarly, increased temperature under Alternative 2D would generally have relatively minor effects on Delta DO levels, relative to Existing Conditions.

Similar to Alternative 4, flows in the San Joaquin River at Stockton were evaluated, and are shown in Figure DO-1 in Appendix B of this RDEIR/SDEIS. The figure shows that while flows do would change somewhat, they are would generally be within the range of flows seen under Existing Conditions and the No Action Alternative. Reports indicate that the aeration facility performs adequately under the range of flows from 250–1,000 cfs (ICF International 2010). Based on the above, the expected changes in flows in the San Joaquin River at Stockton are not expected to substantially move the point of minimum DO, and therefore the aeration facility will would likely still be located appropriately to keep DO levels above Basin Plan objectives.

Overall, assuming continued operation of the aerators, the alternative is not expected to have a substantial impact adverse effect on DO in the Deep Water Ship Channel. It is expected that DO levels in the Deep Water Ship Channel, which is CWA Section 303(d) listed as impaired due to low DO, would remain similar to those under Existing Conditions and the No Action Alternative (ELT and

LLT) or improve as TMDL-required studies are completed and actions are implemented to improve DO levels. DO levels in other Clean Water Act Section 303(d)-listed waterways would not be expected to change relative to Existing Conditions or the No Action Alternative (ELT and LLT), as the circulation of flows, tidal flow exchange, and re-aeration would continue to occur.

In the SWP/CVP Export Service Areas, the primary factor that would affect DO in the conveyance channels and ultimately the receiving reservoirs would be changes in the levels of nutrients and oxygen-demanding substances and DO levels in the exported water. As described above and for Alternative 4, exported water could potentially be warmer and have higher salinity relative to Existing Conditions and the No Action Alternative (ELT and LLT). Nevertheless, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions or the No Action Alternative (ELT and LLT) due to water quality regulations, canal turbulence, exposure of the water to the atmosphere, and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

NEPA Effects: Because DO levels are not expected to change substantially relative to the No Action Alternative (ELT and LLT), the effects on DO from implementing Alternative 2D are determined to not be adverse.

CEQA Conclusion: The effects of Alternative 2D on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Reservoir storage reductions that would occur under Alternative 2D, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DO levels in the reservoirs, because oxygen sources (surface water aeration, aerated inflows, vertical mixing) would remain. Similarly, river flow rate reductions would not be expected to result in a substantial adverse change in DO levels in the rivers upstream of the Delta, given that mean monthly flows would remain within the ranges historically seen under Existing Conditions and the affected river are large and turbulent. Any reduced DO saturation level that may be caused by increased water temperature would not be expected to cause DO levels to be outside of the range seen historically. Finally, amounts of oxygen demanding substances and salinity would not be expected to change sufficiently to affect DO levels.

It is expected there would be no substantial change in Delta DO levels in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to DO. DO levels would be affected by nutrient loading, which the state regulates the discharges of, and this loading would not be expected to lower DO levels relative to Existing Conditions based on historical DO levels. Further, the anticipated changes in salinity would have relatively minor effects on DO levels, and tidal exchange, which contribute to the reaeration of Delta waters would not be expected to change substantially.

There is not expected to be substantial, if even measurable, changes in DO levels in the SWP/CVP Export Service Areas waters, relative to Existing Conditions, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions (due to water quality regulations), canal turbulence and exposure of the water to the atmosphere and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels are expected, long-term water quality degradation would not be expected to occur, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and DO-related impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-10: Effects on Dissolved Oxygen Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. The increased habitat provided by these environmental commitments could contribute to an increased biochemical or sediment demand, through contribution of organic carbon and plants decaying. However, the areal extent of new habitat would be small relative to existing and No Action Alternative habitat areas, and similar habitat existing in the Delta is not identified as contributing to adverse DO conditions. The remaining environmental commitments would not be expected to affect DO levels because they are actions that do not affect the presence of oxygen-demanding substances. Therefore, the effects on DO from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

***CEQA Conclusion*:** It is expected that DO levels in the Upstream of the Delta Region, in the Plan Area, or in the SWP/CVP Export Service Areas following implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D would not be substantially different from existing DO conditions, because these would contribute to a minimal, localized change in oxygen-demanding substances associated with habitat restoration, if at all. Therefore, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels would be expected, long-term water quality degradation would not be expected, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-11: Effects on Electrical Conductivity Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 2D on EC levels in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). The extent of new urban growth would be less in the ELT, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further decrease loading of EC-related parameters to tributaries. Based on these considerations, and those described in Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS, EC levels (highs, lows, typical conditions) in the

Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under Alternative 2D could occur, but would be slightly less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because the effects of climate change and increase water demands on flows, which could effect dilution of high EC discharges, would be less in the ELT. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected to be of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

As mentioned at the beginning of Section 4.4.4 of the RDEIR/SDEIS, the analysis of EC under Alternative 2D is based on modeling conducted for Alternative 2 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. Also, the modeling was originally performed assuming the Emmaton compliance point shifted to Threemile Slough. However, Yolo Bypass Improvements are not a component of Alternative 2D and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the Alternative 2 modeling. Also, Alternative 2D does not include a change in compliance point from Emmaton to Threemile Slough. Furthermore, there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance, when in reality no such exceedance would occur. The result of all of these factors is that the quantitative modeling results presented in this assessment is not entirely predictive of actual effects under Alternative 2D, and the results should be interpreted with caution. In order to understand the significance of all of these factors on the results, sensitivity analyses and further other analyses were performed to evaluate the impact of maintaining the compliance point at Emmaton, the impact of having substantially less restoration than included in the modeling that was analyzed, and whether exceedances were indeed modeling artifacts or were potential alternative-related effects that may actually occur. For more information on these sensitivity analyses, refer to Chapter 8, Section 8.3.1.7, *Electrical Conductivity*, and Appendix 8H, Attachment 1, both in Appendix A of the RDEIR/SDEIS.

In this assessment, the modeling results are described and then in most cases are qualified in light of findings from the sensitivity analyses. Conclusions thus represent assessment of the combination of the modeling results and sensitivity analysis findings.

The modeling of EC under Alternative 2D included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes (i.e., water conveyance facilities). Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-12. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Relative to Existing Conditions and the No Action Alternative (ELT), initial review of modeling results indicated that Alternative 2D would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and San Joaquin River at San Andreas Landing and Prisoners Point (Table EC-9 in Appendix B of this RDEIR/SDEIS). Additionally, the modeling results indicated potentially large increases in EC in Suisun Marsh. However, to understand and interpret these results, considerations must be made regarding uncertainty in the modeling, differing assumptions between the modeling and the alternative, and sensitivity analyses. These objectives and locations are addressed in the context of these considerations in detail below. At all other locations, the level of exceedance and EC in the modeling results was approximately equivalent or lower than under Existing Conditions and the No Action Alternative (ELT).

Sacramento River at Emmaton

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 2D than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of dry and critical water years. However, sensitivity analyses have shown that the level of effect would be less than presented in the modeling. Remaining increases in exceedance of the objective and degradation are expected to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Delta Cross Channel operation. Further discussion is provided below.

Modeling results indicated that the percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 13% under the No Action Alternative (ELT), to 16% and the percent of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative (ELT), to 25%. Although these results are for modeling that was originally performed for Alternative 2 at the ELT assuming the Emmaton compliance point shifted to Threemile Slough, Alternative 2D does not include a change in compliance point from Emmaton to Threemile Slough. Sensitivity analyses were performed that modeled Alternative 4 scenario H3 at the LLT with Emmaton as the compliance point. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H, Attachment 1 in Appendix A of the RDEIR/SDEIS). Assuming the compliance location at Emmaton instead of Threemile Slough in the CALSIM II modeling decreased exceedances at Emmaton from 28% to 15% under Alternative 4, operations scenario H3 at the LLT (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses), which would still be greater than Existing Conditions, but is very close to the No Action Alternative (ELT). Table 2 of Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS indicates that most of these exceedances are a result of modeling artifacts, but some exceedances are due to deadpool conditions that occurred in 1977, 1981, and 1990 under Alternative 4 scenario H3 at the LLT and not under Existing Conditions. As discussed in Chapter 5, *Water Supply*, Section 5.3.1, *Methods for Analysis*, of this RDEIR/SDEIS, under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions. However, these results indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects to agricultural beneficial uses.

This is evidenced in the modeling results, which indicated that long-term monthly average EC levels at Emmaton would increase 1–12% for the entire period modeled (1976–1991) and 4–33% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Table EC-16 in Appendix B of this RDEIR/SDEIS). The largest increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. During these periods, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would be considered not adverse.

San Joaquin River at San Andreas Landing

Alternative 2D is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions and the No Action Alternative (ELT). Modeling results estimated that the percent of days the San Andreas Landing EC objective would be exceeded would increase by <1% relative to Existing Conditions, and the percent of days out of compliance would increase from 1% under Existing Conditions to 2% (Table EC-9 in Appendix B of this RDEIR/SDEIS). San Andreas Landing average EC would decrease 6% for the entire period modeled, but would increase 2% during the drought period modeled, relative to Existing Conditions (Table EC-16 in Appendix B of this RDEIR/SDEIS). Results relative to the No Action Alternative (ELT) were similar (Table EC-16 in Appendix B of this RDEIR/SDEIS). However, sensitivity analyses performed for Alternative 4 scenario H3 at the LLT indicate that many of these exceedances are likely modeling artifacts, and the small number of remaining exceedances would be small in magnitude, lasting only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS).

San Joaquin River at Prisoners Point

Modeling results indicated that the EC objective that applies between the San Joaquin River at Jersey Point and Prisoners Point would be exceeded at Prisoners Point more often under Alternative 2D than under Existing Conditions and the No Action Alternative (ELT). However, modeling results without restoration areas would be expected to show a lesser effect, and remaining exceedances are expected to be able to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Head of Old River Barrier management. Further discussion is provided below.

Modeling results estimated that the percent of days the Prisoners Point EC objective would be exceeded would increase from 6% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 18% and the percent of days out of compliance with the EC objective would increase from 10% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 20% (Table EC-9 in Appendix B of this RDEIR/SDEIS). The magnitude of the exceedances is estimated to be very small—the objective is 440 µmhos/cm, and the EC during times of exceedance was generally between 440 and 550 µmhos/cm. The exceedances generally occurred in drier water years, when flows are lower. During these times, the EC in the San Joaquin River at Vernalis is greater than in the Sacramento River entering the Delta, and is high enough on its own to cause an exceedance.

There are two main drivers of the increase in exceedances under the alternative: an increase in San Joaquin River flow at Prisoners Point during April and May under the alternative, relative to Existing Conditions and the No Action Alternative (ELT), and a reduction in the amount of Sacramento River water moving past Prisoners Point under the alternative. The result is increased San Joaquin River water at Prisoners Point, and a reduction in the dilution that the Sacramento River provides the higher EC San Joaquin River. The increase in San Joaquin River flow at Prisoners Point is due to a reduction in pumping from the south Delta under the alternative, as well as due to the presence of the Head of Old River Barrier, which increases flow in the San Joaquin River downstream of Old River by preventing flow from entering Old River. The reduction in Sacramento River water influence is due to less pumping at the south Delta pumping plants (i.e., greater pumping draws more Sacramento River water through the Delta).

Sensitivity analyses conducted for Alternative 4 scenario H3 at the LLT indicated that removing all tidal restoration areas (such as is largely the case in Alternative 2D at the ELT) would reduce the number of exceedances by about 9 percentage points, but there would still be more exceedances than under Existing Conditions or the No Action Alternative. Sensitivity analyses also indicated that if the Head of Old River Barrier was open in April and May, exceedances would be reduced by about 5 percentage points. Both of these analyses also showed lower EC during April and May, including during times when modeling showed the objective to be exceeded. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT. Results of the sensitivity analyses indicate that the exceedances are partially a function of the restoration that was assumed in the Alternative 2D modeling, but partly due also to operations of the alternative itself, perhaps due to Head of Old River Barrier assumptions and south Delta export differences (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses). Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS contains a more detailed assessment of the likelihood of these exceedances estimated via modeling for Alternatives 1–9 impacting aquatic life beneficial uses. Specifically, Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination for those alternatives. However, based on the sensitivity analyses conducted, modeling of Alternative 2D that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 2 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Suisun Marsh

For Suisun Marsh October–May is the period when Bay-Delta WQCP EC objectives for protection of fish and wildlife apply. Modeling results indicate that average EC for the entire period modeled would increase in the Sacramento River at Collinsville during the months of March through May relative to Existing Conditions, by 0.1–0.2 mS/cm (Table EC-11 in Appendix B of this RDEIR/SDEIS). In Montezuma Slough at National Steel, average EC levels would increase in January through March by 0.2–0.4 mS/cm (Table EC-12 in Appendix B of this RDEIR/SDEIS). The most substantial EC increase would occur in Montezuma Slough near Beldon Landing, with long-term average EC levels increasing by 1.5–5.3 mS/cm, depending on the month, at least doubling during some months the long-term average EC relative to Existing Conditions (Table EC-13 in Appendix B of this RDEIR/SDEIS). Sunrise Duck Club and Volanti Slough also would have long-term average EC increases during October–May ranging 1.3–3.1 mS/cm (Tables EC-14 and EC-15 in Appendix B of this RDEIR/SDEIS). Modeled long-term average EC increases in Suisun Marsh under Alternative 2D relative to the No Action Alternative (ELT) are similar to the increases relative to Existing Conditions.

However, modeling used for the assessment of Alternative 2D assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results discussed above, but EC levels were still somewhat higher than EC levels under Existing Conditions and the No Action Alternative for several locations and months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions and the No Action Alternative (see Appendix 8H, Attachment 1, of the Draft EIR/EIS for more information on these sensitivity analyses). Since Alternative 2D at the ELT includes operation of the gates, and includes very little tidal restoration areas, it is anticipated that EC increases in Suisun Marsh predicted via the modeling would not occur, and that EC in Suisun Marsh under Alternative 2D would be very similar to Existing Conditions and No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, EC under Alternative 2D could be less than under the No Action Alternative (ELT). For these reasons, any changes in EC in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 2D, at the Banks and Jones pumping plants, there would be no exceedance of the Bay-Delta WQCP s 1,000 µmhos/cm EC objective for the entire period modeled (Table EC-10 in Appendix B of this RDEIR/SDEIS), which is the same as under Alternative 4. Relative to Existing Conditions, average EC levels under Alternative 2D would decrease 26–27% for the entire period modeled and 22–23% during the drought period modeled. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 23% for the entire period modeled and 19–20% during the drought period modeled (Table EC-16 in Appendix B of this RDEIR/SDEIS). Based on the decreases in long-term average EC levels that would occur at the Banks and Jones pumping plants, Alternative 2D would not cause degradation of water quality with respect to EC in the SWP/CVP Export Service Areas rather, Alternative 2D would improve long-term average EC conditions in the SWP/CVP Export Service Areas.

Commensurate with the EC decrease in exported waters, an improvement in lower San Joaquin River average EC levels would be expected since EC in the lower San Joaquin River is, in part, related to irrigation water deliveries from the Delta. While the magnitude of this expected lower San Joaquin River improvement in EC is difficult to predict, the relative decrease in overall loading of EC-elevating constituents to the Export Service Areas would likely alleviate or lessen any expected increase in EC at Vernalis related to decreased annual average San Joaquin River flows.

The export area of the Delta is listed on the state's CWA Section 303(d) list as impaired due to elevated EC Alternative 2D would result in lower average EC levels relative to Existing Conditions and the No Action Alternative (ELT) and, thus, would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters.

NEPA Effects: In summary, based on the results of the modeling and sensitivity analyses conducted, it is unlikely that there would be increased frequency of exceedance of agricultural EC objectives in the western, interior, or southern Delta. However, modeling results indicate that there could be increased long-term and drought period average EC levels during the summer months that would occur in the western Delta (i.e., in the Sacramento River at Emmaton) under Alternative 2D relative to the No Action Alternative (ELT), that could contribute to adverse effects on the agricultural beneficial uses. In addition, the increased frequency of exceedance of the San Joaquin River at Prisoners Point EC objective could contribute to adverse effects on fish and wildlife beneficial uses (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 2D, relative to the No Action Alternative (ELT), and thus it is not expected that they would contribute to additional beneficial use impairment. The increases in EC in the Sacramento River at Emmaton, particularly during summer months of dry and critical water years, and the additional exceedances of water quality objectives in the San Joaquin River at Prisoners Point constitute an adverse effect on water quality. Mitigation Measure WQ-11 would be available to reduce these effects.

CEQA Conclusion: River flow rate and reservoir storage reductions that would occur under Alternative 2D, relative to Existing Conditions, would not be expected to result in a substantial adverse change in EC levels in the reservoirs and rivers upstream of the Delta, given that: changes in the quality of watershed runoff and reservoir inflows would not be expected to occur in the future; the state's regulation of point-source discharge effects on Delta salinity-elevating parameters and the expected further regulation as salt management plans are developed; the salt-related TMDLs adopted and being developed for the San Joaquin River; and the expected improvement in lower San Joaquin River average EC levels commensurate with the lower EC of the irrigation water deliveries from the Delta.

Relative to Existing Conditions, Alternative 2D would not result in any substantial increases in long-term average EC levels in the SWP/CVP Export Service Areas, and there would be no exceedance of the Bay-Delta WQCP EC objective for this area of the Delta. Average EC levels for the entire period modeled would decrease at both the Banks and Jones pumping plants and, thus, this alternative would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters. Rather, this alternative would improve long-term EC levels in the SWP/CVP Export Service Areas, relative to Existing Conditions.

Further, relative to Existing Conditions, Alternative 2D would not result in substantial increases in long-term average EC in Suisun Marsh. Thus, EC levels in Suisun Marsh are not expected to further degrade existing EC levels and thus would not contribute additionally to adverse effects on the fish and wildlife beneficial uses. Because EC is not bioaccumulative, any changes in long-term average EC levels would not directly cause bioaccumulative problems in fish and wildlife. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 2D, relative to Existing Conditions, and thus it is not expected that they would contribute to additional beneficial use impairment.

In the Plan Area, Alternative 2D is not expected to result in an increase in the frequency with which Bay-Delta WQCP EC objectives are exceeded, except for at the San Joaquin River at Prisoners Point (fish and wildlife objective; 12% increase). The increased frequency of exceedance of the fish and wildlife objective at Prisoners Point could contribute to adverse effects on aquatic life (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. However, modeling of Alternative 2D that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 2 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Average EC levels at Emmaton would increase by 4% during the drought period modeled. The largest monthly average increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. The increases in drought period average EC levels could cause substantial water quality degradation that would potentially contribute to adverse effects on the agricultural beneficial uses in the western Delta. The comparison to Existing Conditions reflects changes in EC due to both Alternative 2D operations and climate change/sea level rise. The adverse effects expected to occur at Emmaton would be due in part to the effects of climate change/sea level rise, and in part due to Alternative 2D operations. This is evidenced by the significant effects expected in the No Action Alternative (ELT) at Emmaton relative to Existing Conditions, as well as the fact that a lesser level of adverse effects is expected at Emmaton under Alternative 2D relative to the No Action Alternative (ELT). During summer of dry and critical water years, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would not be expected to adversely affect beneficial uses. Because EC is not bioaccumulative, the increases in long-term average EC levels would not directly cause bioaccumulative problems in aquatic life or humans. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse. Based on these findings, this impact in the Plan Area is considered to be significant. Implementation of Mitigation Measure WQ-11 would be expected to reduce these effects to a less than significant level.

Mitigation Measure WQ-11: Avoid, Minimize, or Offset, as Feasible, Reduced Water Quality Conditions

Please see Mitigation Measure WQ-11 in Section 4.3.4, of the RDEIR/SDEIS.

Impact WQ-12: Effects on Electrical Conductivity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15 and 16

***NEPA Effects*:** The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new direct sources of EC to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. As they pertain to EC, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. Such replacement or substitution of land use activity is not expected to result in new or increased sources of EC to the Delta and, in fact, could decrease EC through elimination of high EC agricultural runoff.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable EC changes.

In summary, implementation of the environmental commitments would not be expected to adversely affect EC levels in the affected environment and thus would not adversely affect beneficial uses or substantially degrade water quality with regard to EC within the affected environment. Therefore, the effects on EC from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 2D would not present new or substantially changed sources of EC to the affected environment. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, adverse effects on EC levels throughout the affected environment and would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria that would result in adverse effects on any beneficial uses within affected water bodies. Further, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of adverse effects on beneficial uses. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-13: Effects on Mercury Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the Alternative 2D on mercury levels in surface waters upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because factors which affect mercury concentrations in surface waters upstream of the Delta are similar under Alternatives 4 and 2D. The changes in flow in the Sacramento River under Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT) would not be of the magnitude of storm flows, in which substantial sediment-associated mercury is mobilized. Therefore, mercury loading should not be substantially different due to changes in flow. In addition, even though it may be flow-affected, total mercury concentrations remain well below criteria at upstream locations. Any negligible changes in mercury concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to mercury. Both waterborne methylmercury concentrations and largemouth bass fillet mercury concentrations are expected to remain above guidance levels at upstream of Delta locations, but would not change substantially because the anticipated changes in flow are not expected to substantially change mercury loading relative to Existing Conditions or the No Action Alternative (ELT).

The upstream of Delta areas in the north will benefit from the implementation of the Cache Creek, Sulfur Creek, Harley Gulch, and Clear Lake Mercury TMDLs and the American River methylmercury TMDL. These projects will target specific sources of mercury and methylation upstream of the Delta and could result in net improvement to Delta mercury loading in the future. The implementation of these projects could help to ensure that upstream of Delta environments will not be substantially degraded for water quality with respect to mercury or methylmercury.

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-14. See Chapter 8, Section 8.3.1.3, *Plan Area,* in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 2D on waterborne concentrations of mercury (Table Hg-1 in Appendix B of this RDEIR/SDEIS) and methylmercury (Table Hg-2 in Appendix B of this RDEIR/SDEIS), and fish tissue mercury concentrations for largemouth bass fillet (Tables Hg-11 and Hg-12 in Appendix B of this RDEIR/SDEIS) were evaluated for nine Delta locations.

Similar to Alternative 4, increases in long-term average mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) would be very small, 0.3 ng/L or less. Also, use of assimilative capacity for mercury relative to the 25 ng/L ecological threshold under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT), would be very low, approximately 2% or less for all Delta locations (Table Hg-15 in Appendix B of this RDEIR/SDEIS). These concentration changes and small changes in assimilative capacity for mercury are not expected to result in adverse (or positive) effects to beneficial uses.

Changes in methylmercury concentrations in water also are expected to be very small. The greatest annual average methylmercury concentration under Alternative 2D would be 0.166 ng/L for the San Joaquin River at Buckley Cove, for the drought period modeled, which would be slightly higher than Existing Conditions (0.161 ng/L) and slightly lower than the No Action Alternative (ELT) (0.168 ng/L) (Table Hg-2 in Appendix B of this RDEIR/SDEIS). All methylmercury concentrations in water were estimated to exceed the TMDL guidance objective of 0.06 ng/L under Existing Conditions and, therefore, no assimilative capacity exists.

Fish tissue estimates for largemouth bass fillet show small or no increases in mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) based on long-term annual average concentrations for mercury at the Delta locations (Tables Hg-11 and Hg-12 in Appendix B of the RDEIR/SDEIS). Concentrations expected for Alternative 2D, with Equation 1, show increases of 9 percent or less, relative to Existing Conditions and the No Action Alternative (ELT), in all years (Table Hg-11 in Appendix B of this RDEIR/SDEIS). Concentrations expected with Equation 2 show increases from 10 percent to 13 percent in Mokelumne River (South Fork) at Staten Island, Old River at Rock Slough, and San Joaquin River at Antioch relative to Existing Conditions in all years and an increase of 13 percent at Staten Island relative to the No Action Alternative (ELT) in all years (Table Hg-12 in Appendix B of this RDEIR/SDEIS). Because the increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a complete discussion of the uncertainty associated with the fish tissue estimates.

Briefly, the bioaccumulation models contain multiple sources of uncertainty associated with their development. These are related to: analytical variability; temporal and/or seasonal variability in Delta source water concentrations of merthylmercury; interconversion of mercury species (i.e., the non-conservative nature of methylmercury as a modeled constituent); and limited sample size (both in number of fish and time span over which the measurements were made), among others. Although there is considerable uncertainty in the models used, the results serve as a reasonable approximations of a very complex process. Considering the uncertainty, small (i.e., <20–25%) increases or decreases in modeled fish tissue mercury concentrations at a low number of Delta locations (i.e., 2–3) should be interpreted to be within the uncertainty of the overall approach, and not predictive of actual adverse effects. Larger increases, or increases evident throughout the Delta, can be interpreted as more reliable indicators of potential adverse effects.

In the LLT, the primary difference will be changes in the Delta source water fractions to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

SWP/CVP Export Service Areas

The analysis of mercury and methylmercury in the SWP/CVP Export Service Areas was based on concentrations estimated at the Banks and Jones pumping plants. Both waterborne total and methylmercury concentrations for Alternative 2D, at the Jones and Banks pumping plants would be lower than Existing Conditions and the No Action Alternative (ELT) (Tables Hg-1 and Hg-2 in Appendix B of this RDEIR/SDEIS). Therefore, there would be increased assimilative capacity for mercury at these locations (Table Hg-15 in Appendix B of this RDEIR/SDEIS).

The largest improvements in largemouth bass tissue mercury concentrations and Exceedance Quotients ([EQs]; modeled tissue divided by TMDL guidance concentration) for Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT) at any location within the Delta are expected for the Banks and Jones pumping plants export pump locations. Concentrations expected for Alternative 2D at the export pump locations with Equation 1 in all years show decreases relative to Existing Conditions (10% to 12%) and relative to the No Action Alternative (ELT) (11% to 13%) (Table Hg-11 in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

NEPA Effects: Based on the above discussion, Alternative 2D would not cause concentrations of mercury and methylmercury in water and fish tissue in the affected environment to be substantially different from the No Action Alternative (ELT and LLT) and, thus, would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to the No Action Alternative (ELT and LLT), Alternative 2D would not be expected to increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, the effects of Alternative 2D on mercury in the affected environment are considered to be not adverse.

CEQA Conclusion: Under Alternative 2D, greater water demands and climate change would alter the magnitude and timing of reservoir releases and river flows upstream of the Delta in the Sacramento River watershed and east-side tributaries, relative to Existing Conditions. Concentrations of mercury and methylmercury upstream of the Delta would not be substantially different relative to Existing Conditions due to the lack of important relationships between mercury/methylmercury concentrations and flow for the major rivers.

Methylmercury concentrations exceed criteria at all locations in the Delta and no assimilative capacity exists. However, monthly average waterborne concentrations of total and methylmercury, over the period of record, under Alternative 2D would be very similar to Existing Conditions. Similarly, estimates of fish tissue mercury concentrations show small differences would occur among sites for Alternative 2D as compared to Existing Conditions for Delta sites.

Assessment of effects of mercury in the SWP/CVP Export Service Areas were based on effects on mercury concentrations and fish tissue mercury concentrations at the Banks and Jones pumping plants. The Banks and Jones pumping plants are expected to show increased assimilative capacity for waterborne mercury and decreased fish tissue concentrations of mercury for Alternative 2D, all scenarios, as compared to Existing Conditions.

As such, Alternative 2D is expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, Alternative 2D would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-14: Effects on Mercury Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** The potential types of effects on mercury resulting from implementation of the environmental commitments under Alternative 2D would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on mercury and methylmercury at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service Areas related to habitat restoration would be considerably lower than described for Alternative 4. This is because the amount of habitat restoration to be implemented under Alternative 2D would be very low compared to the total proposed restoration area that would be implemented under Alternative 4. The small amount of habitat restoration to be implemented under Alternative 2D may occur on lands in the Delta formerly used for irrigated agriculture. Habitat restoration proposed under Alternative 2D has the potential to increase water residence times and increase accumulation of organic sediments that are known to enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, there remain uncertainties related to site-specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta in the vicinity of the restored areas. Therefore, the effect of Environmental Commitments 3, 4, 6–12, 15, and 16 on mercury and methylmercury is considered to be adverse.

***CEQA Conclusion*:** There would be no substantial, long-term increase in mercury or methylmercury concentrations or loads in the rivers and reservoirs upstream of the Delta or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. However, in the Delta, due to the small amount of tidal restoration areas proposed, relative to Existing Conditions, uptake of mercury from water and/or methylation of inorganic mercury may increase in localized areas as part of the creation of new, marshy, shallow, or organic-rich restoration areas. Although not quantifiable, on a local level, increases in methylmercury concentrations may be measurable. Methylmercury is CWA Section 303(d)-listed within the affected environment, and therefore any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. Because mercury is bioaccumulative, increases in water-borne mercury or methylmercury that could occur in some areas could bioaccumulate to somewhat greater levels in aquatic organisms and would, in turn, pose health risks to fish, wildlife, or humans. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, the uncertainties related to site specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta result in this potential impact being considered significant. No mitigation measures would be available until specific restoration actions are proposed. Therefore, this impact is considered significant and unavoidable.

Impact WQ-15: Effects on Nitrate Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), nitrate levels in the major rivers (Sacramento, Feather, American) are low, generally due to ample dilution available in the reservoirs and rivers relative to the magnitude of the point and non-point source discharges, and there is no correlation between historical water year average nitrate concentrations and water year average flow in the Sacramento River at Freeport. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to Existing Conditions or the No Action Alternative (ELT), are expected to have negligible, if any, effects on average reservoir and river nitrate-N concentrations in the Sacramento River watershed upstream of the Delta.

In the San Joaquin River watershed, nitrate concentrations are higher than in the Sacramento River watershed, owing to use of nitrate based fertilizers throughout the lower watershed. The correlation between historical water year average nitrate concentrations and water year average flow in the San Joaquin River at Vernalis is a weak inverse relationship—that is, generally higher flows result in lower nitrate concentrations, while low flows result in higher nitrate concentrations (linear regression r^2=0.49; Figure 2 in Appendix 8J, *Nitrate*, of the Draft EIR/EIS). Under Alternative 2D, long-term average flows at Vernalis would decrease an estimated 1% relative to Existing Conditions and would remain virtually the same relative to the No Action Alternative (ELT). Given the relatively small decreases in flows and the weak correlation between nitrate and flows in the San Joaquin River, it is expected that nitrate concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT).

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any negligible changes in nitrate concentrations that may occur under Alternative 2D in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to nitrate.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-16. See section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Mass balance calculations indicate that under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives (Table N-8 in Appendix B of this RDEIR/SDEIS). Although changes at specific Delta locations and for specific months may be substantial on a relative basis (Table N-9 in Appendix B of this RDEIR/SDEIS), the absolute concentration of nitrate in Delta waters would remain low (<1.4 mg/L-N) in relation to the drinking water MCL of 10 mg/L-N, as well as all other thresholds (see *Nitrate* within Chapter 8, Section 8.3.17, *Constituent-Specific Considerations Used in the Assessment*, in Appendix A of the RDEIR/SDEIS). Long-term average nitrate concentrations are anticipated to remain below about 0.6 mg/L-N at all 11 Delta assessment locations except the San Joaquin River at Buckley Cove, where long-term average concentrations would be somewhat above 1 mg/L-N. Nevertheless, at this location, long-term average nitrate concentrations would be similar under Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT). Overall, the difference in long-term average nitrate concentrations at various locations throughout the Delta under Alternative 2D compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), no additional exceedances of the MCL are anticipated at any location under Alternative 2D (Table N-8 in Appendix B of this RDEIR/SDEIS).

Use of assimilative capacity relative to the drinking water MCL of 10 mg/L-N under Alternative 2D would be low or negligible (i.e., <2%) in comparison to both Existing Conditions and the No Action Alternative (ELT), for all locations and months, for all modeled years (1976–1991), and for the drought period (1987–1991) (Table N-11 in Appendix B of this RDEIR/SDEIS). One exception is for Old River at Rock Slough in October/November, where use of assimilative capacity relative to Existing Conditions would be up to about 4%. Changes in use of assimilative capacity relative to Existing Conditions and No Action Alternative (ELT) under Alternative 2D would be approximately the same as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

As described for Alternative 4 (see in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), actual nitrate concentrations would likely be higher than the modeling results indicate in certain locations under Alternative 2D. This is the mass balance modeling does not account for contributions from the SRWTP, which would be implementing nitrification/partial denitrification, or Delta wastewater treatment plant dischargers that practice nitrification, but not denitrification. However, for the reasons described for Alternative 4, any increases in nitrate concentrations that may occur at certain locations within the Delta under Alternative 2D would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to nitrate.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

SWP/CVP Export Service Areas

Assessment of effects of Alternative 2D on nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate at the Banks and Jones pumping plants.

Results of the mass balance calculations indicate that relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations at Banks and Jones pumping plants under Alternative 2D are anticipated to decrease on a long-term average annual basis (Table N-8 in Appendix B of this RDEIR/SDEIS). During the late summer, particularly in the drought period assessed, concentrations are expected to increase substantially on a relative basis (i.e., up to 67%), but the absolute value of these changes (i.e., in mg/L-N) would be small. Additionally, given the many factors that contribute to potential algal blooms in the SWP and CVP canals within the Export Service Areas, and the lack of studies that have shown a direct relationship between nutrient concentrations in the canals and reservoirs and problematic algal blooms in these water bodies, there is no basis to conclude that these small (i.e., generally <0.4 mg/L-N), seasonal increases in nitrate concentrations would increase the potential for problem algal blooms in the SWP/CVP Export Service Areas. Overall, the difference in long-term average nitrate concentrations at Banks and Jones pumping plants under Alternative 2D compared to Alternative 4 would be negligible (i.e., <0.1 mg/L) (Table N-9 in Appendix B of this RDEIR/SDEIS). As was similarly concluded for Alternative 4, no additional exceedances of the MCL are anticipated under Alternative 2D (Table N-8 in Appendix B of this RDEIR/SDEIS). On a monthly average basis and on a long-term annual average basis, for all modeled years and for the drought period only, use of assimilative capacity available under Existing Conditions and the No Action Alternative (ELT), relative to the 10 mg/L-N MCL, would be negligible (<2.2%) for both Banks and Jones pumping plants (Table N-11 in Appendix B of this RDEIR/SDEIS). Use of assimilative capacity relative to Existing Conditions and the No Action Alternative (ELT) for Alternative 2D would be slightly less than expected to occur under Alternative 4.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any increases in nitrate concentrations that may occur in water exported via Banks and Jones pumping plants are not expected to result in adverse effects to beneficial uses or substantially degrade the quality of exported water, with regard to nitrate.

***NEPA Effects*:** Modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed. In the Delta, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any Delta location, and use of assimilative capacity available under the No Action Alternative, relative to the drinking water MCL of 10 mg/L-N, would be low. Long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to differ negligibly relative to the No Action Alternative (ELT and LLT) and no additional exceedances of the 10 mg/L-N MCL are anticipated. Therefore, the effects on nitrate from implementing water conveyance facilities are considered to be not adverse.

CEQA Conclusion: Nitrate concentrations are generally low in the reservoirs and rivers of the watersheds, owing to substantial dilution available for point sources and the lack of substantial nonpoint sources of nitrate upstream of the SRWTP in the Sacramento River watershed, and in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers). Although higher in the San Joaquin River watershed, nitrate concentrations are not well-correlated with flow rates. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to Existing Conditions, are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed.

In the Delta, results of the mass balance calculations indicate that under Alternative 2D, relative to Existing Conditions, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any location, and use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <2%) for virtually all locations and months.

Assessment of effects of nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate concentrations at the Banks and Jones pumping plants. Results of the mass balance calculations indicate that under Alternative 2D, relative to Existing Conditions, long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly. No additional exceedances of the 10 mg/L-N MCL are anticipated, and use of assimilative capacity available under Existing Conditions, relative to the MCL would be negligible (i.e., <2.2%) for both Banks and Jones pumping plants for all months.

Based on the above, there would be no substantial, long-term increase in nitrate concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the SWP/CVP Export Service Areas under Alternative 2D relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any increases that may occur in some areas and months would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, increases that may occur in some areas and months would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-16: Effects on Nitrate Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands within the Delta formerly used for agriculture. As discussed for Impact WQ-2, increased biota that may result in those areas may increase ammonia, which in turn may be converted to nitrate by established microbial communities. However, the areal extent of the new habitat implemented for the Environmental Commitments would be less than the existing and No Action Alternative habitat areas, and similar habitat exists currently in the Delta and is not identified as contributing to adverse nitrate conditions. Thus, these land use changes would not be expected to substantially increase nitrate concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect nitrate sources or loading. Based on these findings, the effects on nitrate from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

***CEQA Conclusion*:** Land use changes that would occur from the environmental commitments are not expected to substantially increase nitrate concentrations, because the amount of area to be converted would be small relative to existing habitat, and existing habitats are not known for contributing to adverse nitrate conditions. Thus, it is expected that implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-17: Effects on Dissolved Organic Carbon Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 2D on DOC concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 because factors affecting DOC concentrations in these water bodies would be similar. Moreover, long-term average flow and DOC levels in the Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated. Thus changes in system operations and resulting reservoir storage levels and river flows under Alternative 2D would not be expected to cause substantial long-term changes in DOC concentrations in the water bodies upstream of the Delta. Any changes in DOC levels in water bodies upstream of the Delta under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be of sufficient frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies.

Delta

Effects of water conveyance facilities on long-term average DOC concentrations under Alternative 2D in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration under Alternative 2D because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-

18. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Under Alternative 2D, the geographic extent of effects pertaining to long-term average DOC concentrations in the Delta would be less extensive, and the magnitude of predicted long-term change and relative frequency of concentration threshold exceedances would be similar to, or lower than, the changes described for Alternative 4. The effects of Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 2D would result in small increases in long-term average DOC concentrations for both the modeled 16-year period (1976–1991) and drought period (1987–1991) at several interior Delta locations (increases up to 0.3 mg/L at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1) (Table DOC-2 in Appendix B of this RDEIR/SDEIS). The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at the Contra Costa Pumping Plant #1 associated with the 3 mg/L threshold (i.e., increase from 52% under Existing Conditions to 69% under Alternative 2D for the modeled 16-year period). The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower.

While Alternative 2D would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. As discussed for Alternative 4, substantial changes in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 2D are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Relative to Existing Conditions and the No Action Alternative (ELT and LLT), Alternative 2D would lead to predicted improvements in long-term average DOC concentrations at Barker Slough, as well as Banks and Jones pumping plants (discussed below).

SWP/CVP Export Service Areas

Under the Alternative 2D, long-term average DOC concentrations would decrease at Barker Slough (as much as 0.2 mg/L) and at both the Banks and Jones pumping plants (as much as 0.5 mg/L) relative to Existing Conditions, and the reductions would be similar compared to No Action Alternative (ELT) (Table DOC-2 in Appendix B of this RDEIR/SDEIS). Decreases in long-term average DOC would result in generally lower exceedance frequencies for concentration thresholds, although the frequency of exceedances of the 3 mg/L threshold during the modeled drought period would increase at the Banks and Jones pumping plants (i.e., increase at Banks pumping plant from 57% under Existing Conditions to 77% under Alternative 2D). Comparisons to the No Action Alternative (ELT) yield similar trends, but with slightly smaller magnitude drought period changes.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Maintenance of SWP and CVP facilities under Alternative 2D would not be expected to create new sources of DOC or contribute towards a substantial change in existing sources of DOC in the affected area.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 2D, relative to the No Action Alternative (ELT and LLT), would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. The long-term average DOC concentrations at the Barker Slough and Banks and Jones pumping plants are predicted to decrease (by up to 0.5 mg/L), while long-term average DOC concentrations for some Delta interior locations are predicted to increase by as much as 0.3 mg/L. However, the increase in long-term average DOC concentration that could occur within the Delta interior would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters. Based on these findings, the effect of operations and maintenance activities on DOC under Alternative 2D is determined to be not adverse.

CEQA Conclusion: For the same reasons described for Alternative 4, the operations and maintenance activities under Alternative 2D, relative to the Existing Conditions, would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Any modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DOC levels upstream of the Delta. Moreover, long-term average flow and DOC at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in DOC concentrations upstream of the Delta.

Relative to Existing Conditions, the Alternative 2D would result in relatively small increases (i.e., ≤0.3 mg/L) in long-term average DOC concentrations at some interior Delta locations. The predicted increases under the operational scenarios modeled would not substantially increase the frequency with which long-term average DOC concentrations exceeds 2, 3, or 4 mg/L. While the operational scenarios would lead to slightly higher long-term average DOC concentrations at the interior Delta locations and some municipal water intakes, the predicted changes would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

Relative to Existing Conditions, Alternative 2D would result in reduced long-term average DOC concentrations at the Banks and Jones pumping plants and Barker Slough. However, Alternative 2D would result in slightly greater frequency of exceedance of the 3 mg/L DOC concentration threshold during the modeled drought period. Nevertheless, an overall improvement in DOC-related water quality would be predicted in the SWP/CVP Export Service Areas.

Based on the above, the operations and maintenance activities of Alternative 2D would not result in any substantial change in long-term average DOC concentration. The increases in long-term average DOC concentration that could occur within the Delta would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters or waters of the SWP/CVP Service Area. Because DOC is not bioaccumulative, the increases in long-term average DOC concentrations would not directly cause bioaccumulative problems in aquatic life or humans.

Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-18: Effects on Dissolved Organic Carbon Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Relative to existing habitat and that to be developed under the No Action Alternative (ELT and LLT), the area of new habitat restoration implemented for the Environmental Commitments would be very small. Implementation of non-habitat restoration environmental commitments would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, any increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Based on these findings, the effect of the environmental commitments on DOC is determined to be not adverse.

CEQA Conclusion: Implementation of habitat restoration (i.e., Environmental Commitments 4, 6, 7, and 10), relative to the Existing Conditions, is not expected to cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas, because the land area proposed for restoration would be relatively small compared to existing land area and sources of DOC. Implementation of other environmental commitments also would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Furthermore, DOC is not bioaccumulative, therefore changes in DOC concentrations would not cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-19: Effects on Pathogens Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 2D on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described for Alternative 4, pathogen concentrations in the Sacramento and San Joaquin Rivers have a minimal relationship to flow rate in these rivers. Further, urban runoff contributions during the dry season would be expected to be a relatively small fraction of the rivers' total flow rates. During wet weather events, when urban runoff contributions would be higher, the flows in the rivers also would be higher. Given the small magnitude of urban runoff contributions relative to the magnitude of river flows and that pathogen concentrations in the rivers have a minimal relationship to river flow rate, river flow rate and reservoir storage reductions that would occur under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in pathogen concentrations in the reservoirs and rivers upstream of the Delta.

The effects of Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be changes in the relative percentage of water throughout the Delta being comprised of various source waters (i.e., water from the Sacramento River, San Joaquin River, Bay water, eastside tributaries, and agricultural return flow), due to potential changes in inflows particularly from the Sacramento River watershed. However, as described for Alternative 4, it is expected there would be no substantial change in Delta pathogen concentrations in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to pathogens, because it is expected that pathogen sources in close proximity to Delta sites would have a greater influence on pathogen levels at the site, rather than the primary source(s) of water to the site. In-Delta potential pathogen sources, including water-based recreation, tidal habitat, wildlife, and livestock-related uses, would continue under this alternative. As such, there is not expected to be substantial, if even measurable, changes in pathogen concentrations in the SWP/CVP Export Service Area waters.

As such, Alternative 2D would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or U.S. EPA-recommended pathogen criteria would be exceeded in water bodies of the affected environment located upstream of the Delta or substantially degrade the quality of these water bodies, with regard to pathogens.

NEPA Effects: Because pathogen levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on pathogens from implementing Alternative 2D are determined to be not adverse.

CEQA Conclusion: The effects of Alternative 2D on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-20: Effects on Pathogens Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. This could result in localized increases in wildlife-related coliforms relative to the No Action Alternative (ELT and LLT). The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. The remaining environmental commitments would not be expected to affect pathogen levels, because they are actions that do not affect the presence of pathogen sources. Based on these findings, the effects on pathogens from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, and 6–11 could result in localized increases in wildlife-related coliforms relative to Existing Conditions. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. Therefore, the environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-21: Effects on Pesticide Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 2D on pesticide levels in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT), would be similar to those expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because under Alternative 2D, the primary factor that would influence pesticide concentrations in surface waters upstream of the Delta—the effect of timing and magnitude of reservoir releases on dilution capacity—is expected to change by a similar degree. As shown in Tables P-1 through P-4 in Appendix B of this RDEIR/SDEIS, changes in average winter and summer flow rates, relative to Existing Conditions and the No Action Alternative (ELT), are expected to be similar to or less than changes in flow rates expected under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis (shown in Tables 1–4 in Appendix 8L, *Pesticides*, of the Draft EIR/EIS). Similarly, the primary factor that would influence pesticide concentrations in surface waters of the Delta and in the SWP/CVP Export Service Areas (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As shown for Alternative 2D (Figures B.4-67 through B.4-88 in Appendix B of this RDEIR/SDEIS), the percent change in monthly average source water fractions would be similar to changes expected under Alternative 4 (Figures 133–175 in Appendix 8D, *Source Water Fingerprinting Results*, of the Draft EIR/EIS).

It was concluded for Alternative 4, and thus for Alternative 2D based on similar flow changes, that the potential average summer flow reductions would not be of sufficient magnitude to substantially increase in-river pesticide concentrations or alter the long-term risk of pesticide-related effects on aquatic life beneficial uses upstream of the Delta. Greater long-term average flow reductions, and corresponding reductions in dilution/assimilative capacity, would be necessary before long-term risk of pesticide related effects on aquatic life beneficial uses would be adversely altered. Similarly, the modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 2D would not be of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses of the Delta. Based on the general observation that San Joaquin River, in comparison to the Sacramento River, is a greater contributor of organophosphate insecticides in terms of greater frequency of incidence and presence at concentrations exceeding water quality benchmarks, modeled increases in Sacramento River fraction at Banks and Jones would generally represent an improvement in export water quality respective to pesticides.

The flow changes in the LLT would be expected in the ranges of that described above for Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT), and that described for Alternative 4 relative to the No Action Alternative (LLT) in Chapter 8, Section 8.3.3.9, in Appendix A of this RDEIR/SDEIS. Thus, similar to above and Alternative 4, the flow changes that would occur in the LLT under Alternative 2D, relative to Existing Conditions and the No Action Alternative (LLT), would not be expected to result in changes in dilution of pesticides of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses upstream of the Delta, in the Delta, or the SWP/CVP Export Service Areas.

NEPA Effects: In summary, the changes in long-term average flows on the Sacramento, Feather, American, and San Joaquin Rivers under Alternative 2D relative to the No Action Alternative (ELT and LLT) would be of insufficient magnitude to substantially increase the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in these water bodies upstream of the Delta. Similarly, changes in source water fractions to the Delta would be of insufficient magnitude to substantially alter the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in the Delta or CVP/SWP Export Service Areas. Therefore, the effects on pesticides from the water conveyance facilities are determined not to be adverse.

***CEQA Conclusion*:** Based on the discussion above, the effects of Alternative 2D on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or slightly less than those described for the Alternative 4. The considered operational scenarios of Alternative 2D would not result in any substantial change in long-term average pesticide concentration or result in substantial increase in the anticipated frequency with which long-term average pesticide concentrations would exceed aquatic life toxicity thresholds or other beneficial use effect thresholds upstream of the Delta, at the 11 assessment locations analyzed for the Delta, or the SWP/CVP service area. Numerous pesticides are currently used throughout the affected environment, and while some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence for their presence in waters affected by SWP and CVP operations (i.e., diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative, and thus changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, while there are numerous CWA Section 303(d) listings throughout the affected environment that name pesticides as the cause for beneficial use impairment, the modeled changes in upstream river flows and Delta source water fractions under Scenarios H3–H4 would not be expected to make any of these beneficial use impairments measurably worse. Because long-term average pesticide concentrations are not expected to increase substantially, no long-term water quality degradation with respect to pesticides is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-22: Effects on Pesticide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly. Therefore, relative to the No Action Alternative (ELT), the effects on pesticides from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

***CEQA Conclusion*:** Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly, such that pesticide levels would differ little from Existing Conditions. Therefore, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in pesticide concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas. As such, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pesticide concentrations are not expected to increase substantially, no long-term water quality degradation for pesticides is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term pesticide concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Environmental Commitments 3, 4, 6–12, 15, 16 do not include the use of pesticides known to be bioaccumulative in animals or humans, nor do the environmental commitments propose the use of any pesticide currently named in a CWA Section 303(d) listing of the affected environment. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-23: Effects on Phosphorus Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 2D on phosphorus concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because factors which affect phosphorus concentrations in surface waters of these areas are the same under Alternative 4 and Alternative 2D. As described for Alternative 4, phosphorus loading to waters upstream of the Delta is not anticipated to change, and because changes in flows do not necessarily result in changes in concentrations or loading of phosphorus to these water bodies, substantial changes in phosphorus concentration are not anticipated under Alternative 2D, relative to Existing Conditions or the No Action Alternative (ELT and LLT), upstream of the Delta. Phosphorus concentrations may increase during January through March at locations in the Delta where the source fraction of San Joaquin River water increases, due to the higher concentration of phosphorus in the San Joaquin River during these months compared to Sacramento River water or San Francisco Bay water. However, based on the DSM2 fingerprinting results (Figures B.4-1 through B.4-66 in Appendix B of this RDEIR/SDEIS), together with source water concentrations (in Figure 8-56 in Appendix A of the RDEIR/SDEIS), the magnitude of increases during these months is expected to be negligible to low (i.e., <0.02 mg/L) at all Delta locations relative to Existing Conditions and the No Action Alternative (ELT and LLT). Thus, phosphorus concentrations in the Delta and waters exported from Banks and Jones pumping plants to the SWP/CVP Export Service Areas are expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT).

NEPA Effects: In summary, operation of the water conveyance facilities would have little to no effect on phosphorus concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on phosphorus are considered to be not adverse.

CEQA Conclusion**:** The effects of Alternative 2D on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the Alternative 4. There would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 2D relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because phosphorus concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-24: Effects on Phosphorus Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects**:** Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on phosphorus from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, there would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the waters exported to the SWP/CVP Export Service Areas due to implementation of these environmental commitments relative to Existing Conditions. Because phosphorus concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and, thus, the environmental commitments would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, any increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-25: Effects on Selenium Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 2D on selenium concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), because factors affecting selenium concentrations in these water bodies would be similar. Substantial point sources of selenium do not exist upstream in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Nonpoint sources of selenium within the watersheds of the Sacramento River and the eastern tributaries also are relatively low, resulting in generally low selenium concentrations in the reservoirs and rivers of those watersheds. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 2D, relative to Existing Conditions or the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river selenium concentrations upstream of Freeport in the Sacramento River watershed or in the eastern tributaries upstream of the Delta. Similarly, it is expected that selenium concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under Alternative 2D, given the relatively small decreases in flows and the considerable variability in the relationship between selenium concentrations and flows in the San Joaquin River. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-26. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Alternative 2D would result in small changes in average selenium concentrations in water relative to Existing Conditions and No Action Alternative (ELT) at all modeled Delta assessment locations

(Table Se-1 in Appendix B of this RDEIR/SDEIS). Long-term average concentrations at some interior and western Delta locations would increase by 0.01–0.04 µg/L for the entire period modeled (1976–1991). These small increases in selenium concentrations in water would result in small reductions (4% or less) in available assimilative capacity for selenium, relative to USEPA's draft water quality criterion of 1.3 µg/L (Table Se-8c in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water under Alternative 2D (range 0.09–0.40 µg/L) would be similar to Existing Conditions (range 0.09–0.41 µg/L) and the No Action Alternative (ELT) (range 0.09–0.39 µg/L), and would be below the draft water quality criterion of 1.3 µg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS). These changes would be nearly identical to those under Alternative 4.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 2D would result in small changes (about 1% or less) in estimated selenium concentrations in most biota (whole-body fish, bird eggs [invertebrate diet or fish diet], and fish fillets) throughout the Delta, with little difference among locations (Tables Se-2c and Se-4c in Appendix B of this RDEIR/SDEIS). Level of Concern Exceedance Quotients (i.e., modeled tissue divided by Level of Concern benchmarks) for selenium concentrations in those biota for all years and for drought years are less than 1.0, indicating low probability of adverse effects. Similarly, Advisory Tissue Level Exceedance Quotients for selenium concentrations in fish fillets for all years and drought years are less than 1.0. Estimated selenium concentrations in sturgeon for the San Joaquin River at Antioch are predicted to increase by about 19 percent relative to Existing Conditions and to the No Action Alternative (ELT) in all years (from about 4.7 to about 5.6 mg/kg dry weight [dw]), and those for sturgeon in the Sacramento River at Mallard Island are predicted to increase by about 13 percent in all years (from about 4.4 to 5.0 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Selenium concentrations in sturgeon during drought years are expected to increase by about 4 to 7 percent at those locations (from about 6.9 to 7.3 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Detection of small changes in whole-body sturgeon such as those estimated for the western Delta would require very large sample sizes because of the inherent variability in fish tissue selenium concentrations. Low Toxicity Threshold Exceedance Quotients for selenium concentrations in sturgeon in the western Delta would exceed 1.0 for drought years at both locations (as they do for Existing Conditions and the No Action Alternative (ELT)) and for all years in the San Joaquin River at Antioch (where quotient increases from 0.94 to 1.1) (Table Se-7 in Appendix B of this RDEIR/SDEIS). The High Toxicity Threshold Quotient would be less than 1.0 at both locations for all years and drought years (Table Se-7 in Appendix B of this RDEIR/SDEIS).

The disparity between larger estimated changes for sturgeon and smaller changes for other biota is attributable largely to differences in modeling approaches, as described in Appendix 8M, *Selenium*, in Appendix A of this RDEIR/SDEIS. The model for most biota was calibrated to encompass the varying concentration-dependent uptake from waterborne selenium concentrations (expressed as the K_d, which is the ratio of selenium concentrations in particulates [as the lowest level of the food chain] relative to the waterborne concentration) that was exhibited in data for largemouth bass in 2000, 2005, and 2007 at various locations across the Delta. In contrast, the modeling for sturgeon could not be similarly calibrated at the two western Delta locations and used literature-derived uptake factors and trophic transfer factors for the estuary from Presser and Luoma (2013). As noted in Appendix 8M, there was a significant negative log-log relationship of K_d to waterborne selenium concentration that reflected the greater bioaccumulation rates for bass at low waterborne selenium than at higher concentrations. There was no difference in bass selenium concentrations in the Sacramento River at Rio Vista in comparison to the San Joaquin River at Vernalis in 2000, 2005, and 2007 [Foe 2010], despite a nearly 10-fold difference in waterborne selenium. Thus, there is more confidence in the site-specific modeling based on the Delta-wide model that was calibrated for bass data than in the estimates for sturgeon based on “fixed” K_ds for all years and for drought years without regard to waterborne selenium concentration at the two locations in different time periods.

Residence time of water in the Delta is expected to increase relative to Existing Conditions primarily as a result of habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur under the No Action Alternative (ELT) separate from Alternative 2D. Although estimates of the residence time increases are not available for Alternative 2D, estimates for Alternative 2 at the Late Long Term (presented in Table 8-60a in Section 8.3.1.7 of Appendix A in the *Microcystis* subsection) which contained 65,000 acres of tidal restoration are available, and is expected that residence time increases under Alternative 2D would be substantially less than identified for Alternative 2 in the table.

If increases in fish tissue or bird egg selenium were to occur as a result of increased residence time, the increases would likely be of concern only where fish tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is, where biota concentrations are currently low and not approaching thresholds of concern (which, as discussed above, is the case throughout the Delta, except for sturgeon in the western Delta), changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Thus, the most likely area in which biota tissues would be at levels high enough that additional bioaccumulation due to increased residence time from restoration areas would be a concern is the western Delta and Suisun Bay for sturgeon. Based on the expected minor increases in residence time in the western Delta and Suisun Bay, any increases are not expected to be of sufficient magnitude to substantially affect selenium bioaccumulation.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 2D would result in essentially no change in selenium concentrations throughout the Delta for most biota (about 1% or less), although larger increases in selenium concentrations are predicted for sturgeon in the western Delta. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. The modeling of bioaccumulation for sturgeon is less calibrated to site-specific conditions than that for other biota, which was calibrated on a robust dataset for modeling of bioaccumulation in largemouth bass as a representative species for the Delta. Overall, Alternative 2D would not be expected to substantially increase the frequency with which applicable water quality criterion, or toxicity and level of concern benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon relative to the low benchmark and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium. These changes would be similar to those described for Alternative 4.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

SWP/CVP Export Service Areas

Alternative 2D would result in small (0.06–0.09 µg/L) decreases in long-term average selenium concentrations in water at the Banks and Jones pumping plants, relative to Existing Conditions and the No Action Alternative (ELT), for the entire period modeled (Table Se-1 in Appendix B of this RDEIR/SDEIS). These decreases in long-term average selenium concentrations in water would result in increases in available assimilative capacity for selenium at these pumping plants, relative to the USEPA's draft water quality criterion of 1.3 μg/L (Table Se-8c in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water for Alternative 2D (range 0.15–0.19 μg/L) would be well below the draft water quality criterion of 1.3 μg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS).

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 2D would result in small changes (about 1% or less) in estimated selenium concentrations in biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets) (Table Se-4c in Appendix B of this RDEIR/SDEIS). Concentrations in biota would not exceed any selenium toxicity or level of concern benchmarks for Alternative 2D (Table Se-4c in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

***NEPA Effects*:** Relative to the No Action Alternative (ELT and LLT), Alternative 2D would result in essentially negligible changes in selenium concentrations in water upstream of the Delta. Similarly, there would be negligible changes in selenium water and most biota concentrations in the Delta, with no exceedances of benchmarks for biological effects. For sturgeon in the Delta, there would be only a small increase of threshold exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark. At the Banks and Jones pumping plants, Alternative 2D would cause no increases in the frequency with which applicable benchmarks would be exceeded and would slightly improve the quality of water in selenium concentrations. Therefore, the effects on selenium (both as waterborne and as bioaccumulated in biota) from Alternative 2D are considered to be not adverse.

***CEQA Conclusion*:** There are no substantial point sources of selenium in watersheds upstream of the Delta, and no substantial nonpoint sources of selenium in the watersheds of the Sacramento River and the eastern tributaries. Nonpoint sources in the San Joaquin Valley that contribute selenium to the Delta will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board [2010 d] and State Water Board [2010b, 2010c]) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 2, relative to Existing Conditions, are expected to cause negligible changes in selenium concentrations in water. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Relative to Existing Conditions, modeling estimates indicate Alternative 2D would result in essentially no change in selenium concentrations in water or most biota throughout the Delta, with no exceedances of benchmarks for biological effects. The Low Toxicity Threshold Exceedance Quotient for selenium concentrations in sturgeon for all years in the San Joaquin River at Antioch would increase slightly, from 0.94 for Existing Conditions to 1.1 for Alternative 2D. Concentrations of selenium in sturgeon would exceed only the lower benchmark, indicating a low potential for effects. Overall, Alternative 2D would not be expected to substantially increase the frequency with which applicable benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium.

Assessment of effects of selenium in the SWP/CVP Export Service Areas is based on effects on selenium concentrations at the Banks and Jones pumping plants. Relative to Existing Conditions, Alternative 2D would cause no increases in the frequency with which applicable benchmarks would be exceeded, and would slightly improve the quality of water in selenium concentrations at the Banks and Jones pumping plants.

Based on the above, selenium concentrations that would occur in water under Alternative 2D would not cause additional exceedances of applicable state or federal numeric or narrative water quality objectives/criteria, or other relevant water quality effects thresholds identified for this assessment, by frequency, magnitude, and geographic extent that would result in adverse effects to one or more beneficial uses within affected water bodies. In comparison to Existing Conditions, water quality conditions under Alternative 2D would not increase levels of selenium by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of selenium in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Water quality conditions under this alternative with respect to selenium would not cause long-term degradation of water quality in the affected environment, and therefore would not result in use of available assimilative capacity such that exceedances of water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. This alternative would not further degrade water quality by measurable levels, on a long-term basis, for selenium and, thus, cause the CWA Section 303(d)-listed impairment of beneficial use to be made discernibly worse. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-26: Effects on Selenium Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to the No Action Alternative (ELT and LLT), under which more restoration would occur. Therefore, the effects on selenium from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

***CEQA Conclusion*:** Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to Existing Conditions. Therefore, it is expected that with implementation of these environmental commitments there would be no substantial, long-term increase in selenium concentrations in water in the rivers and reservoirs upstream of the Delta, water in the Delta, or the waters exported to the SWP/CVP Export Service Areas, relative to Existing Conditions. As such, these environmental commitments would not contribute to additional exceedances of applicable water quality objectives/criteria. Given the factors discussed in the assessment above and for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), any increases in bioaccumulation rates from waterborne selenium that could occur in some areas as a result of increased water residence times would not be of sufficient magnitude and geographic extent that any portion of the Delta would be expected to have measurably higher body burdens of selenium in aquatic organisms, and therefore would not substantially increase risk for adverse effects to beneficial uses. Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause long-term degradation of water quality resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely. Also, these environmental commitments would not result in substantially increased risk for adverse effects to any beneficial uses. Furthermore, although the Delta is a CWA Section 303(d)-listed water body for selenium, given the discussion in the assessment above, it is unlikely that restoration areas would result in measurable increases in selenium in fish tissues or bird eggs such that the beneficial use impairment would be made discernibly worse.

Because it is unlikely that substantial increases in selenium in fish tissues or bird eggs would occur such that effects on aquatic life beneficial uses would be anticipated, and because of the avoidance and minimization measures that are designed to further minimize and evaluate the risk of such increases (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for more detail on AMM27) as well as the Selenium Management environmental commitment (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS this impact is considered less than significant. No mitigation is required.

Impact WQ-27: Effects on Trace Metal Concentrations Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 2D on trace metal concentrations in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

Given the poor association of dissolved trace metal concentrations with flow, river flow rate and reservoir storage reductions that would occur under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in trace metal concentrations in the reservoirs and rivers upstream of the Delta.

In the Delta, for metals of primarily aquatic life concern (copper, cadmium, chromium, lead, nickel, silver, and zinc), average and 95th percentile trace metal concentrations of the primary source waters to the Delta are very similar, and very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria, including those that are hardness-based (see Tables 8-51 and 8-52 in Appendix A of this RDEIR/SDEIS). No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average and 95th percentile source water concentrations for copper, cadmium, chromium, led, nickel, silver, and zinc do not exceed their respective criteria, more frequent exceedances of criteria in the Delta would not occur. For metals of primarily human health and drinking water concern (arsenic, iron, manganese), average and 95th percentile concentrations are also very similar (see Tables 8–10 in Appendix 8N,*Trace Metals*, of the Draft EIR/EIS) and average concentrations are below human health criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be expected to occur.

Because Alternative 2D would not result in substantial increases in trace metal concentrations in the water exported from the Delta or diverted from the Sacramento River through the proposed conveyance facilities, there is not expected to be substantial changes in trace metal concentrations in the SWP/CVP Export Service Areas, relative to Existing Conditions or the No Action Alternative (ELT and LLT).

As such, Alternative 2D would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals.

NEPA Effects: Alternative 2D would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals, relative to the No Action Alternative (ELT and LLT)., Therefore, the effects on trace metals from implementing Alternative 2D are determined to not be adverse.

CEQA Conclusion: While Alternative 2D would alter the magnitude and timing of reservoir releases north, south and east of the Delta, this would have no substantial effect on the various watershed sources of trace metals. Moreover, long-term average flow and trace metals at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in trace metal concentrations upstream of the Delta.

Average and 95th percentile trace metal concentrations are very similar across the primary source waters to the Delta. Given this similarity, very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that trace metals do not already exceed water quality criteria, more frequent exceedances of criteria in the Delta would not be expected to occur under Alternative 2D.

Because Alternative 2D is not expected to result in substantial changes in trace metal concentrations in Delta waters, which includes Banks and Jones pumping plants, effects on trace metal concentrations in the SWP/CVP Export Service Area are expected to be negligible.

As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur in water bodies of the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-28: Effects on Trace Metal Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Because Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, the effects on trace metal concentrations from implementing these environmental commitments are determined to be not adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in trace metal concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas, because they present no new sources of trace metals to the affected environment. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-29: Effects on TSS and Turbidity Resulting from Facilities Operations and Maintenance

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), the operation of the water conveyance facilities under Alternative 2D is expected to have a minimal effect on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT). This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be the same. TSS concentrations and turbidity levels in rivers upstream of the Delta are affected primarily by: 1) TSS concentrations and turbidity levels of the water released from the upstream reservoirs, 2) erosion occurring within the river channel beds, which is affected by river flow velocity and bank protection, 3) TSS concentrations and turbidity levels of tributary inflows, point-source inputs, and nonpoint runoff as influenced by surrounding land uses; and 4) phytoplankton, zooplankton and other biological material in the water. Within the Delta, TSS concentrations and turbidity levels in Delta waters are affected by TSS concentrations and turbidity levels of inflows (and associated sediment load), as well as fluctuation in flows within the channels due to the tides, with sediments depositing as flow velocities and turbulence are low at periods of slack tide, and sediments becoming suspended when flow velocities and turbulence increase when tides are near the maximum. TSS and turbidity variations can also be attributed to phytoplankton, zooplankton and other biological material in the water. These factors would be similar under Alternative 2D and Alternative 4, are expected to be minimally different from Existing Conditions and the No Action Alternative (ELT and LLT). Because Alternative 2D is expected to have minimal effect on TSS concentrations and turbidity levels in Delta waters, including water exported at the south Delta pumps, relative to Existing Conditions or the No Action Alternative (ELT and LLT), Alternative 2D also is expected to have minimal effect on TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters.

NEPA Effects: Because TSS concentrations and turbidity levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on TSS and turbidity from implementing Alternative 2D are determined to not be adverse.

CEQA Conclusion: As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) changes in river flow rate and reservoir storage that would occur under Alternative 2D, relative to Existing Conditions, would not be expected to result in a substantial adverse change in TSS concentrations and turbidity levels in the reservoirs and rivers upstream of the Delta, given that suspended sediment concentrations are more affected by season than flow. Within the Delta, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years, and high storm event inflows would not be substantially affected. Thus, it is expected that the TSS concentrations and turbidity levels in the affected channels would not be substantially different from the levels under Existing Conditions. There is not expected to be substantial, if even measurable, changes in TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters under Alternative 2D, relative to Existing Conditions, because this alternative is not expected to result in substantial changes in TSS concentrations and turbidity levels at the south Delta export pumps, relative to Existing Conditions. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels are not expected to be substantially different, long-term water quality degradation is not expected, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-30: Effects on TSS and Turbidity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Localized, temporary changes in TSS and turbidity could occur associated with the restoration actions of Environmental Commitments 3, 4, 6–12, 15, and 16. However, these changes would be gradual and not expected to substantially differ from No Action Alternative (ELT and LLT) conditions. Therefore, the effects on TSS and turbidity from implementing these environmental commitments are determined to be not adverse.

***CEQA Conclusion*:** It is expected that the TSS concentrations and turbidity levels Upstream of the Delta, in the Plan Area, and the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not be substantially different relative to Existing Conditions, except within localized areas of the Delta modified through creation of habitat and open water. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels Upstream of the Delta, in the greater Plan Area, and in the SWP/CVP Export Service Areas are not expected to be substantially different, long-term water quality degradation is not expected relative to TSS and turbidity, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-31: Water Quality Effects Resulting from Construction-Related Activities for the Water Conveyance Facilities and Environmental Commitments

The potential construction-related water quality effects that would occur under Alternative 2D would be similar to the effects described for Alternative 4A (see Section 4.3.4 of the RDEIR/SDEIS). This is because the type, size and number of construction activities for water conveyance facilities and environmental commitments that would occur under Alternative 2D would be similar to Alternative 4A. The construction-related activities for the water conveyance facilities under Alternative 2D would be similar to those described for Alternative 4A. However, there would be more construction activity associated with two additional intakes and the area of in-water habitat restoration activities implemented under Alternative 2D would be greater.

NEPA Effects: The types and magnitude of potential construction-related water quality effects associated with implementation of Alternative 2D would be very similar to the effects discussed for Alternative 4A. Nevertheless, the construction of water conveyance facilities and environmental commitments, with the implementation of the BMPs specified in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS and other agency permitted construction requirements, would result in the potential water quality effects being largely avoided and minimized. The specific environmental commitments that would be implemented under Alternative 2D would be similar to those described for Alternative 4A. Consequently, relative to the No Action Alternative (ELT), Alternative 2D would not be expected to cause exceedance of applicable water quality objectives/criteria or substantial water quality degradation with respect to constituents of concern, and thus would not adversely affect any beneficial uses upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Therefore, with implementation of environmental commitments presented in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS, the potential construction-related water quality effects are considered to be not adverse.

CEQA Conclusion: Because environmental commitments would be implemented under Alternative 2D for construction-related activities along with agency-issued permits that also contain construction requirements to protect water quality, the construction-related effects, relative to Existing Conditions, would not be expected to cause or contribute to substantial alteration of existing drainage patterns which would result in substantial erosion or siltation on- or off-site, substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern on a long-term average basis, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. Moreover, because the construction-related activities would be temporary and intermittent in nature, the construction would involve negligible discharges, if any, of bioaccumulative or CWA Section 303(d) listed constituents to water bodies of the affected environment. As such, construction activities would not contribute measurably to bioaccumulation of contaminants in organisms or humans or cause CWA Section 303(d) impairments to be discernibly worse. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-32: Effects on *Microcystis* Bloom Formation Resulting from Facilities Operations and Maintenance

Upstream of the Delta

Adverse effects from *Microcystis* upstream of the Delta have only been documented in lakes such as Clear Lake, where eutrophic levels of nutrients give cyanobacteria a competitive advantage over other phytoplankton during the bloom season. Large reservoirs upstream of the Delta are typically characterized by low nutrient concentrations, where other phytoplankton outcompete cyanobacteria, including *Microcystis*. In the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta under Existing Conditions, bloom development is limited by high water velocity and low residence times. These conditions are not expected to change under Alternative 2D or the No Action Alternative (ELT and LLT). Consequently, any modified reservoir operations under Alternative 2D are not expected to promote *Microcystis* production upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT).

Delta

Modeling that adequately accounted for the effects of water conveyance facilities operations and maintenance and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the six Delta sub-areas was not available for Alternative 2D, so the hydrodynamic effects of this alternative on *Microcystis* were determined qualitatively. For the assessment of Alternative 4, modeling scenarios included assumptions regarding how certain habitat restoration activities of the project alternative would affect Delta hydrodynamics, so the impacts due solely to operations and maintenance of the water conveyance facilities under Alternative 4 could not be determined. Because the assessment for Alternative 2D is qualitative, the effects discussed for the Delta under water conveyance facilities are related solely to operations and maintenance, not the hydrodynamic effects of restoration actions, which are discussed in Impact WQ-33.

The effects of Alternative 2D on *Microcystis* levels, and thus microcystin concentrations in the Delta, relative to Existing Conditions, would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

Under Alternative 2D, a portion of the Sacramento River water which would be conveyed through the Delta to the south Delta intakes under Existing Conditions would be replaced at various locations throughout the Delta by other source water due to diversion of Sacramento River water at the north Delta intake under Alternative 2D. The change in flow paths of water through the Delta that would occur under Alternative 2D could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 2D would result in a net increase in water residence times at various locations throughout the Delta relative to Existing Conditions. In contrast to Alternative 2D, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta at the LLT relative to Existing Conditions.

Besides the effects of operations and maintenance described above, substantial increases in water residence times due to factors unrelated to the project alternative, including habitat restoration (8,000 acres of tidal habitat and enhancements to the Yolo Bypass), sea level rise and climate change, are expected to occur in the Delta, relative to Existing Conditions. Although there is uncertainty regarding the degree to which operations and maintenance of the project alternative would affect water residence times in the Delta, it is likely that such effects would be small in comparison to the combined effects of restoration activities, sea level rise and climate change. Slight increases in ambient water temperatures (1.3–2.5°F), due to climate change in the ELT, are expected to occur in the Delta under Alternative 2D, relative to Existing Conditions. However, due to the combination of the effects of restoration activities unrelated to the project alternative, climate change, and sea level rise on increased residence times, as well as the effects of climate change on increased ambient water temperatures, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur, relative to Existing Conditions. The magnitude by which water temperatures and residence times would increase due to these factors would be less under Alternative 2D than under Alternative 4.

The effects of Alternative 2D on *Microcystis* levels, and thus microcystin concentrations in the Delta relative to the No Action Alternative (ELT and LLT) would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

As described relative to Existing Conditions, operations and maintenance of Alternative 2D could alter source water flow paths through the Delta, which could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 2D would result in a net increase in water residence times at various locations throughout the Delta relative to the No Action Alternative (ELT). The previously discussed influence of factors unrelated to implementation of the project alternative, including habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass), climate change and sea level rise, on increased water residence times, as well as the influence of climate change on increased ambient water temperatures in the Delta, would occur under both Alternative 2D and No Action Alternative (ELT). In summary, operations and maintenance of Alternative 2D is not expected to increase water residence times or ambient water temperatures throughout the Delta, and thus result in adverse effects on *Microcystis*, relative to No Action Alternative (ELT and LLT).

SWP/CVP Export Service Area

The effects of Alternative 2D on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas relative to Existing Conditions would be less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described above for the Delta, source waters to the south Delta intakes could be adversely affected relative to Existing Conditions by *Microcystis* both from an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased Delta water residence times would be primarily related to habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur separate from Alternative 2D. The combined effect of these factors on *Microcystis* in source waters to the south Delta intakes would likely be much greater than the influence of operations and maintenance of Alternative 2D, the effects of which are uncertain. In contrast to Alternative 2D, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta relative to Existing Conditions. Increases in ambient air temperatures due to climate change relative to Existing Conditions are expected under this alternative. Increases in ambient air temperatures are expected to result in warmer ambient water temperatures, and thus conditions more suitable to *Microcystis* growth, in the water bodies of the SWP/CVP Export Service Areas. The incremental increase in long-term average air temperatures would be less at the ELT (2.0°F), compared to the LLT (4.0°F).

The effects of Alternative 2D on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT), are expected to be less than effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because effects of *Microcystis* on water exports from Banks and Jones pumping plants would be different between Alternative 2D and Alternative 4. Specifically, under Alternative 2D, the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (ELT and LLT), as discussed in the *Delta* section above; while under Alternative 4 this fraction of water is expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (LLT). Additionally, conditions in the SWP/CVP Export Service Areas under Alternative 2D are not expected to become more conducive to *Microcystis* bloom formation, relative to the No Action Alternative (ELT and LLT), because neither water residence time nor water temperatures are projected to increase in the SWP/CVP Export Service Areas.

NEPA Effects: For the reasons discussed above, the effects on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas from implementing water conveyance facilities are determined to be not adverse.

CEQA Conclusion: For the reasons described above, the effects of operations and maintenance of water conveyance facilities under Alternative 2D on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas, relative to Existing Conditions, would be less than those described for the Alternative 4. As such, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur under Alternative 2D for reasons unassociated with operations and maintenance of the project alternative, including tidal habitat restoration activities, climate change and sea level rise. While long-term water quality degradation may occur and, thus, impacts on beneficial uses could occur, these impacts are not related to implementation of Alternative 2D. Although there is considerable uncertainty regarding this impact, the effects on *Microcystis* from implementing water conveyance facilities are determined to be less than significant. No mitigation is required.

Impact WQ-33: Effects on *Microcystis* Bloom Formation Resulting from Environmental Commitments

Effects on *Microcystis* from implementation of environmental commitments under Alternative 2D would be the same as those described for Alternative 4A.

NEPA Effects: Based on the discussion for Impact WQ-33 in Section 4.3.4 of this RDEIR/SDEIS, the effects on *Microcystis* from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusions: Based on the discussion for Impact WQ-33 in Section 4.3.4 of this RDEIR/SDEIS, Environmental Commitments 3, 4, 6–12, 15, and 16 would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Because *Microcystis* levels are not expected to increase substantially, no long-term water quality degradation from *Microcystis* or microcystins is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term *Microcystis* levels that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-34: Effects on San Francisco Bay Water Quality Resulting from Facilities Operations and Maintenance and Environmental Commitments

The effects analysis presented in the preceding impacts (Impact WQ-1 through WQ-33) concluded that Alternative 2D would have a less-than-significant impact/no adverse effect on the following constituents in the Delta:

- Boron
- Bromide
- Chloride
- Dissolved organic carbon (DOC)
- Dissolved oxygen
- Pathogens
- Pesticides
- Trace metals
- Turbidity and TSS
- *Microcystis*

Elevated concentrations of boron are of concern in drinking and agricultural water supplies. Chloride, DOC, and bromide concentrations also are of concern in drinking water supplies. However, waters in the San Francisco Bay are not designated to support municipal water supply (MUN) and agricultural supply (AGR) beneficial uses. Changes in Delta dissolved oxygen, pathogens, pesticides, trace metals, and turbidity and TSS are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the Delta. Changes in *Microcystis* would be primarily due to factors unassociated with the project alternative. Thus, changes in boron, bromide, chloride, DOC, dissolved oxygen, pathogens, pesticides, trace metals, turbidity and TSS, and *Microcystis* in Delta outflow associated with implementation of Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT) are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the of San Francisco Bay, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

Elevated EC is of concern for its effects on the agricultural beneficial use (AGR) and fish and wildlife beneficial uses. San Francisco Bay does not have an AGR beneficial use designation. As described for Alternative 4, salinity throughout San Francisco Bay is largely a function of the tides, as well as to some extent the freshwater inflow from upstream. However, the changes in Delta outflow due to Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would be minor compared to tidal flows, and thus no substantial adverse effects on salinity, or fish and wildlife beneficial uses, downstream of the Delta are expected.

Also, as described for Alternative 4, changes in nutrient loading would not be expected to contribute to adverse effects to beneficial uses. Changes in nitrogen (ammonia and nitrate) loading to Suisun and San Pablo Bays under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not adversely impact primary productivity in these embayments because light limitation and grazing current limit algal production in these embayments. Nutrient levels and ratios are not considered a direct driver of *Microcystis* and cyanobacteria levels in the North Bay. The only postulated effect of changes in phosphorus loads to Suisun and San Pablo Bays is related to the influence of nutrient stoichiometry on primary productivity. However, there is uncertainty regarding the impact of nutrient ratios on phytoplankton community composition and abundance. As described for Alternative 4, any effect on phytoplankton community composition would likely be small compared to the effects of grazing from introduced clams and zooplankton in the estuary. Therefore, changes in total nitrogen and phosphorus loading that would occur in Delta outflow to San Francisco Bay, relative to Existing Conditions and the No Action Alternative (ELT and LLT), are not expected to result in degradation of water quality with regard to nutrients that would result in adverse effects to beneficial uses.

Similar to Alternative 4, loads of mercury, methylmercury, and selenium from the Delta to San Francisco Bay are estimated to change relatively little due to changes in source water fractions and net Delta outflow that would occur under Alternative 2D, relative to Existing Conditions and the No Action Alternative (ELT and LLT), because changes in Delta outflow would be similar.

NEPA Effects: Based on the discussion above, Alternative 2D, relative to the No Action Alternative (ELT and LLT), would not cause further degradation to water quality with respect to boron, bromide, chloride, dissolved oxygen, DOC, EC, mercury, pathogens, pesticides, selenium, nutrients (ammonia, nitrate, phosphorus), trace metals, turbidity and TSS, or *Microcystis* in the San Francisco Bay. Further, changes in these constituent concentrations in Delta outflow would not be expected to cause changes in Bay concentrations of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses. In summary, effects on the San Francisco Bay from implementation of water conveyance facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: As with Alternative 4, Alternative 2D would not be expected to cause long-term degradation of water quality in San Francisco Bay resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. Further, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria in the San Francisco Bay by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Any changes in boron, bromide, chloride, and DOC in the San Francisco Bay would not adversely affect beneficial uses, because the uses most affected by changes in these parameters, MUN and AGR, are not beneficial uses of the Bay. Further, no substantial changes in dissolved oxygen, pathogens, pesticides, trace metals, turbidity or TSS, and *Microcystis* are anticipated in the Delta due to the implementation of Alternative 2D, relative to Existing Conditions, therefore, no substantial changes to these constituents levels in the Bay are anticipated. Changes in Delta salinity would not contribute to measurable changes in Bay salinity, as the change in Delta outflow would be two to three orders of magnitude lower than (and thus minimal compared to) the Bay's tidal flow and thus, have minimal influence on salinity changes. Changes in nutrient load, relative to Existing Conditions, are expected to have minimal effect on water quality degradation, primary productivity, or phytoplankton community composition. As with Alternative 4, the change in mercury and methylmercury load (which is based on source water and Delta outflow), relative to Existing Conditions, would be within the level of uncertainty in the mass load estimate and not expected to contribute to water quality degradation, make the CWA Section 303(d) mercury impairment measurably worse or cause mercury/methylmercury to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Similarly, based on Alternative 4 estimates, the increase in selenium load would be minimal, and total and dissolved selenium concentrations would be expected to be the same as Existing Conditions, and less than the target associated with white sturgeon whole-body fish tissue levels for the North Bay. Thus, the change in selenium load is not expected to contribute to water quality degradation, or make the CWA Section 303(d) selenium impairment measurably worse or cause selenium to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

4.4.5 Geology and Seismicity

Impact GEO-1: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking of Water Conveyance Features during Construction

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These intakes would be located where the intakes are sited for Alternative 1A. These differences would present a slightly higher hazard of seismic shaking but would not substantially change the hazard of loss of property, personal injury, or death during construction. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the discussion of Impact GEO-1 under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Seismically induced ground shaking that is estimated to occur and the resultant ground motion anticipated at Alternative 2D construction sites, including the intake locations, the tunnels, the pipelines and the forebays, could cause collapse or other failure of project facilities while under construction. DWR would conform to Cal-OSHA and other state code requirements, such as shoring, bracing, lighting, excavation depth restrictions, required slope angles, and other measures, to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. Conformance with these standards and codes is an environmental commitment of the project (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce this risk and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. This impact would be less than significant. No mitigation is required.

Impact GEO-2: Loss of Property, Personal Injury, or Death from Settlement or Collapse Caused by Dewatering during Construction of Water Conveyance Features

Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. Soil excavation in areas with shallow or perched groundwater levels would require the pumping of groundwater from excavations to allow for construction of facilities. This can be anticipated at all intake locations (Sites 1–5), where 70% of the dewatering for Alternative 2D would take place. All of the intake locations for Alternative 2D are located on alluvial floodbasin deposits, alluvial floodplain deposits and natural levee deposits. Similar dewatering may be necessary where intake and forebay pipelines cross waterways and major irrigation canals east of the Sacramento River and north of the proposed intermediate forebay.

NEPA Effects: This potential effect could be substantial because settlement or collapse during dewatering could cause injury of workers at the construction sites as a result of collapse of excavations. The hazard of settlement and subsequent collapse of excavations would be evaluated by assessing site-specific geotechnical and hydrological conditions at intake locations, as well as where intake and forebay pipelines cross waterways and major irrigation canals. The additional intakes would present a slightly higher hazard of settlement or collapse but would not substantially change the hazard of loss of property, personal injury, or death during construction. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Impact GEO-2, Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Settlement or failure of excavations during construction could result in loss of property or personal injury. However, DWR would conform to Cal-OSHA and other state code requirements, such as using seepage cutoff walls, shoring, and other measures, to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. DWR has made an environmental commitment to use the appropriate code and standard requirements to minimize potential risks (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-3: Loss of Property, Personal Injury, or Death from Ground Settlement during Construction of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These differences would present a slightly higher hazard of ground settlement of tunnels but would not change the hazard of loss of property, personal injury, or death during construction. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4, but somewhat greater due to the two additional structures. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Ground settlement as a result of geotechnical investigation and the tunneling operation could result in loss of property or personal injury during construction. However, DWR would conform to Cal-OSHA, USACE and other design requirements to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. DWR has made conformance to geotechnical design recommendations and monitoring an environmental commitment and an avoidance and minimization measure (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Hazards to workers and project structures would be controlled at safe levels and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-4: Loss of Property, Personal Injury, or Death from Slope Failure during Construction of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional intakes would have a slightly higher hazard of slope failure at borrow and storage sites and would not change the hazard of loss of property, personal injury, or death during construction. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Settlement/failure of cutslopes of borrow sites and failure of soil/RTM fill slopes could result in loss of property or personal injury during construction. However, because DWR would conform to Cal-OSHA and other state code requirements and conform to applicable geotechnical design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-5: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Construction-Related Ground Motions during Construction of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional structures would have a slightly higher hazard of structural failure from construction-related ground motions and would create only a slightly greater hazard of loss of property, personal injury, or death during operation of the water conveyance features due to a greater number of structures. The effects of Alternative 2D would, therefore, be similar to 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Construction-related ground motions could initiate liquefaction, which could cause failure of structures during construction. However, because DWR would conform with Cal-OSHA and other state code requirements and conform to applicable design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a level that would protect worker safety (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-6: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Rupture of a Known Earthquake Fault during Operation of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional intakes would have a slightly higher hazard of fault rupture would have a slight increase on the hazard of loss of property, personal injury, or death during operation of the water conveyance features due to the additional structures. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** There are no active faults capable of surface rupture that extend into the Alternative 2D alignment. Facilities lying directly on or near active blind faults, such as the concrete batch plants and fuel stations near Twin Cities Road and Interstate 5 and at the expanded Clifton Court Forebay, as well as the expanded Forebay itself for Alternative 2D, may have an increased likelihood of loss of property or personal injury at these sites in the event of seismically-induced ground shaking. However, DWR would conform to Cal-OSHA and other state code requirements, such as shoring, bracing, lighting, excavation depth restrictions, required slope angles, and other measures, to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. Conformance with these standards and codes is an environmental commitment of the project (see Appendix 3B, *Environmental Commitments,* in Appendix A of this RDEIR/SDEIS). Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce this risk and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 2D. This impact would be less than significant. No mitigation is required.

Impact GEO-7: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking during Operation of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional intakes would have a slightly higher hazard of structural failure from seismic shaking and would marginally increase the hazard of loss of property, personal injury, or death during operation of the water conveyance features due to the greater number of structures. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Seismically induced strong ground shaking could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities. The damage could disrupt the water supply through the conveyance system. In an extreme event, an uncontrolled release of water from the damaged conveyance system could cause flooding and inundation of structures. (Please refer to Chapter 6, *Surface Water*, of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, which would be supported by geotechnical investigations required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure that ground shaking risks are minimized as the water conveyance features are operated (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-8: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction during Operation of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional intakes would have a slightly higher hazard of structural failure from ground failure and would result in a marginal increase in the hazard of loss of property, personal injury, or death during operation of the water conveyance features due to the greater number of structures. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Seismically induced ground shaking could cause liquefaction. Liquefaction could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities, and thereby disrupt the water supply through the conveyance system. In an extreme event, flooding and inundation of structures could result from an uncontrolled release of water from the damaged conveyance system. (Please refer to Chapter 6, *Surface Water* of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. Conformance with these design standards is an environmental commitment by DWR to ensure that liquefaction risks are minimized as the water conveyance features are operated (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 2D. The impact would be less than significant. No mitigation is required.

Impact GEO-9: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability during Operation of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional structures create a slightly higher hazard of landslides and other slope instability and would only marginally increase the hazard of loss of property, personal injury, or death during operation of the water conveyance features. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Unstable levee slopes and natural stream banks may fail, either from high pore-water pressure caused by high rainfall and weak soil, or from seismic shaking. Structures constructed on these slopes could be damaged or fail entirely as a result of slope instability. However, through the final design process, measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions during facility operations. DWR would also ensure that measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure cut and fill slopes and embankments will be stable as the water conveyance features are operated and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 2D (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-10: Loss of Property, Personal Injury, or Death from Seiche or Tsunami during Operation of Water Conveyance Features

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, but would entail two additional intakes. These additional intakes would create a slightly higher hazard of seiche or tsunami and would only marginally change the hazard of loss of property, personal injury, or death during operation of the water conveyance features due to the additional structures. The effects of Alternative 2D would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Based on recorded tsunami wave heights at the Golden Gate (Contra Costa Transportation Agency 2009) and in the interior of the San Francisco Bay and on tsunami inundation maps prepared by the California Department of Conservation (2009), the height of a tsunami wave reaching the Suisun Marsh and the Delta would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in most parts of the project area is considered low because the seismic hazard and the geometry of the water bodies (i.e., wide and shallow) near conveyance facilities are not favorable for a seiche to occur. However, assuming the West Tracy fault is potentially active, a potential exists for a seiche to occur in the expanded Clifton Court Forebay. The impact would not be significant because the expanded Clifton Court Forebay embankment would be designed and constructed according to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS to contain and withstand the anticipated maximum seiche wave height, as required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). There would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 2D from seiche or tsunami. The impact would be less than significant. No additional mitigation is required.

Impact GEO-11: Ground Failure Caused by Increased Groundwater Surface Elevations from Unlined Canal Seepage as a Result of Operating the Water Conveyance Facilities

NEPA Effects: Alternative 2D would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no effect caused by canal seepage. There would be no adverse effect.

***CEQA Conclusion*:** Alternative 2D would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no impact caused by canal seepage. The impact would be less than significant. No mitigation is required.

Impact GEO-12: Loss of Property, Personal Injury, or Death Resulting from Structural Failure Caused by Rupture of a Known Earthquake Fault at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 2D to those under Alternative 4A, but would involve a slightly greater acreage of restoration, as described in Section 4.1.3.3 of this RDEIR/SDEIS. The effect would be similar to that of Alternative 4A. See Impact GEO-12 under Alternative 4A in this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** According to the available AP Earthquake Fault Zone Maps, only the Suisun Marsh ROA could be affected by rupture of an earthquake fault. The active Green Valley fault crosses the southwestern corner of the ROA. The active Cordelia fault extends approximately 1 mile into the northwestern corner of the ROA. Rupture of the Cordelia and Green Valley faults could occur at the Suisun Marsh ROA and damage ROA facilities, such as levees and berms. Damage to these features could result in their failure, causing flooding of otherwise protected areas. However, Alternative 2D would not include Environmental Commitments in the Suisun Marsh area.

Additionally, the final design process for habitat restoration and enhancement activities in the ROAs would include measures to address the fault rupture hazard, as required to conform to applicable design codes, guidelines, and standards. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, such design codes, guidelines, and standards include the Division of Safety of Dams *Guidelines for Use of the Consequence Hazard Matrix and Selection of Ground Motion Parameters*, DWR's Division of Flood Management *FloodSAFE Urban Levee Design Criteria*, and USACE's *Engineering and Design—Earthquake Design and Evaluation for Civil Works Projects*. Conformance with these design standards is an environmental commitment by the project proponents to ensure that fault rupture risks are minimized as the Environmental Commitments are implemented (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, any hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-13: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 2D to those under Alternative 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.3.3 of this RDEIR/SDEIS. See Impact GEO-13 under Alternative 4A in this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Ground shaking could damage levees, berms, and other structures. Among all the ROAs, the Suisun Marsh ROA would be the most subject to ground shaking because of its proximity to active faults. However, Alternative 2D would not include Environmental Commitments in the Suisun Marsh area. Additionally, conformance with design standards is an environmental commitment by the project proponents to ensure that any remaining strong seismic shaking risks are minimized as the conservation activities are operated and there would be no increased likelihood of loss of property, personal injury or death in the ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-14: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction beneath Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 2D to those under Alternative 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.3.3. See Impact GEO-14 under Alternative 4A in this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Earthquake-induced ground shaking could cause liquefaction, resulting in damage to or failure of levees, berms, and other features constructed at the restoration areas. Failure of levees and other structures could result in flooding of otherwise protected areas. However, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, such design codes, guidelines, and standards include USACE's *Engineering and Design—Stability Analysis of Concrete Structures* and *Soil Liquefaction during Earthquakes,* by the Earthquake Engineering Research Institute. Conformance with these design standards is an environmental commitment by the project proponents to ensure that liquefaction risks are minimized as the water conservation features are implemented (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-15: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 2D to those under 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.3.3. See Impact GEO-15 under Alternative 4A in this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Unstable new and existing levee and embankment slopes could fail as a result of seismic shaking and as a result of high soil-water content during heavy rainfall and cause flooding of otherwise protected areas. However, because project proponents would conform to applicable design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-16: Loss of Property, Personal Injury, or Death from Seiche or Tsunami at Restoration Opportunity Areas as a Result of Implementing the Conservation Actions

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 2D to those under 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.3.3. The distance from the ocean and attenuating effect of the San Francisco Bay would likely allow only a low tsunami wave height to reach the Suisun Marsh and the Delta. Conditions for a seiche to occur at the ROAs are not favorable. Therefore, the effect would not be adverse.

CEQA Conclusion: Based on recorded tsunami heights at the Golden Gate Bridge, the height of a tsunami wave reaching the ROAs would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in the project area that would cause loss of property, personal injury, or death at the ROAs is considered low because conditions for a seiche to occur at the ROAs are not favorable. The impact would be less than significant. No mitigation is required.

4.4.6 Soils

Impact SOILS-1: Accelerated Erosion Caused by Vegetation Removal and Other Soil Disturbances as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. These intakes would be identical to where the intakes are sited for Alternative 1A. These differences would present a slightly higher hazard of accelerated soil erosion because the primary work areas that would involve extensive soil disturbance (i.e., staging areas, borrow areas, and intakes) within the Alternative 2D footprint are underlain by soils with a moderate or high susceptibility to wind erosion (Natural Resources Conservation Service 2010a) (Figure 10-6). However, the addition of two additional intakes would not substantially change the project effects on water soil erosion. The effects of Alternative 2D would, therefore, be similar to those under Alternative 4. See the discussion of Impact SOILS-1 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Construction of the proposed water conveyance facility under Alternative 2D could cause substantial accelerated erosion. DWR would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS). Proper implementation of the requisite SWPPP and compliance with the General Permit (as discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would ensure that there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs as a result of construction of the proposed water conveyance facility. Additionally, implementation of the environmental commitment Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material would help reduce wind blowing of excavated soils, particularly peat soils, during transport and placement at spoils storage, disposal, and reuse areas. Therefore, there would not be an adverse effect.

***CEQA Conclusion*:** Vegetation removal and other soil disturbances associated with construction of water conveyance facilities could cause accelerated water and wind erosion of soil. However, DWR would seek coverage under the state General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. As a result of implementation of the requisite SWPPP, and compliance with the General Permit, there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs the effect would be less than significant. No mitigation is required.

Impact SOILS-2: Loss of Topsoil from Excavation, Overcovering and Inundation as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. Construction operations would be the same as under Alternative 4 but occur over a larger area, and therefore the effects on topsoil under Alternative 2D would be slightly greater than those under Alternative 4, but would otherwise be similar. See the discussion of Impact SOILS-2 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., forebays, borrow areas, tunnel shafts, levee foundations, intake facilities, pumping plants):

overcovering (e.g., levees and embankments, spoil storage, pumping plants); and water inundation (e.g., forebays, sedimentation basins, and solids lagoons). DWR has made an environmental commitment for Disposal Site Preparation which would require that a portion of the temporary sites selected for storage of spoils, RTM and dredged material will be set aside for topsoil storage and the topsoil would be saved for reapplication to disturbed areas, thereby lessening the effect. However, this effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Construction of the water conveyance facilities would involve excavation, overcovering, and inundation of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil despite a commitment for Disposal Site Preparation. The impact on soils in the project area would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts, but not to a less-than-significant level because topsoil would be permanently lost over extensive areas. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact SOILS-3: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on or in Soils Subject to Subsidence as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes. The locations of these intakes would be identical to the intake sites proposed under Alternative 1A and would be constructed in areas in which the near-surface soils have approximately 2–4% organic matter content. Compared to organic soils, these mineral soils would not be subject to appreciable subsidence caused by organic matter decomposition because there is relatively little organic matter available to decompose. However, without adequate engineering, certain structures (such as the forebay levees and interior) could be subject to appreciable subsidence resulting in potentially adverse effects. Damage to or collapse of the project facilities could occur if they are constructed in soils and sediments that are subject to subsidence or differential settlement. Therefore the effects from potential soil subsidence under Alternative 2D would be similar to those under Alternative 4, but greater due to two additional structures. See the discussion of Impact SOILS-3 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. Geotechnical studies (as described in the Geotechnical Exploration Plan—Phase 2 [California Department of Water Resources 2014]) would be conducted at all facilities to identify the types of soil avoidance or soil stabilization measures that should be implemented to ensure that the facilities are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards (Appendix 3B, *Environmental*

Commitments, in Appendix A of this RDEIR/SDEIS). These investigations would build upon the geotechnical data reports (California Department of Water Resources 2010a, 2010b, 2011) and the CERs (California Department of Water Resources 2010a, 2010b, 2015), as well as the results of the investigations that will be conducted under the Geotechnical Exploration Plan—Phase 2 (California Department of Water Resources 2014). Conforming to state and federal design standards (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS), including conduct of site-specific geotechnical evaluations, would ensure that appropriate design measures are incorporated into the project and any subsidence that takes place under the project facilities would not jeopardize their integrity. Therefore, there would not be an adverse effect.

CEQA Conclusion**:** Some of the conveyance facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, as stated in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR would be required to design and construct the facilities according to state and federal design standards and guidelines (e.g., California Building Code, American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures, ASCE-7-10, 2010). Conforming to these codes would reduce the potential hazard of subsidence or settlement to acceptable levels by avoiding construction directly on or otherwise stabilizing the soil material that is prone to subsidence. Because these measures would reduce the potential hazard of subsidence or settlement to meet design standards, the impact would be less than significant. No mitigation is required.

Impact SOILS-4: Risk to Life and Property as a Result of Constructing the Proposed Water Conveyance Facilities in Areas of Expansive, Corrosive, and Compressible Soils

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes. These intakes would be located where the intakes were sited for Alternative 1A. Some of the intakes would be built on soils with high shrink-swell potential (note areas of high linear extensibility in Figure 10-4 in the Draft EIR/EIS). The remainder of the alignment would have similar properties of expansiveness, corrosivity, and compressibility as discussed under Alternative 4. Therefore, the effects under Alternative 2D would therefore be similar to those under Alternative 4, but slightly greater. See discussion of Impact SOILS-4 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: The integrity of the water conveyance facilities, including tunnels, pipelines, intake facilities, pumping plants, access roads and utilities, and other features could be adversely affected because they would be located on expansive, corrosive, and compressible soils. However, all facility design and construction would be executed in conformance with the CBC (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS), which specifies measures to mitigate effects of expansive soils, corrosive soils, and soils subject to compression and subsidence. By conforming to the CBC and other applicable design standards, potential effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset. There would be no adverse effect.

CEQA Conclusion**:** Some of the project facilities would be constructed on soils that are subject to expansion, corrosion to concrete and uncoated steel, and compression under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression/settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, because DWR would be required to design and construct the facilities in conformance with state and federal design standards, guidelines, and building codes (e.g., CBC and USACE design standards). Conforming to these codes and standards is an environmental commitment by DWR to ensure that potential adverse effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, this impact would be less than significant. No mitigation is required.

Impact SOILS-5: Accelerated Bank Erosion from Increased Channel Flow Rates as a Result of Operations

Alternative 2D has identical operations to Alternative 2A but would have the same potential effect on accelerated bank erosion as under Alternative 4. See the discussion of Impact SOILS-5 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: River channel bank erosion/scour is a natural process. The rate of natural erosion can increase during high flows and as a result of wave effect on banks during high wind conditions.

In general, changes in river flow rates associated with project operations would remain within the range that presently occurs. However, the operational components would cause changes in the tidal flows in some Delta channels, specifically those that lead into the major habitat restoration areas (Suisun Marsh, Cache Slough, Yolo Bypass, and South Delta ROAs). In major channels leading to the restoration areas, tidal flow velocities may increase; this may cause some localized accelerated erosion/scour.

However, the increased flows would be offset by implementation of Environmental Commitment 4 which could involve dredging of these major channels, which would create a larger channel cross-section (see description of restoration actions in Chapter 3, *Description of Alternatives*, Section 3.6.2, in Appendix A of this RDEIR/SDEIS). The larger cross-section would allow river flow rates to be similar to that of other high tidal flows in the region. Moreover, as presently occurs and as is typical with most naturally-functioning river channels, local erosion and deposition within the tidal habitats is expected as part of the restoration.

For most of the existing channels that would not be subject to tidal flow restoration, there would be no adverse effect to tidal flow volumes and velocities. The tidal prism would increase by 5–10%, but the intertidal (i.e., MHHW to MLLW) cross-sectional area also would be increased such that tidal flow velocities would be reduced by 10–20% compared to Existing Conditions. Consequently, no appreciable increase in scour is anticipated.

The effect would not be adverse because there would be no net increase in river flow rates and, accordingly, no net increase in channel bank scour.

***CEQA Conclusion*:** Changes in operational flow regimes could cause increases in flow rates in channels and sloughs, potentially leading to increases in channel bank scour. However, where such changes are expected to occur (i.e., at the mouths of tidal marsh channels), the project would also entail expansion of the channel cross-section to increase the tidal prism at these locations described in Chapter 3, *Description of Alternatives*, Section 3.6.2, in Appendix A of this RDEIR/SDEIS. The net effect would be to reduce the channel flow rates by 10–20% compared to Existing Conditions. Consequently, no appreciable increase in scour is anticipated. The impact would be less than significant. No mitigation is required.

Impact SOILS-6: Accelerated Erosion Caused by Clearing, Grubbing, Grading, and Other Disturbances Associated with Implementation of Proposed Environmental Commitments 3, 4, 6-11

Effects on accelerated erosion from implementation of Environmental Commitments under Alternative 2D, as described in Section 4.1.3.3 of this RDEIR/SDEIS, would be similar in mechanism and magnitude to those described for Alternative 4A. Any differences would be due to differing acreages or locations, but would be slight. See the discussion in Section 4.3.6 of Impact SOILS-6 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: Implementation of some of the Environmental Commitments under Alternative 2D would involve ground disturbance and construction activities that could lead to accelerated soil erosion rates and consequent loss of topsoil. However, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, the project proponents would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper implementation of the requisite SWPPP, site-specific BMPs, and compliance with the General Permit would ensure that accelerated water and wind erosion as a result of implementing Environmental Commitments would not be an adverse effect.

***CEQA Conclusion*:** Vegetation removal and other soil disturbances associated with construction of restoration areas could cause accelerated water and wind erosion of soil. However, the project proponents would seek coverage under the state General Permit for Construction and Land Disturbance Activities. Permit conditions would include erosion and sediment control BMPs and compliance with water quality standards. As a result of implementation of permit conditions, the impact would be less than significant. No mitigation is required.

Impact SOILS-7: Loss of Topsoil from Excavation, Overcovering and Inundation Associated with Restoration Activities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 2D on loss of topsoil would be similar in mechanism to those described for Alternative 4A. Differences in Environmental Commitments, as described in Section 4.1.3 of this RDEIR/SDEIS, would be slight. See the discussion in Section 4.3.6 of Impact SOILS-7 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., levee foundations, water control structures); overcovering (e.g., levees, embankments, application of fill material in subsided areas); and water inundation (e.g., aquatic habitat areas) over areas of the Plan Area. Based on ICF's calculations using a geographic information system, implementation of habitat restoration activities at the ROAs would result in excavation, overcovering, or inundation of a minimum of over a thousand acres of topsoil. This effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Significant impacts could occur if there is loss of topsoil from excavation, overcovering, and inundation associated with restoration activities as a result of implementing the proposed Environmental Commitments. Implementation of the Environmental Commitments would involve excavation, overcovering, and inundation (to create aquatic habitat areas) of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil. The impact would be significant.

Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts to a degree, but not to a less-than-significant level. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact SOILS-8: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on Soils Subject to Subsidence as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 2D (as described in Section 4.1.3 of this RDEIR/SDEIS) related to subsidence would be similar in mechanism to those described for Alternative 4A. See the discussion of Impact SOILS-8 under Alternative 4A in Appendix A of this RDEIR/SDEIS.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. However, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, geotechnical studies would be conducted at all the ROAs to identify the types of soil stabilization that should be implemented to ensure that levees, berms, and other features are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards.

With construction of all levees, berms, and other conservation features designed and constructed to withstand subsidence and settlement and through conformance with applicable state and federal design standards, this effect would not be adverse.

***CEQA Conclusion*:** Some of the restoration area facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, as outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project proponents would be required to design and construct the facilities according to state and federal design standards and guidelines (which may involve, for example, replacement of the organic soil), the impact would be less than significant. No mitigation is required.

Impact SOILS-9: Risk to Life and Property from Construction in Areas of Expansive, Corrosive, and Compressible Soils as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 2D, as described in Section 4.1.3 of this RDEIR/SDEIS, resulting from construction of conservation actions in areas of expansive, corrosive, or compressible soils would be similar in mechanism to those described for Alternative 4A. See the discussion of Impact SOILS-9 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: ROA specific geotechnical studies and testing would be completed prior to construction of the Environmental Commitments within the ROAs. The site-specific studies and tests would identify specific areas where engineering soil properties, including soil compressibility, may require special consideration during construction of specific features within ROAs. Conformity with USACE, CBC and other design standards for construction on expansive, corrosive and/or compressible soils described in detail in Chapter 10, *Soils*, in the Draft EIR/EIS, would prevent adverse effects of such soils.

***CEQA Conclusion*:** Some of the Environmental Commitments facilities could be constructed on soils that are subject to expansion, corrosive to concrete and uncoated steel, and compress under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression or settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, as outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project proponents would be required to design and construct the facilities according to state and federal design standards, guidelines, and building codes (which may involve, for example, soil lime stabilization, cathodic protection of steel, and soil replacement), this impact would be considered less than significant. No mitigation is required.

4.4.7 Fish and Aquatic Resources

The principal features of Alternative 2D are described in section 4.1.3. This alternative is similar to Alternative 4A in terms of water conveyance facilities but includes five north Delta intakes as opposed to three under Alternative 4A, as well as Operational Scenario B (as opposed to Operational Scenario H3+ for Alternative 4A). The analysis below includes a comparison between Alternative 2D in the early long term (a scenario termed A2D_ELT when discussing results based on water operations modeling) and the No Action Alternative in the early long term (a scenario termed NAA_ELT, which is the baseline for NEPA purposes), as well as a comparison between A2D_ELT and Existing Conditions (which is the baseline for CEQA purposes, and is at the current time frame as opposed to the early long term). Additionally, the effects of Alternative 2D in the LLT are similar to the effects of the alternative in the ELT, except where noted.

Delta Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-1: Effects of Construction of Water Conveyance Facilities on Delta Smelt

The potential effects of construction of the water conveyance facilities on delta smelt or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-1) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to delta smelt.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-1, the effect would not be adverse for delta smelt or designated critical habitat. This is because local water quality conditions (very low electrical conductivity and typically low turbidity) in the proposed north Delta intakes reach limits habitat suitability. In addition, changes to Clifton Court Forebay occur in a marginal environment within which delta smelt are trapped once entrained, with little prospect of effective salvage. The principal in-water work activities at the Head of Old River operable barrier will be conducted during August–November, and therefore would have minimal temporal overlap with delta smelt; the location of this site generally would be expected to result in minimal spatial overlap with delta smelt. Moreover, any habitat losses will be offset by restoration of up to 65 acres of tidal habitat and the beneficial operational effects of Alternative 2D (described below) on the Delta as a whole.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-1, the impact of the construction of water conveyance facilities on delta smelt and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-2: Effects of Maintenance of Water Conveyance Facilities on Delta Smelt

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-2, the effect would not be adverse for delta smelt.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-2 for delta smelt, the impact of the maintenance of water conveyance facilities on delta smelt or critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-3: Effects of Water Operations on Entrainment of Delta Smelt

Water Exports from SWP/CVP South Delta Facilities

Overall, operational activities under Alternative 2D would benefit delta smelt by reducing average proportional entrainment at the south Delta facilities. Average juvenile proportional entrainment (March–June) would be 0.13 (i.e., 13% of the juvenile population) under Alternative 2D, which would be reduced 0.007 (a 5% relative decrease) compared to baseline (0.13 for the No Action Alternative in the early long-term [NAA_ELT]) (Table 11-2D-1). As described under Alternative 1A and Alternative 2A (Impact AQUA-3), the greatest relative reductions in larval/juvenile proportional entrainment would be in wetter years (28% to 33% relative decrease compared to NAA_ELT). Average adult proportional entrainment (December–March) for all water year types would be reduced under Alternative 2D by 0.02 (a 28% relative decrease) under Alternative 2D compared to NAA_ELT (Table 11-2D-1).

Table 11-2D-1. Differences in Proportional Entrainment of Delta Smelt at SWP/CVP South Delta Facilities

	Proportional Entrainment[a] Difference in Proportions (Relative Change in Proportions)	
Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Total Population		
Wet	-0.047 (-43%)	-0.028 (-13%)
Above Normal	-0.045 (-28%)	-0.055 (-48%)
Below Normal	-0.004 (-2%)	-0.054 (-32%)
Dry	0.016 (6%)	-0.016 (-7%)
Critical	0.001 (0%)	0.0 (0%)
All Years	-0.019 (-9%)	0.002 (1%)
Larval/Juvenile Delta Smelt (March–June)		
Wet	-0.007 (-18%)	-0.015 (-33%)
Above Normal	-0.016 (-19%)	-0.025 (-28%)
Below Normal	0.011 (8%)	-0.002 (-1%)
Dry	0.023 (13%)	0.008 (4%)
Critical	0.004 (2%)	0.004 (2%)
All Years	0.003 (3%)	-0.007 (-5%)
Adult Delta Smelt[b] (December–March)		
Wet	-0.040 (-58%)	-0.040 (-57%)
Above Normal	-0.029 (-36%)	-0.029 (-36%)
Below Normal	-0.016 (-19%)	-0.015 (-18%)
Dry	-0.008 (-9%)	-0.008 (-10%)
Critical	-0.004 (-5%)	-0.001 (-2%)
All Years	-0.022 (-28%)	-0.021 (-28%)
	Shading indicates >5% or more increased entrainment.	

Note: Negative values indicate lower entrainment loss under Alternative 2D than under EXISTING CONDITIONS or NAA_ELT.

[a] Proportional entrainment index (U.S. Fish and Wildlife Service 2008a).

[b] Adult proportional entrainment adjusted according to Kimmerer (2011).

Water Exports from SWP/CVP North Delta Intake Facilities

As described for Alternative 1A and for Alternative 2A (Impact AQUA-3 for delta smelt), delta smelt would face potential entrainment and impingement at the proposed north Delta diversion facilities. The exposure to potential entrainment would be low, however, because only a very small proportion of the population occurs at this location. The intakes would be screened to exclude fish larger than 22-mm SL, which would include juvenile delta smelt. There would be potential negative effects from entrainment of smaller life stages (eggs and larvae) and potential impingement and screen contact by juveniles and adults (Appendix B, *Entrainment*, Section B.6.2.3).

Predation Associated with Entrainment

As described in Impact AQUA-3 for Alternative 2A, pre-screen losses of delta smelt at the SWP/CVP facilities are believed to be high. Under Alternative 2D, pre-screen losses at the south Delta facilities would decrease commensurate with entrainment reductions described above. Structures associated with the proposed north Delta intakes could attract piscivorous fish, potentially increasing localized predation risk. However few delta smelt would be expected to occur in the vicinity of the north Delta intakes, thus limiting their exposure to the predation risk.

NEPA Effects: Under Alternative 2D, overall potential entrainment of delta smelt would be reduced at the south Delta SWP/CVP facilities. Entrainment and impingement could potentially occur at the proposed north Delta intakes, but the risk would be low due to the location, design and operation of intakes, and offset by reduced entrainment at the south Delta facilities. Furthermore, any potential effects would be reduced by monitoring and adaptive management through real-time operations. Overall, Alternative 2D would not have an adverse effect and may be beneficial to delta smelt due to a small reduction in entrainment and associated predation losses at the south Delta facilities, and minimal entrainment at the north Delta facilities.

CEQA Conclusion: As described above, operations under Alternative 2D would reduce average adult proportional entrainment by 0.022 (a 28% relative decrease) compared to Existing Conditions. Larval/juvenile entrainment would be similar or slightly greater (3% relative increase) on average, and increase by 0.023 (13% relative increase) in dry years compared to Existing Conditions (Table 11-2D-1). However, this would affect a small proportion of the population (0.3% on average, 2.3% in below normal years).

This CEQA interpretation of the biological modeling differs from the NEPA analysis, which is likely attributable to different modeling assumptions (as described fully in Section 11.3.3 and Alternative 1A Impact AQUA-3). Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. Note that the analysis for larvae and juveniles includes both OMR flows and X2 as predictors of proportional entrainment; primarily because of sea level rise assumptions, X2 would be further upstream in the ELT even with similar water operations, so that the comparison of the action alternative in the ELT to Existing Conditions is confounded.

Therefore, the impact analysis is better informed by the results from the NEPA analysis presented above, which accounts for sea level rise by considering the NAA in the ELT. When climate change is factored in, larval-juvenile delta smelt proportional entrainment is reduced 0.007 (5% relative decrease) on average compared to conditions without BDCP, and is similar or only slightly greater in below normal years (Table 11-2D-1).

The risk of entrainment and impingement at the proposed north Delta intakes is low due to the low abundance of delta smelt in the vicinity, and would be further minimized by fish screens.

Overall, Alternative 2D would not significantly increase entrainment and associated predation losses at the south Delta facilities, and would minimize entrainment at the north Delta facilities. Furthermore, any potential impacts would be reduced by monitoring and adaptive management by real-time operations. The impact is considered to be less than significant, and no mitigation would be required.

Impact AQUA-4: Effects of Water Operations on Spawning and Egg Incubation Habitat for Delta Smelt

NEPA Effects: The effects of operations under Alternative 2D on abiotic spawning habitat would be similar to those described for Alternative 2A (Impact AQUA-4). Flow reductions below the north Delta intakes would not reduce available spawning habitat. In-Delta water temperatures, which can affect spawning timing, would not change across Alternatives, because they would be in thermal equilibrium with atmospheric conditions and not strongly influenced by the flow changes. The effect of Alternative 2D operations on spawning would not be adverse, because there would be little change in abiotic spawning conditions for delta smelt.

CEQA Conclusion: As described above, operations under Alternative 2D would not reduce abiotic spawning habitat availability or change spawning temperatures for delta smelt. Consequently, the impact would be less than significant, and no mitigation is required.

Impact AQUA-5: Effects of Water Operations on Rearing Habitat for Delta Smelt

As described for Alternative 4A (Impact AQUA-5 for delta smelt), rearing habitat conditions for juvenile delta smelt were evaluated using the fall abiotic habitat index (Feyrer et al. 2011); further details and limitations of this method are discussed under Alternative 4A. Alternative 2D includes the BiOp Fall X2 requirements, and as such the abiotic habitat index under Alternative 2D would be similar to NAA_ELT (Table 11-2D-3).

NEPA Effects: Inclusion of the BiOp Fall X2 requirements results in there being little difference in abiotic habitat between Alternative 2D and NAA_ELT, when applying the fall abiotic habitat index method. As such, this effect would not be adverse.

Table 11-2D-3. Differences in Delta Smelt Fall Abiotic Index (hectares) between Alternative 2D (A2D_ELT) and Existing Conditions/NAA_ELT Scenarios, Averaged by Prior Water Year Type

Water Year	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
All	1,133 (28%)	82 (2%)
Wet	2,476 (53%)	36 (1%)
Above Normal	2,007 (52%)	62 (1%)
Below Normal	199 (5%)	161 (4%)
Dry	138 (4%)	149 (4%)
Critical	8 (0%)	8 (0%)

Note: Negative values indicate lower habitat indices under preliminary proposal scenarios. Water year 1922 was omitted because water year classification for prior year was not available.

CEQA Conclusion: Alternative 2D would not result in less rearing habitat area (based on the Feyrer et al. 2011 abiotic habitat index) compared to Existing Conditions. Averaged across all water year types, Alternative 2D would result in an overall increase in the abiotic habitat index by 28% (Table 11-2D-3). This increase is a function of Alternative 2D including the BiOp Fall X2 requirements in wet and above normal years (Existing Conditions does not include Fall X2). The NEPA analysis is a better approach for isolating the effect of the Alternative from the effects of sea level rise, climate change, future water demands, and implementation of required actions under the BiOps such as the Fall X2 requirement. When compared to the NAA_ELT and informed by the NEPA analysis, the average delta smelt abiotic habitat index under Alternative 2D would be similar to NAA_ELT (Table 11-2D-3).

The impact of Alternative 2D would be less than significant. No mitigation is required.

Impact AQUA-6: Effects of Water Operations on Migration Conditions for Delta Smelt

More detailed discussion of water temperature and turbidity as migration cues for delta smelt is provided under Alternative 4A. As described above in Impact AQUA-4, in-Delta water temperatures would not change in response to Alternative 2D flows. Although Alternative 2D would result in sediment being removed at the north Delta intakes, Alternative 2D is not expected to affect suspended sediment concentration during the first flush of precipitation that cues delta smelt migration. With regard to suspended sediment concentrations at other times of the year, any effect will be minimized through the reintroduction of sediment collected at the north Delta intakes into tidal natural communities restoration projects (Environmental Commitment 4), consistent with the Environmental Commitment addressing Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material.

NEPA Effects: Alternative 2D may decrease sediment supply to the estuary, with the potential for decreased habitat suitability for delta smelt in some locations, but there would not be an adverse effect during the migration period and water temperature would not be affected by Alternative 2D water operations. Operations of Alternative 2D would not affect turbidity or temperatures during the migration period, and therefore the impact on migration conditions for delta smelt would not be adverse relative to NAA_ELT.

CEQA Conclusion: As described above, operations under Alternative 2D would not substantially alter the turbidity cues associated with winter flush events that may initiate the adult delta smelt migration. Additionally there would be no appreciable changes in water temperatures under Alternative 2D. Consequently, the impact on adult delta smelt migration conditions would be less than significant, and no mitigation is required.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-7: Effects of Construction of Restoration Measures on Delta Smelt

Impact AQUA-8: Effects of Contaminants Associated with Restoration Measures on Delta Smelt

Impact AQUA-9: Effects of Restored Habitat Conditions on Delta Smelt

Impact AQUA-10: Effects of Methylmercury Management on Delta Smelt (Environmental Commitment 12)

Impact AQUA-13: Effects of Localized Reduction of Predatory Fish on Delta Smelt (Environmental Commitment 15)

Impact AQUA-14: Effects of Nonphysical Fish Barriers on Delta Smelt (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on delta smelt for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Longfin Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-19: Effects of Construction of Water Conveyance Facilities on Longfin Smelt

The potential effects of construction of the water conveyance facilities on longfin smelt would be similar to those described for Alternative 4A (Impact AQUA-19) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to longfin smelt.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-19, the effect would not be adverse for longfin smelt.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-19, the impact of the construction of water conveyance facilities on longfin smelt would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-20: Effects of Maintenance of Water Conveyance Facilities on Longfin Smelt

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-20, the effect would not be adverse for longfin smelt.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-20, the impact of the maintenance of water conveyance facilities on longfin smelt would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-21: Effects of Water Operations on Entrainment of Longfin Smelt

Water Exports from SWP/CVP South Delta Facilities

For larval longfin smelt, particle tracking model simulations indicate that overall the magnitude of entrainment risk is low under all hydrologic conditions and starting geographic distributions (wetter and drier). Average entrainment loss under Alternative 2D with the wetter starting distribution was 1.0% compared to 1.7% under NAA_ELT, a 41% relative decrease (Table 11-2D-4). Average entrainment loss with the drier starting distribution was 1.3% for Alternative 2D compared to 2.2% under NAA_ELT, a 42% decline in relative terms. The risk of entrainment would be greater during years when outflows during late winter and spring are low (generally in dry years, as modeled by the drier distribution), with reduced entrainment under Alternative 2D compared to baseline conditions. Overall, larval entrainment would be reduced under Alternative 2D relative to NAA_ELT.

Table 11-2D-4. Percentage of Particles (and Difference) Representing Longfin Smelt Larvae Entrained by the South Delta Facilities under Alternative 2D and Baseline Scenarios

	Percent Particles Entrained			Difference (and Relative Difference)	
Starting Distribution	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	A2D_ELT vs. EXISTING CONDITIONS	A2D_ELT vs. NAA_ELT
Wetter	1.9	1.7	1.0	-0.88 (-47%)	-0.70 (-41%)
Drier	2.5	2.2	1.3	-1.21 (-48%)	-0.94 (-42%)

Note: 60-day runs of PTM. Negative difference values indicate lower entrainment under the alternative compared to the baseline scenario.

As with the other alternatives, juvenile and adult longfin smelt entrainment at the south Delta facilities was estimated with the salvage-density method, normalized to fall midwater trawl index values. Entrainment under Alternative 2D would be reduced compared to NAA_ELT. Entrainment averaged across all water year types would be reduced for juvenile longfin smelt by 52% compared to NAA_ELT; entrainment would decrease for adults by 67% compared to NAA_ELT (Table 11-2D-5). As discussed for Alternative 2A (Impact AQUA-21 for longfin smelt), entrainment would be highest in critical years. Under Alternative 2D, entrainment in critical years would be reduced 32% for juveniles and 17% for adults, compared to NAA_ELT. This reflects substantial reductions in south Delta exports under Alternative 2D for December to June.

Table 11-2D-5. Longfin Smelt Entrainment Index (March–June) at the SWP and CVP Salvage Facilities and Differences (Absolute and Percentage) between Model Scenarios

		Absolute Difference (Percent Difference)	
Life Stage	Water Year Types	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Juvenile (March–June)	Wet	-52,583 (-82%)	-56,464 (-83%)
	Above Normal	-2,093 (-46%)	-2,370 (-49%)
	Below Normal	-524 (-17%)	-522 (-17%)
	Dry	-13,883 (-3%)	-61,071 (-11%)
	Critical	-197,270 (-35%)	-172,763 (-32%)
	All Years	-129,613 (-48%)	-152,345 (-52%)
Adult (December–March)	Wet	-100 (-78%)	-106 (-79%)
	Above Normal	-438 (-67%)	-489 (-70%)
	Below Normal	-938 (-48%)	-1,030 (-51%)
	Dry	-384 (-32%)	-400 (-33%)
	Critical	-5,968 (-24%)	-3,847 (-17%)
	All Years	-2,382 (-66%)	-2,452 (-67%)
	Shading indicates >5% increase in entrainment index.		

Water Exports from SWP/CVP North Delta Intake Facilities

The proposed new north Delta intakes would increase entrainment potential in this area, but entrainment of longfin smelt and potential exposure to predators at the diversion structures would be extremely low because this species is rarely encountered in surveys this far upstream (California Department of Fish and Game 2012a; 2012b; 2013b).

In summary, under Alternative 2D potential entrainment of longfin smelt would be reduced at the SWP/CVP south Delta facilities. Entrainment loss of longfin smelt at the proposed north Delta intakes would be rare because longfin smelt are not expected to occur in that area of the Sacramento River, and the intakes would be screened.

Predation Associated with Entrainment

Pre-screen loss of longfin smelt at the south Delta facilities is typically attributed to predation (as described for Impact AQUA-3 for Alternative 1). Under Alternative 2D, pre-screen loss is expected to decrease commensurate with entrainment reductions. Predation loss at the proposed north Delta intakes would be limited because longfin smelt rarely occur that far upstream.

NEPA Effects: In conclusion, the effect on entrainment and entrainment-related predation loss under Alternative 2D would be beneficial because of the substantial reduction in entrainment and predation loss at the south Delta facilities.

CEQA Conclusion: As described above, entrainment loss of longfin smelt would be reduced under Alternative 2D. Entrainment and associated predation loss at the south Delta facilities under Alternative 2D would decrease 48% for juveniles and 66% for adults compared to Existing Conditions. Based on particle tracking simulations, entrainment of larval longfin smelt to the south delta facilities would be expected to be less than baseline under most scenarios. Predation loss at the proposed north Delta intakes would be limited because longfin smelt rarely occur that far upstream.

The impact under Alternative 2D would be beneficial to the species because of the reduction in entrainment and predation loss for both juveniles and adults.

Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt

As noted for Alternative 4A, background on the general distribution of longfin smelt and the evidence for relationships between longfin smelt abundance with freshwater outflow is provided in detail in the discussion for Alternative 4. The X2–longfin smelt abundance relationship provided by Kimmerer et al. (2009) was used to evaluate the effects of the alternatives on longfin smelt, following the historical observation that lower X2 (farther downstream) correlates with increased recruitment (represented by abundance indices in trawl surveys), although it is not understood if or how this would affect spawning, egg incubation, and/or rearing longfin smelt. Relationships between X2 and longfin smelt abundance developed by Kimmerer et al. (2009) were used to determine how the changes in winter-spring X2 position described above might influence longfin smelt abundance the following fall.

NEPA Effects: Modeling results based on Kimmerer et al. (2009) predict longfin smelt Fall Midwater and Bay Otter Trawl indices would decrease for most water year types, relative to NAA_ELT, based on changes in winter-spring flow alone (Table 11-2D-7). Alternative 2D operations would be expected to result in 8–9% lower longfin smelt abundance compared to NAA_ELT, for all years combined.

Table 11-2D-7. Estimated Differences between Scenarios for Longfin Smelt Relative Abundance in the Fall Midwater Trawl or Bay Otter Trawl

	Fall Midwater Trawl Relative Abundance		Bay Otter Trawl Relative Abundance	
Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
All	-1,627 (-18%)	-601 (-8%)	-6,382 (-21%)	-2,243 (-9%)
Wet	-3,490 (-18%)	-1204 (-7%)	-14,526 (-21%)	-4663 (-8%)
Above Normal	-1,842 (-18%)	-843 (-9%)	-6,885 (-21%)	-3,159 (-11%)
Below Normal	-896 (-20%)	-372 (-9%)	-2,862 (-23%)	-1,224 (-12%)
Dry	-410 (-18%)	-148 (-7%)	-1,179 (-21%)	-431 (-9%)
Critical	-54 (-5%)	4 (0%)	-141 (-7%)	6 (0%)
	Shading indicates greater than 10% decrease in relative abundance.			

During the period of longfin smelt rearing from January–June, Delta outflows would be similar (<10% difference) to NAA_ELT in all months except April and May, when flows averaged all years would be reduced 12%. The adverse effect of reduced Delta outflow on longfin smelt would be minimized with Mitigation Measures AQUA-22a-c (see below) but would remain adverse.

CEQA Conclusion: Average Delta outflow under Alternative 2D would be similar (less than 5% difference, averaged over all years) to Existing Conditions in winter (January, February, March) and decreased in spring (13% in April, 17% in May, 14% in June). Relative longfin smelt abundance based on Kimmerer et al. 2009 decreased 18–21% on average compared to Existing Conditions (Table 11-2D-7), with greatest reductions in below normal water years (20–23% lower under Alternative 2D).

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2 could be significant because the alternative could substantially reduce relative abundance based on Kimmerer et al. 2009. However, and as noted for Alternative 4A, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed above (Section 11.3.3), because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA) models anticipated future conditions that would occur at 2025, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the NEPA analysis, which compares results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, longfin smelt relative abundance, based on Kimmerer et al. (2009), decreased 8% to 9% on average relative to conditions without BDCP (Table 11-2D-7). These modeling results represent the increment of change attributable to the alternative and address the limitations of the comparison the CEQA baseline (Existing Conditions). The Adaptive Management and Monitoring Program included in Alternative 2D would allow for an evaluation of the necessary volume and timing of spring outflow. However, based on the Kimmerer et al. (2009) approach applied for this analysis, Alternative 2D would result in a significant impact on longfin smelt due to a decrease in abundance of 8% to 9% for a species experiencing a sustained poor population status (the 2014 fall midwater trawl index was the second lowest on record). Because of the potential for this alternative to reduce longfin smelt abundance, this impact is considered significant. To mitigate this effect, Mitigation Measures AQUA-22a, AQUA-22b, and AQUA 22c would be implemented. However, no feasible mitigation exists and as such, based on the Kimmerer et al. (2009) regression, this impact is considered significant and unavoidable.

Mitigation Measure AQUA-22a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Longfin Smelt to Determine Feasibility of Mitigation to Reduce Impacts to Spawning and Rearing Habitat

Please refer to Mitigation Measure AQUA-22a under Alternative 1A, Impact AQUA-22.

Mitigation Measure AQUA-22b: Conduct Additional Evaluation and Modeling of Impacts on Longfin Smelt Rearing Habitat Following Initial Operations of Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-22b under Alternative 1A, Impact AQUA-22.

Mitigation Measure AQUA-22c: Consult with USFWS and CDFW to Identify and Implement Feasible Means to Minimize Effects on Longfin Smelt Rearing Habitat Consistent with Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-22c under Alternative 1A, Impact AQUA-22.

Impact AQUA-23: Effects of Water Operations on Rearing Habitat for Longfin Smelt

The analysis, NEPA Effects and CEQA Conclusion for effects of water operations on rearing habitat for longfin smelt is included in *Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt.*

Impact AQUA-24: Effects of Water Operations on Migration Conditions for Longfin Smelt

The analysis, NEPA Effects and CEQA Conclusion for effects of water operations on migration conditions for longfin smelt is included in *Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt.*

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-25: Effects of Construction of Restoration Measures on Longfin Smelt

Impact AQUA-26: Effects of Contaminants Associated with Restoration Measures on Longfin Smelt

Impact AQUA-27: Effects of Restored Habitat Conditions on Longfin Smelt

Impact AQUA-28: Effects of Methylmercury Management on Longfin Smelt (Environmental Commitment 12)

Impact AQUA-31: Effects of Localized Reduction of Predatory Fish on Longfin Smelt (Environmental Commitment 15)

Impact AQUA-32: Effects of Nonphysical Fish Barriers on Longfin Smelt (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on longfin smelt for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Winter-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-37: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

The potential effects of construction of the water conveyance facilities on winter-run Chinook salmon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-37) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to winter-run Chinook salmon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-37, the effect would not be adverse for winter-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-37, the impact of the construction of water conveyance facilities on winter-run Chinook salmon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-38: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-38, the effect would not be adverse for winter-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-38 for winter-run Chinook salmon, the impact of the maintenance of water conveyance facilities on winter-run Chinook salmon or critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-39: Effects of Water Operations on Entrainment of Chinook Salmon (Winter-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Entrainment losses would be reduced under Alternative 2D (A2D_ELT) at the south Delta facilities. Losses for all years combined would decrease by approximately 4,700 fish (67–68%) compared to NAA_ELT (Table 11-2D-8). Entrainment would be reduced in all water year types, ranging from moderate reductions in critical water years (15% fewer fish compared to NAA_ELT) to significant reductions in wet years (90% fewer fish entrained) (Table 11-2D-8). Pre-screen losses, typically attributed to predation, would be expected to decrease commensurate with decreased entrainment at the south Delta facilities.

The proportion of the annual winter-run Chinook population (assumed to be 500,000 juveniles approaching the Delta) lost at the south Delta facilities across all years is very small, averaging 1.4% under NAA_ELT and decreasing to 0.45% under Alternative 2D.

Table 11-2D-8. Juvenile Winter-Run Chinook Salmon Annual Entrainment Index at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)[a]	
Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-10,212 (-90%)	-10,935 (-90%)
Above Normal	-5,424 (-82%)	-5,574 (-82%)
Below Normal	-3,890 (-54%)	-4,076 (-55%)
Dry	-853 (-22%)	-717 (-20%)
Critical	-262 (-21%)	-171 (-15%)
All Years	-4,553 (-67%)	-4,701 (-68%)

Shading indicates10% or greater increased entrainment.

[a] Estimated annual number of fish lost, based on normalized data.

Water Exports from SWP/CVP North Delta Intake Facilities

The effect of Alternative 2D on entrainment and impingement at the North Delta facilities would be the same as described for Alternative 2A (Impact AQUA-39) because both alternatives would have state-of-the-art screens installed to prevent entrainment and be designed to minimize impingement.

Predation Associated with Entrainment

Pre-screen loss of juvenile Chinook salmon at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 2D, commensurate with entrainment reductions. Predation at the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River. Application of bioenergetics modeling for ELT water temperature with a median predator density for the five intakes proposed under Alternative 2D predicts increased predation loss of about 7,450 juveniles, or 0.29% of the winter-run Chinook salmon juvenile index of abundance under Alternative 2D (Table 11-2D-1; note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 4A; See additional discussion under Impact AQUA-42).

Table 11-2D-1. Winter-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes (Five Intakes for Alternative 2D)

Striped Bass at NDD (Five Intakes)			Winter-Run Chinook Consumed	
Density Assumption	Bass per 1,000 Feet of Intake	Total Number of Bass	Number	Percentage of Annual Juvenile Production Entering the Delta[1]
Low	18	154	1,127	0.04%
Median	119	1,017	7,449	0.29%
High	219	1,872	13,708	0.53%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 2.6 million juveniles. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

NEPA Effects: Due to reduced entrainment and associated predation loss at the south Delta facilities, together with state-of-the-art screening at the north Delta intakes, the effect of Alternative 2D water operations on winter-run Chinook entrainment would be not be adverse and would be beneficial.

CEQA Conclusion: As described above, entrainment losses of juvenile Chinook salmon at the south Delta facilities would decrease under Alternative 2D (A2D_ELT) compared to Existing Conditions (Table 11-2D-8). At the north Delta facilities, the screened intakes as designed would exclude this species, although there is some potential for impingement or contact by smaller fish with the screen, as well as predation near the screens. Overall impacts of Alternative 2D water operations on entrainment of Chinook salmon (winter-run ESU) would be less than significant and would be beneficial due to a reduction in entrainment and no mitigation would be required.

Impact AQUA-40: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Winter-Run ESU)

In general, Alternative 2D would reduce the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to NAA_ELT.

Mean flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam were examined during the May through September winter-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation. Flows under A2D_ELT during May, through August would generally be similar to or greater than flows under NAA_ELT. Flows under A2D_ELT during September would generally be lower than flows under NAA_ELT by up to 18%. These modeling results indicate that there would generally be no flow-related effects of Alternative 2D on spawning and egg incubation habitat except during September, in which there would be intermittent negligible-to-small flow reductions.

Shasta Reservoir storage volume at the end of May influences flow rates below the dam during the May through September winter-run spawning and egg incubation period. May Shasta storage volume under A2D_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-2D-9).

Table 11-2D-9. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-19 (0%)	-7 (0%)
Above Normal	-89 (-2%)	-63 (-1%)
Below Normal	-102 (-2%)	-6 (0%)
Dry	-230 (-6%)	-27 (-1%)
Critical	-218 (-9%)	79 (4%)

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no substantial differences (<5%) in mean monthly water temperature between NAA_ELT and A2D in any month or water year type throughout the period at either location.

The number of days on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-12. There would be 3 (4%) more years with a "red" level of concern under A2D_ELT than under NAA_ELT. This difference would not be biologically meaningful to winter-run Chinook salmon spawners and eggs, as the 3 years constitute a small proportion of the 82 year period used for analysis, as long as the years were not consecutive, which they were not in this case.

Table 11-2D-10. Maximum Water Temperature Thresholds for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Location	Period	Maximum Water Temperature °F)	Purpose
Upper Sacramento River			
Bend Bridge	May–Sep	56	Winter- and spring-run spawning and egg incubation
		63	Green sturgeon spawning and egg incubation
Red Bluff	Oct–Apr	56	Spring-, fall-, and late fall–run spawning and egg incubation
Hamilton City	Mar–Jun	61 (optimal), 68 (lethal)	White sturgeon spawning and egg incubation
Feather River			
Robinson Riffle (RM 61.6)	Sep–Apr	56	Spring-run (Sep-Jan) and steelhead (Jan-Apr) spawning and incubation
	May–Aug	63	Spring-run and steelhead rearing
Gridley Bridge	Oct–Apr	56	Fall- and late fall–run spawning and steelhead rearing
	May–Sep	64	Green sturgeon spawning, incubation, and rearing
American River			
Watt Avenue Bridge	May–Oct	65	Juvenile steelhead rearing

Table 11-2D-11. Number of Days per Month Required to Trigger Each Level of Concern for Water Temperature Exceedances in the Sacramento River for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Exceedance above Water Temperature Threshold (°F)	Level of Concern			
	None	Yellow	Orange	Red
1	0-9 days	10-14 days	15-19 days	≥20 days
2	0-4 days	5-9 days	10-14 days	≥15 days
3	0 days	1-4 days	5-9 days	≥10 days

Table 11-2D-12. Differences between Baseline and Alternative 2D Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Red	29 (59%)	3 (4%)
Orange	-10 (-71%)	-2 (-50%)
Yellow	-16 (-100%)	-1 (NA)
None	-3 (-100%)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] For definitions of levels of concern, see Table 11-2D-11.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-2D-13). Total degree-days (all water year types combined) under A2D would be up to 12% lower than under NAA_ELT during May and June and up to 10% higher during July through September.

Table 11-2D-13. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
May	Wet	458 (121%)	-41 (-4.7%)
	Above Normal	107 (50%)	-128 (-29%)
	Below Normal	253 (116%)	-35 (-7%)
	Dry	196 (105%)	-89 (-19%)
	Critical	175 (79%)	-43 (-10%)
	All	1,189 (98%)	-336 (-12%)
June	Wet	280 (73%)	-85 (-11%)
	Above Normal	56 (38%)	-58 (-22%)
	Below Normal	122 (88%)	-18 (-6%)
	Dry	144 (77%)	-65 (-16%)
	Critical	183 (46%)	-61 (-9%)
	All	786 (62%)	-286 (-12%)
July	Wet	261 (50%)	39 (5%)
	Above Normal	119 (147%)	43 (27%)
	Below Normal	172 (117%)	-12 (-4%)
	Dry	332 (118%)	75 (14%)
	Critical	775 (94%)	-9 (-1%)
	All	1,659 (90%)	136 (4%)
August	Wet	971 (139%)	35 (2%)
	Above Normal	339 (83%)	53 (8%)
	Below Normal	500 (189%)	8 (1%)
	Dry	1,134 (169%)	326 (22%)
	Critical	1,236 (83%)	-40 (-1%)
	All	4,181 (119%)	383 (5%)
September	Wet	116 (16%)	107 (14%)
	Above Normal	197 (28%)	317 (53%)
	Below Normal	771 (103%)	318 (27%)
	Dry	1,381 (108%)	132 (5%)
	Critical	1,000 (48%)	-30 (-1%)
	All	3,466 (62%)	844 (10%)

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be lower or similar to mortality under NAA_ELT except in below normal water years (25% higher). The increase in the percent of winter-run population subject to mortality in below normal years would be 0.3%. Therefore, the increase in mortality from NAA_ELT to A2D_ELT during a below normal year, although large on a relative scale (i.e., 25%

difference), would be negligible at an absolute scale to the winter-run population (i.e., 0.3%; Table 11-2D-14).

Table 11-2D-14. Difference and Percent Difference in Percent Mortality of Winter-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0.3 (85%)	-0.01 (-2%)
Above Normal	0.4 (90%)	-0.04 (-4%)
Below Normal	1 (72%)	0.3 (25%)
Dry	2 (106%)	0.02 (1%)
Critical	20 (75%)	-3 (-5%)
All	4 (78%)	-0.3 (-4%)

SacEFT predicts that there would be a 24% decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-15). On an absolute scale, this reduction would be smaller (i.e., 11%). SacEFT predicts that the percentage of years with good (lower) redd scour risk under A2D_ELT would be similar to the percentage of years under NAA_ELT. SacEFT predicts that the percentage of years with good egg incubation conditions under A2D_ELT would be similar to that under NAA_ELT. SacEFT predicts that there would be a 17% decrease (5% on an absolute scale) in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to NAA_ELT. These results indicate that there would be small to moderate negative effects of Alternative 2D on spawning habitat.

The biological significance of a reduction in available suitable spawning habitat varies at the population level in response to a number of factors, including adult escapement. For those years when adult escapement is less than the carrying capacity of the spawning habitat, a reduction in area would have little or no population level effect. In years when escapement exceeds carrying capacity of the reduced habitat, competition among spawners for space (e.g., increased redd superimposition) would increase, resulting in reduced reproductive success. The reduction in the frequency of years in which spawning habitat availability is considered to be good by SacEFT could result in reduced reproductive success and abundance of winter-run Chinook salmon if the number of spawners is limited by spawning habitat quantity. However, it is unlikely that spawning habitat is limiting to winter-run Chinook salmon due to their small spawning adult population sizes in recent years relative to historical numbers.

Table 11-2D-15. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Winter-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Spawning WUA	-23 (-40%)	-11 (-24%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-9 (-9%)	0 (0%)
Redd Dewatering Risk	-1 (-4%)	-5 (-17%)
Juvenile Rearing WUA	-5 (-10%)	8 (22%)
Juvenile Stranding Risk	-5 (-25%)	-17 (-53%)

WUA = Weighted Usable Area.

NEPA Effects: Considering the range of results presented here for winter-run Chinook salmon spawning and egg incubation, this effect would be adverse because it has the potential to substantially reduce suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. There would be small to moderate reductions in flow during September that would degrade spawning and egg incubation conditions for winter-run Chinook salmon. Total degree-days would be up to 10% higher under Alternative 2D during a substantial portion (3 of 5 months) of the spawning and egg incubation period. Further, SacEFT predicts that the number of years with good winter-run spawning habitat would be reduced by 24% under Alternative 2D and the number of years with good (lower) redd dewatering risk would be 5% lower (Table 11-2D-15). This effect is a result of the specific reservoir operations and resulting flows associated with this alternative. Applying mitigation (e.g., changing reservoir operations in order to alter the flows) to the extent necessary to reduce this effect to a level that is not adverse would fundamentally change the alternative, thereby making it a different alternative than that which has been modeled and analyzed. As a result, this would be an unavoidable adverse effect because there is no feasible mitigation available. Even so, proposed mitigation (Mitigation Measure AQUA-40a through AQUA-40c) has the potential to reduce the severity of impact, although not necessarily to a not adverse level.

CEQA Conclusion: In general, Alternative 2D would degrade the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to the Existing Conditions.

CALSIM mean flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the May through September winter-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to flows under Existing Conditions during May through August with few exceptions (up to 14% lower) and would generally be up to 24% lower during September.

Shasta Reservoir storage volume at the end of May under A2D_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% and 9% in dry and critical water years, respectively (Table 11-2D-9). This indicates that there would be a small to moderate effect of Alternative 2D on flows during the spawning and egg incubation period.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and

Alternative 2D throughout the period except in critical years during August and September at Keswick (6% and 5% higher, respectively) and in critical years during August at Bend Bridge (6% higher).

The number of days on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. The number of years classified as "red" would increase by 59% under A2D relative to Existing Conditions (Table 11-2D-12). This would cause a negative effect to winter-run Chinook salmon spawning and egg incubation.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-2D-13). Total degree-days (all water year types combined) under A2D would be 62% to 119% higher than that under Existing Conditions depending on month throughout the period. This would cause a negative effect to winter-run Chinook salmons spawning and egg incubation.

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be 72 to 106% greater on a relative scale and up to 20% greater on an absolute scale than mortality under Existing Conditions depending on water year type (Table 11-2D-14). These increases would only affect the winter-run population during critical years, in which the absolute percent increase of the winter-run population would be 20%. These results indicate that Alternative 2D would cause increased winter-run Chinook salmon egg mortality in the Sacramento River.

SacEFT predicts that there would be a 40% decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-15). SacEFT predicts that the percentage of years with good (lower) redd scour risk under A2D_ELT would be similar to the percentage of years under Existing Conditions. SacEFT predicts that the percentage of years with good egg incubation conditions under A2D_ELT would be 9% lower than under Existing Conditions. SacEFT predicts that the percentage of years with good (lower) redd dewatering risk under A2D_ELT would be 4% lower than the percentage of years under Existing Conditions. These results indicate that Alternative 2D would cause large reductions in spawning WUA. However, due to the highly suppressed population size of winter-run Chinook salmon relative to historical population sizes, it is unlikely that spawning habitat is currently limiting.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would be significant because it has the potential to substantially reduce suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. Reservoir storage would be lower under Alternative 2D, particularly in critical years (9% lower). The number of years with a red level of concern regarding water temperatures and exceedances of NMFS temperature thresholds would be substantially greater under Alternative 2D. Egg mortality in drier years, during which winter-run Chinook salmon would already be stressed due to reduced flows and increased temperatures, would be up to 75% greater due to Alternative 2D compared to the Existing Conditions (Table 11-2D-14). Further, the number of years with "good" spawning habitat would be 40% lower due to Alternative 2D compared to the Existing Conditions (Table 11-2D-15), which represents a substantial reduction in spawning habitat and, therefore, in adult spawner and redd carrying capacity. This impact is a result of the specific reservoir operations and resulting flows associated with this alternative. Applying mitigation (e.g., changing reservoir operations in order to alter the flows) to the extent necessary to reduce this impact to a less-than-significant level would fundamentally change the alternative, thereby making it a different alternative than that which has been modeled and analyzed. As a result, this impact is significant and unavoidable because there is no feasible mitigation available. Even so, proposed below is mitigation that has the potential to reduce the severity of impact though not to a less-than-significant level.

Mitigation Measure AQUA-40a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Winter-Run Chinook Salmon to Determine Feasibility of Mitigation to Reduce Impacts to Spawning Habitat

Although analysis conducted as part of the EIR/EIS determined that Alternative 2D would have significant and unavoidable adverse effects on spawning habitat, this conclusion was based on the best available scientific information at the time and may prove to have been overstated. Upon the commencement of operations of water conveyance facilities and continuing through the life of the permit, the project proponents will monitor effects on spawning habitat in order to determine whether such effects would be as extensive as concluded at the time of preparation of this document and to determine any potentially feasible means of reducing the severity of such effects. This mitigation measure requires a series of actions to accomplish these purposes, consistent with the operational framework for Alternative 2D.

The development and implementation of any mitigation actions shall be focused on those incremental effects attributable to implementation of Alternative 2D operations only. Development of mitigation actions for the incremental impact on spawning habitat attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 2D.

Mitigation Measure AQUA-40b: Conduct Additional Evaluation and Modeling of Impacts on Winter-Run Chinook Salmon Spawning Habitat Following Initial Operations of Water Conveyance Facilities

Following commencement of initial operations of water conveyance facilities and continuing through the life of the permit, the project proponents will conduct additional evaluations to define the extent to which modified operations could reduce impacts to spawning habitat under Alternative 2D. The analysis required under this measure may be conducted as a part of the Adaptive Management and Monitoring Program.

Mitigation Measure AQUA-40c: Consult with NMFS, USFWS, and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Winter-Run Chinook Salmon Spawning Habitat Consistent with Water Conveyance Facilities

In order to determine the feasibility of reducing the effects of water conveyance facilities operations on winter-run Chinook salmon habitat, the project proponents will consult with NMFS, USFWS and CDFW to identify and implement any feasible operational means to minimize effects on spawning habitat. Any such action will be developed in conjunction with the ongoing monitoring and evaluation of habitat conditions required by Mitigation Measure AQUA-40d.

If feasible means are identified to reduce impacts on spawning habitat consistent with the overall operational framework of Alternative 2D without causing new significant adverse impacts on other covered species, such means shall be implemented. If sufficient operational flexibility to reduce effects on winter-run Chinook salmon habitat is not feasible under Alternative 2D operations, achieving further impact reduction pursuant to this mitigation measure would not be feasible under this Alternative, and the impact on winter-run Chinook salmon would remain significant and unavoidable.

Impact AQUA-41: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Winter-Run ESU)

In general, Alternative 2D would not reduce the quantity and quality of rearing habitat for fry and juvenile winter-run Chinook salmon relative to NAA_ELT.

Sacramento River mean flows between Keswick and upstream of Red Bluff were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix *B, Supplemental Modeling for New Alternatives*). Lower flows can lead to reduced extent and quality of fry and juvenile rearing habitat. Flows under A2D_ELT would generally be lower than flows under NAA_ELT by up to 24% during September and November, and similar to flows under NAA_ELT during August, October and December. The biological implications of the flow reductions is analyzed below in the SALMOD and SacEFT analyses.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under A2D_ELT would be 22% higher on a relative scale (8% on an absolute scale) than the percentage of years under NAA_ELT (Table 11-2D-14). However, the percentage of years with good (low) juvenile stranding risk under A2D_ELT is predicted to be 53% lower on a relative scale (17% on an absolute scale)) than under NAA_ELT. These results indicate that the quantity of juvenile rearing habitat in the Sacramento River would be slightly higher under A2D_ELT relative to NAA_ELT, but the quality of this habitat, with respect to stranding risk, would be reduced.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under A2D_ELT would be 5% lower than the habitat-related mortality with NAA_ELT. These results are inconsistent with SacEFT results, which indicate that juvenile stranding risk would increase under A2D_ELT (Table 11-2D-14).

Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about winter-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile stranding risk may increase under Alternative 2D, when combined with all early life stage effects in SALMOD, the effects of Alternative 2D would be marginally beneficial to winter-run Chinook salmon survival. Further, these results indicate that the August through November flow reductions in the Sacramento River identified above would not have a biological effect on winter-run Chinook salmon rearing.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 2D is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat and substantially interfere with winter-run Chinook salmon rearing. There would be no substantial effects of Alternative 2D on flows or water temperatures. SALMOD and SacEFT predicted contradicting results regarding habitat-related mortality. SacEFT found that juvenile stranding risk is expected to increase. However, the SALMOD model found that Alternative 2D would provide a minor beneficial effect (5% reduction in habitat-related mortality) to early life stages of winter-run Chinook salmon. The SALMOD results include the effects to all early life stages combined and, therefore, are more representative of the overall effects to winter-run Chinook salmon in the upper Sacramento River.

CEQA Conclusion: In general, Alternative 2D would not reduce the quantity and quality of fry and juvenile rearing habitat for winter-run Chinook salmon relative to the Existing Conditions.

Sacramento River mean flows between Keswick and upstream of Red Bluff were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to flows under Existing Conditions during December, but up to 24% lower than Existing Conditions during August, September, October, and November, except for September of wet and above normal years (to 29% greater).

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D throughout the period except in critical years during August and September at Keswick (6% and 5% higher, respectively) and in critical years during August at Bend Bridge (6% higher).

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under A2D_ELT would be 10% lower on a relative scale (5% lower on an absolute scale) than under Existing Conditions (Table 11-2D-14). In addition, the percentage of years with good (low) juvenile stranding risk under A2D_ELT is predicted to be 25% lower on a relative scale (5% lower on an absolute scale) than under Existing Conditions. This indicates that the quantity and quality, with respect to stranding, of juvenile rearing habitat in the Sacramento River would be marginally lower under A2D_ELT relative to Existing Conditions.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under A2D_ELT would not be different (<5%) from that under Existing Conditions. These results are somewhat inconsistent with SacEFT results, which indicate that the number of years with good juvenile rearing WUA and with good (low) stranding risk would both decrease under A2D_ELT (Table 11-2D-14). Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP. Therefore, results of both models were used to draw conclusions about winter-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile stranding risk may increase under A2D_ELT, when combined with all early life stage effects in SALMOD, A2D_ELT is predicted to have minor effects on winter-run Chinook salmon rearing.

Summary of CEQA Conclusion

These modeling results indicate that the impact could be significant because it has the potential to substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish. Differences in flows are moderately large during the majority of months and water year types. Water temperatures would be higher than those under NAA_ELT in the Sacramento River during critical water years, when winter-run Chinook salmon would already be stressed due to reduced flows and increased temperatures, in a portion of the winter-run rearing period. SALMOD and SacEFT predicted contradicting results regarding habitat-related mortality, although, because SALMOD incorporates more of the life cycle of winter-run Chinook salmon, its results are more representative of overall effects to winter-run Chinook salmon in the upper Sacramento River.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 2D. SacEFT predicts that juvenile stranding risk may increase under Alternative 2D, but when combined with all early life stage effects in SALMOD, the effects of the alternative would be marginally beneficial to winter-run Chinook salmon. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-42: Effects of Water Operations on Migration Conditions for Chinook Salmon (Winter-Run ESU)

In general, the effects of Alternative 2D on winter-run Chinook salmon migration conditions relative to the NAA_ELT are adverse because although the operations of the NDD would take into account triggers developed by DFW and NMFS that would allow for adjustments in NDD operations to minimize and avoid effects on Chinook salmon and steelhead, the cumulative effects associated with five north Delta intake facilities, including mortality related to near-field effects (e.g. impingement and predation) and far-field effects (reduced survival due to reduced flows downstream of the intakes) associated with the five NDD intakes poses an unacceptable risk to winter-run Chinook salmon.

Upstream of the Delta

Mean flows in the Sacramento River upstream of Red Bluff were examined for the July through November juvenile emigration period. A substantial reduction in flow may reduce the ability of juvenile winter-run Chinook salmon to migrate effectively down the Sacramento River due to a reduction in olfactory cues, although there is little empirical evidence supporting this. Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT, except during September and November, in which flows would be up to 18% lower under A2D_ELT. The largest flow reductions would occur in above normal, and below normal water year types. The flow reductions would not be large enough to have biologically meaningful effects on juvenile emigration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run Chinook salmon juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D in any month or water year type throughout the period at either location.

Mean flows in the Sacramento River upstream of Red Bluff were examined during the adult winter-run Chinook salmon upstream migration period (December through August). A reduction in flows may reduce the olfactory cues needed by adults to return to natal spawning grounds in the upper Sacramento River. Flows under A2D_ELT would generally be similar to or greater than those under NAA_ELT except for dry water years during August, in which flow would be up to 11% lower under A2D_ELT. This reduction would not be large or frequent enough to cause biologically meaningful effects on adult migration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D in any month or water year type throughout the period at either location.

Overall, Sacramento River migration flows and water temperatures during the winter-run Chinook salmon juvenile and adult migration periods would not differ substantially between Alternative 2D and NAA_ELT.

Through-Delta

The effects of Alternative 2D on through-Delta migration were evaluated using the approach described in Alternative 1A, Impact AQUA-42.

Juveniles

During the juvenile winter-run Chinook salmon emigration period (November to early May), mean monthly flows downstream of the north Delta diversion facility under Alternative 2D would be reduced up to 33% compared to NAA_ELT, depending on the month and water-year type.

The north Delta export facilities would replace aquatic habitat and likely attract piscivorous fish around the intake structures. The predation effects of Alternative 2D would be similar to those described for Alternatives 1A and 2A (see details in Impact AQUA-42), because there are five intakes for these alternatives. The five NDD intakes would remove or modify habitat along that portion of the migration corridor (13 acres aquatic habitat and 2.3 linear miles of shoreline). As described above under Impact AQUA-39, potential predation losses at the north Delta intakes, as estimated by the bioenergetics model with median density of predators (119 striped bass per 1,000 feet of intake), would be less than 0.3% compared to the annual production estimated for the Sacramento Valley that enters the Delta (Table 11-2D-1). As discussed for Alternative 4A, a conservative assumption of 5% loss per intake (based on GCID losses; Vogel 2008) would yield a cumulative loss of 18.5% of juvenile winter-run Chinook that reach the north Delta. This assumption is uncertain and represents an upper bound estimate which does not take into account baseline levels of predation.

Through-Delta survival to Chipps Island by emigrating juvenile winter-run Chinook salmon was modeled by the DPM. Average survival under Alternative 2D would be 33% across all years, 25% in drier years, and 45% in wetter years (Table 11-2D-16). Compared to NAA_ELT, juvenile survival would decrease 1.6% across all years (a 5% relative decrease) and decrease 2.0% (7% relative decrease) in drier years. As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that are assumed to be included under NAA that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 2D and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Table 11-2D-16. Through-Delta Survival (%) of Emigrating Juvenile Winter-Run Chinook Salmon under Alternative 2D

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Type	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wetter Years	46.3	46.3	45.2	-1.2 (-3%)	-1.1 (-2%)
Drier Years	28.0	27.2	25.3	-2.7 (-9%)	-2.0 (-7%)
All Years	34.9	34.4	32.7	-2.1 (-7%)	-1.6 (-5%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

Attraction flow, as estimated by the percentage of Sacramento River water at Collinsville, declined under Alternative 2D by no more than 10% during the December through June migration period for winter-run adults (Table 11-2D-17). The reductions in percentage are small in comparison with the magnitude of change in dilution reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to affect winter-run adult migration. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. For further discussion of the topic see the analysis for Alternative 1A.

Table 11-2D-17. Percentage (%) of Water at Collinsville that Originated in the Sacramento River and San Joaquin River during the Adult Salmonid Migration Period for Alternative 2D

Month	Percentage of Water			Difference	
	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River					
September	60	65	60	0	-5
October	60	64	64	4	0
November	60	64	63	2	-2
December	67	67	65	-2	-2
January	76	75	73	-3	-2
February	75	74	69	-7	-5
March	78	77	68	-10	-9
April	77	76	67	-10	-10
May	69	67	60	-9	-7
June	64	61	56	-8	-5
San Joaquin River					
September	0.3	0.2	1.9	1.6	1.7
October	0.2	0.2	4.7	4.5	4.5
November	0.4	0.8	6.0	5.6	5.2
December	0.9	1.0	3.1	2.2	2.1
January	1.6	1.7	3.1	1.5	1.5
February	1.4	1.5	4.0	2.6	2.5
March	2.6	2.6	6.3	3.7	3.7
April	6.3	6.2	10.7	4.4	4.5

Shading indicates a difference of 10% or greater in flow proportion.

NEPA Effects: Overall, the results indicate that the effect of Alternative 2D is adverse due to the cumulative effects associated with five north Delta intake facilities, including juvenile mortality related to near-field effects (e.g., impingement and predation) and far-field effects (reduced survival due to reduced flows downstream of the intakes) associated with the five NDD intakes.

Upstream of the Delta, Alternative 2D would not affect migration conditions for winter-run Chinook salmon, as migration flows and water temperatures would not differ substantially between Alternative 2D and NAA_ELT.

Adult attraction flows under Alternative 2D would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

Near-field effects of Alternative 2D on winter-run Chinook salmon related to impingement and predation associated with five new intakes could result in substantial effects on juvenile migrating winter-run Chinook salmon, although there is high uncertainty regarding the potential effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to very significant effects (~ 19% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structures will be implemented as part of the final NDD screen design effort. As with Alternative 4A, Alternative 2D also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for winter-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains highly uncertain.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 2D would be lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 2D on juvenile winter-run Chinook salmon migration suggests a potential adverse effect of small magnitude. This adverse effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 2D of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of winter-run Chinook salmon juveniles into the low-survival interior Delta.

Overall, primarily as a result of unacceptable levels of uncertainty regarding the cumulative impacts of near-field and far-field effects associated with the presence and operation of the five intakes on winter-run Chinook salmon, this effect is adverse. While implementation of the environmental commitments noted above and mitigation measures listed below would address these impacts, these are not anticipated to reduce the impacts to a level considered not adverse.

CEQA Conclusion: In general, Alternative 2D would degrade migration conditions for winter-run Chinook salmon relative to the Existing Conditions.

Upstream of the Delta

Mean flows in the Sacramento River upstream of Red Bluff were examined during the July through November juvenile emigration period. Flows under A2D_ELT for juvenile migrants would generally be similar to flows under Existing Conditions during July, and would be up to 22% lower during August through November, except for September of wet and above normal year types, in which the flows would be 20% and 27% higher, respectively (Appendix *B, Supplemental Modeling for New Alternatives)*. The flow reductions would not be large or frequent enough to cause biologically meaningful effects on juvenile emigration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D throughout the period except in critical years during August and September at Keswick (6% and 5% higher, respectively) and in critical years during August at Bend Bridge (6% higher).

Mean flows under A2D_ELT in the Sacramento River upstream of Red Bluff during December through August would generally be similar to flows under Existing Conditions, except during August, in which flows would be up to 12% lower. These reductions in flow would not be large or frequent enough to cause biologically meaningful effects on adult migration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D throughout the period except in critical years during August at both locations (6% higher at both locations).

Through-Delta

As described above, predation losses of migrating juvenile winter-run Chinook would increase at the five north Delta intakes, hypothetically ranging from less than 1% up to nearly 19% that reach the north Delta. Through-Delta survival of emigrating juvenile winter-run Chinook salmon averaged across all years would decrease slightly compared to Existing Conditions (2.1% lower, a 7% relative decrease for all years) (Table 11-2D-16).

For migrating adults, olfactory cues, based on the proportion of Sacramento River flows, would be similar (10% or less difference) to Existing Conditions during the winter-run Chinook salmon migration period (Table 11-2D-17). For further discussion of this topic see the analysis for Alternative 1A.

Summary of CEQA Conclusion

Overall, Alternative 2D would significantly affect the migration conditions for winter-run Chinook salmon, relative to the Existing Conditions. Through-Delta survival of emigrating juveniles has the potential to be appreciably reduced, compared to Existing Conditions. There would be little effect of Alternative 2D on adult olfactory cues in the Delta. Water temperatures under Alternative 2D in the Sacramento River upstream of the Delta would generally be similar to those under Existing Conditions during both the juvenile and adult winter-run Chinook salmon migration periods. Flows in the Sacramento River upstream of the Delta would be similar during the adult migration period, although reduced during the juvenile migration period.

Implementation of *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers* (all of which are summarized further in Section 4.1.3.3) would address the through-Delta impacts, but are not anticipated to reduce them to a level considered less than significant because of the presence of five intakes. As a result of these changes in migration conditions, this impact is significant and unavoidable.

Mitigation Measure AQUA-42a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Winter-Run Chinook Salmon to Determine Feasibility of Mitigation to Reduce Impacts to Migration Conditions

Although analysis conducted as part of this recirculated EIR/EIS determined that Alternative 2D would have significant and unavoidable adverse effects on migration habitat, this conclusion was based on the best available scientific information at the time and may prove to have been over- or understated. Upon the commencement of operations of the proposed water conveyance facilities and continuing through the life of the permit, the project proponents will monitor effects on migration habitat in order to determine whether such effects would be as extensive as concluded at the time of preparation of this document and to determine any potentially feasible means of reducing the severity of such effects. This mitigation measure requires a series of actions to accomplish these purposes, consistent with the operational framework for Alternative 2D.

The development and implementation of any mitigation actions shall be focused on those incremental effects attributable to implementation of Alternative 2D operations only. Development of mitigation actions for the incremental impact on migration habitat attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 2D.

Mitigation Measure AQUA-42b: Conduct Additional Evaluation and Modeling of Impacts on Winter-Run Chinook Salmon Migration Conditions Following Initial Operations of Water Conveyance Facilities

Following commencement of initial operations of the proposed water conveyance facilities and continuing through the life of the permit, the project proponents will conduct additional evaluations to define the extent to which modified operations could reduce impacts to migration habitat under Alternative 2D. The analysis required under this measure may be conducted as a part of the Adaptive Management and Monitoring Program.

Mitigation Measure AQUA-42c: Consult with NMFS and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Winter-Run Chinook Salmon Migration Conditions Consistent with Water Conveyance Facility Operations

In order to determine the feasibility of reducing the effects of water conveyance facility operations on winter-run Chinook salmon habitat, the project proponents will consult with NMFS and the Department of Fish and Wildlife to identify and implement any feasible operational means to minimize effects on migration habitat. Any such action will be developed in conjunction with the ongoing monitoring and evaluation of habitat conditions required by Mitigation Measure AQUA-42a.

If feasible means are identified to reduce impacts on migration habitat consistent with the overall operational framework of Alternative 2D without causing new significant adverse impacts on other covered species, such means shall be implemented. If sufficient operational flexibility to reduce effects on winter-run Chinook salmon habitat is not feasible under Alternative 2D operations, achieving further impact reduction pursuant to this mitigation measure would not be feasible under this Alternative, and the impact on winter-run Chinook salmon would remain significant and unavoidable.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-43: Effects of Construction of Restoration Measures on Chinook Salmon (Winter-Run ESU)

Impact AQUA-44: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Winter-Run ESU)

Impact AQUA-45: Effects of Restored Habitat Conditions on Chinook Salmon (Winter-Run ESU)

Impact AQUA-46: Effects of Methylmercury Management on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 12)

Impact AQUA-49: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 15)

Impact AQUA-50: Effects of Nonphysical Fish Barriers on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on winter-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Spring-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-55: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

The potential effects of construction of the water conveyance facilities on spring-run Chinook salmon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-55) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to spring-run Chinook salmon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-55, the effect would not be adverse for spring-run Chinook salmon or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-55, the impact of the construction of water conveyance facilities on spring-run Chinook salmon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-56: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-56, the effect would not be adverse for spring-run Chinook salmon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-56 for spring-run Chinook salmon, the impact of the maintenance of water conveyance facilities on spring-run Chinook salmon or critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-57: Effects of Water Operations on Entrainment of Chinook Salmon (Spring-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Based on the salvage-density method, entrainment losses under Alternative 2D would decrease by approximately 53% compared to NAA_ELT averaged across all years (Table 11-2D-18). Entrainment reductions under Alternative 2D would be greater in wetter years, ranging from slightly greater (9%) in dry years up to 86% decrease in wet years compared to Existing Conditions (Table 11-2D-18). Pre-screen losses, typically attributed to predation, would also decrease commensurate with entrainment reductions.

The proportion of the annual spring-run Chinook population (assumed to be 750,000 juveniles approaching the Delta) lost at the south Delta facilities across all years averaged 5.2% under NAA_ELT, and would decrease to 2.4% under Alternative 2D.

Table 11-2D-18. Juvenile Spring-Run Chinook Salmon Annual Entrainment Index at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)[a]	
Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-76,409 (-86%)	-80,570 (-87%)
Above Normal	-15,223 (-57%)	-16,341 (-59%)
Below Normal	-1,692 (-27%)	-2,003 (-30%)
Dry	1,413 (9%)	-211 (-1%)
Critical	-2,582 (-22%)	-1,876 (-17%)
All Years	-19,431 (-51%)	-20,901 (-53%)

Shading indicates 10% or greater increased entrainment.

[a] Estimated annual number of fish lost, based on normalized data.

Water Exports from SWP/CVP North Delta Intake Facilities

The impacts from the proposed SWP/CVP north Delta intakes on spring-run Chinook salmon would be the same as described for Impact AQUA-57 for spring-run Chinook Salmon under Alternative 2A. State-of-the-art fish screens operated with an adaptive management plan would be expected to eliminate entrainment risk for juvenile spring-run Chinook salmon to these intakes.

Predation Associated with Entrainment

Entrainment-related predation loss of spring-run Chinook salmon at the south Delta facilities would be lower than baseline due to a reduction in entrainment loss (see analysis above). Predation at the north Delta would be increased at the proposed North Delta intake facilities on the Sacramento River, as discussed below in Impact AQUA-60.

NEPA Effects: Under Alternative 2D, entrainment of juvenile spring-run Chinook salmon at the south Delta facilities was estimated to be lower than NAA_ELT across all water years (considering the all-year salvage density results). It is concluded that this reduction, in addition to associated reduction in predation losses, would offset any losses associated with predation at the north Delta intakes. Therefore, the effect would not be adverse.

CEQA Conclusion: As described above, operational activities associated with water exports from SWP/CVP south Delta facilities would result in an overall decrease in entrainment and associated predation losses for juvenile spring-run Chinook salmon, albeit with substantial variation among water year types (Table 11-2D-18). Consequently, the impact of water operations on entrainment of juvenile Chinook salmon (spring-run ESU) is considered less than significant, and no mitigation would be required.

Impact AQUA-58: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Spring-Run ESU)

In general, the effects of Alternative 2D on spawning and egg incubation habitat for spring-run Chinook salmon relative to NAA_ELT are not adverse.

Sacramento River

There has been a small, inconsistent spawning population (<400 individuals) in the mainstem Sacramento River primarily upstream of Red Bluff Diversion Dam over the past decade (Azat 2012).

Flows in the Sacramento River between Keswick and upstream of Red Bluff during the spring-run Chinook salmon spawning and incubation period (September through January) under A2D_ELT would generally be similar to or greater than flows under NAA_ELT except in September and November, in which flows would be up to 24% lower than those under NAA_ELT, depending on location and water year type (Appendix *B, Supplemental Modeling for New Alternatives*).

Shasta Reservoir storage volume at the end of September influences flows downstream of the dam during the spring-run spawning and egg incubation period (September through January). Storage under A2D_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19).

Table 11-2D-19. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-286 (-9%)	11 (0%)
Above Normal	-346 (-11%)	17 (1%)
Below Normal	-229 (-8%)	-62 (-2%)
Dry	-172 (-7%)	30 (1%)
Critical	-137 (-12%)	60 (6%)

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period at either location.

The number of days on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-12 for Bend Bridge and in Table 11-2D-20 for Red Bluff. At Bend Bridge, there would be 3 (4%) more years with a "red" level of concern and 2 (50%) fewer years with an "orange" level of concern for Alternative 2Drelative to NAA_ELT. At Red Bluff, there would be 2 (18%) fewer years with an "orange" level of concern, under Alternative 2D and 2 (7%) more years with a "yellow" level of concern.

Table 11-2D-20. Differences between Baseline and Alternative 2D Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Red	9 (75%)	0 (0%)
Orange	5 (83%)	-2 (-18%)
Yellow	15 (115%)	2 (7%)
None	-29 (-57%)	0 (0%)

[a] For definitions of levels of concern, see Table 11-2D-11.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, total degree-days (all water year types combined) under Alternative 2D would be 12% lower than those under NAA_ELT during May and June and up to 10% higher during July through September (Table 11-2D-13). At Red Bluff, total degree-days under Alternative 2D would be similar to or lower than those under NAA_ELT except during November and March (3% and 18% 8higher, respectively), (Table 11-2D-21).

Table 11-2D-21. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
October	Wet	437 (170%)	15 (2%)
	Above Normal	206 (79%)	9 (2%)
	Below Normal	246 (118%)	-12 (-3%)
	Dry	411 (84%)	37 (4%)
	Critical	353 (59%)	-62 (-6%)
	All	1653 (91%)	-13 (0%)
November	Wet	11 (1,100%)	3 (33%)
	Above Normal	4 (NA)	1 (33%)
	Below Normal	2 (NA)	0 (0%)
	Dry	38 (475%)	-4 (-8%)
	Critical	21 (525%)	3 (14%)
	All	76 (585%)	3 (3%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	1 (NA)	1 (NA)
	Below Normal	10 (111%)	9 (90%)
	Dry	20 (143%)	0 (0%)
	Critical	11 (1,100%)	0 (0%)
	All	43 (179%)	10 (18%)
April	Wet	101 (88%)	4 (2%)
	Above Normal	77 (55%)	5 (2%)
	Below Normal	86 (109%)	-8 (-5%)
	Dry	108 (58%)	1 (0%)
	Critical	39 (325%)	-3 (-6%)
	All	411 (77%)	-1 (0%)

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be similar to mortality under NAA_ELT in wet, dry and critical years, but greater in above normal (30% greater) and below normal (36% greater) water years (Table 11-2D-22). Absolute scale increases of 5% and 8% of the spring-run population under above normal and below normal water years would have a negligible to small effect on the population. Combining all water year types, there would be no effect of Alternative 2D on egg mortality (3% absolute change).

Table 11-2D-22. Difference and Percent Difference in Percent Mortality of Spring-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	4 (41%)	0.3 (2%)
Above Normal	8 (58%)	5 (30%)
Below Normal	17 (142%)	8 (36%)
Dry	23 (116%)	2 (4%)
Critical	19 (25%)	1 (1%)
All	13 (59%)	3 (8%)

SacEFT predicts that there would be a minimal (<5%) difference in the percentage of years with good spawning availability, measured as weighted useable area, between A2D_ELT and NAA_ELT (Table 11-2D-23). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under A2D_ELT relative to NAA_ELT (Table 11-2D-23). SacEFT predicts that there would be an 11% decrease (7% decrease on absolute scale) in the percentage of years with good (lower) egg incubation conditions under A2D_ELT relative to NAA_ELT. SacEFT predicts that there would be a minimal (<5%) difference in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to NAA_ELT. It is unlikely that spawning habitat availability is currently limiting to spring-run Chinook salmon due to deeply suppressed escapement values over the past decade. Given this, these SacEFT outputs may be less important to spring-run Chinook salmon spawning.

Table 11-2D-23. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Spring-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Spawning WUA	-12 (-17%)	1 (2%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-28 (-33%)	-7 (-11%)
Redd Dewatering Risk	-9 (-18%)	-1 (-2%)
Juvenile Rearing WUA	7 (32%)	4 (16%)
Juvenile Stranding Risk	3 (16%)	2 (10%)
WUA = Weighted Usable Area.		

The results of the SacEFT model and Reclamation egg mortality model are inconsistent with regard to predicted conditions for spring-run salmon eggs. SacEFT predicts that egg incubation habitat would decrease (7% absolute scale decrease) and the Reclamation egg mortality model predicts that overall egg mortality would not change (<5% absolute scale) under the A2D_ELT relative to NAA_ELT. The SacEFT uses mid-August through early March as the egg incubation period, based on Vogel and Marine (1991), and the reach between ACID Dam and Battle Creek for redd locations. The Reclamation egg mortality model uses the number of days after Julian week 33 (mid-August) that it takes to accumulate 750 temperature units to hatching and another 750 temperature units to emergence. Temperatures units are calculated by subtracting 32°F from daily river temperature and are computed on a daily basis. As a result, egg incubation duration is generally mid-August through January, but is dependent on river temperature. The Reclamation model uses the reach between ACID Dam and Jelly's Ferry (approximately 5 river miles downstream of Battle Creek), which includes 95% of Sacramento River spawning locations based on 2001–2004 redd survey data (Reclamation 2008). The SacEFT model has been peer-reviewed, and the Reclamation egg mortality model has been extensively reviewed and used in prior biological assessments and BiOps. Therefore, both results are considered valid and were considered in drawing conclusions about spring-run egg mortality in the Sacramento River.

Clear Creek

Flows in Clear Creek were examined during the spring-run Chinook salmon spawning and egg incubation period (September through January). Mean flows under A2D_ELT would be similar to flows under NAA_ELT throughout the period for all water year types, except September of critical water years (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under A2D_ELT would be the same as that under NAA_ELT in all water year types, except for 33% greater (worse) maximum reduction in dry years (Table 11-2D-24).

Water temperatures were not modeled in Clear Creek.

Table 11-2D-24. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-100 (NA)	-33 (-50%)
Critical	-33 (-50%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Flows were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) where spring-run Chinook primarily spawn during September through January (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would not differ from NAA_ELT because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006).

Oroville Reservoir storage volume at the end of September influence flows downstream of the dam during the spring-run spawning and egg incubation period. Mean storage volume at the end of September under A2D_ELT would be similar to or up to 17% greater than storage under NAA_ELT, depending on water year type (Table 11-2D-25).

Table 11-2D-25. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-656 (-23%)	66 (3%)
Above Normal	-670 (-28%)	-113 (-6%)
Below Normal	-374 (-19%)	-49 (-3%)
Dry	-46 (-3%)	192 (17%)
Critical	48 (5%)	131 (14%)

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the egg incubation period to the flow in September when spawning is assumed to occur. Flows in the low-flow channel during September through January were identical between A2D_ELT and NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 2D on redd dewatering in the Feather River low-flow channel.

Mean water temperatures were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) during September through January (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during September through January (Table 11-2D-26). The percent of months exceeding the threshold under Alternative 2D would generally be lower (up to 16% lower on an absolute scale) than the percent under NAA_ELT during September, October and November and similar during other months.

Table 11-2D-26. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through January

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
September	0 (0%)	-1 (-1%)	4 (4%)	0 (0%)	-1 (-3%)
October	11 (50%)	10 (133%)	7 (120%)	5 (200%)	0 (0%)
November	9 (350%)	5 (400%)	2 (200%)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
NAA_ELT vs. A2D_ELT					
September	0 (0%)	-1 (-1%)	-2 (-3%)	-5 (-6%)	-6 (-14%)
October	-16 (-33%)	-6 (-26%)	-4 (-21%)	-4 (-33%)	-6 (-71%)
November	1 (13%)	-2 (-29%)	-1 (-25%)	-2 (-100%)	-1 (-100%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

The effects of A2D_ELT on water temperature-related spawning and egg incubation conditions for spring-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the September through January spring-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-2D-27). Combining all water year types, there would be a reduction of 19 degree-months in the number of degree-months exceeding the NMFS threshold under A2D_ELT relative to NAA_ELT for October and an increase of 8 degree-months for September. There would be negligible differences in degree months between NAA_ELT and A2D_ELT in the other months. Results are highly variable when separating out by water year type, ranging from 9 more degree-months (absolute scale) under A2D_ELT in below normal water years during September to 7 fewer degree-months under A2D_ELT in critical water years during September. The absolute scale is used to compare results for these analyses because large relative differences (percent differences) between NAA_ELT and A2D_ELT in most cases are mathematical artifacts due to the small values of degree-months for NAA_ELT (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon.

Table 11-2D-27. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through January

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
September	Wet	-7 (-6%)	2 (2%)
	Above Normal	0 (0%)	3 (8%)
	Below Normal	14 (23%)	9 (14%)
	Dry	30 (43%)	1 (1%)
	Critical	4 (6%)	-7 (-9%)
	All	41 (12%)	8 (2%)
October	Wet	9 (180%)	-1 (-7%)
	Above Normal	5 (50%)	-3 (-17%)
	Below Normal	11 (157%)	-3 (-14%)
	Dry	16 (229%)	-5 (-18%)
	Critical	7 (88%)	-6 (-29%)
	All	47 (127%)	-19 (-18%)
November	Wet	2 (NA)	1 (100%)
	Above Normal	3 (100%)	0 (0%)
	Below Normal	2 (200%)	-2 (-40%)
	Dry	9 (NA)	2 (29%)
	Critical	1 (NA)	-2 (-67%)
	All	17 (425%)	-1 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 2D on spring-run Chinook salmon spawning and egg incubation conditions would not be adverse because the alternative does not substantially reduce the amount of suitable spawning and egg incubation habitat or substantially interfere with spring-run Chinook salmon spawning and egg incubation. There are no substantial changes to flows, cold water pool storage, or water temperatures that would cause a biologically meaningful negative effect to spring-run Chinook salmon spawners or eggs. The Reclamation Egg Mortality Model also indicates that there would be no biologically meaningful effects. However, one model, SacEFT, shows adverse effects for egg incubation. After extensive investigation of these modeling results, they appear to be a function of high model sensitivity to relatively small changes in estimated upstream conditions, which may or may not accurately predict adverse effects. Overall, based on the results of all models except the SacEFT, this impact would not be adverse.

CEQA Conclusion: Collectively, the results of the Impact AQUA-58 CEQA analysis show that the difference between the CEQA baseline and Alternative 2D could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to Existing Conditions, However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 2D would not affect the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to the CEQA conclusion.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the spring-run Chinook salmon spawning and incubation period (September through January). Mean flows under A2D_ELT during January and December would generally be similar to flows under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during October and November would be up to 18% lower (both months at Keswick). Mean flows under A2D_ELT during September would be up to 24% lower (dry water years at Keswick) and up to 29% higher (above normal water years at Keswick) than flows under Existing Conditions.

Shasta Reservoir mean storage volume at the end of September would be 7% to 12% lower under A2D_ELT relative to Existing Conditions depending on water year type (Table 11-2D-19).

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At Keswick, mean water temperatures under A2D_ELT during September of critical water years would be 5% greater than those under Existing Conditions, but would not be different in other water year types or months during the period. At Bend Bridge, mean temperatures under A2D_ELT would be similar (<5% difference) to those under Existing Conditions in all months and water year types during the period.

The number of days on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a “level of concern” as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-12 for Bend Bridge and in Table 11-2D-20 for Red Bluff. At Bend Bridge, there would be a 59% increase in the number of years with a “red” level of concern under Alternative 2D relative to Existing Conditions. At Red Bluff, there would be 75%, 83%, and 115% increases in the number of years with “red”, “orange”, and “yellow” levels of concern, respectively, under Alternative 2D relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, total degree-days (all water years combined) under Alternative 2D would be 62% to 119% higher than those under Existing Conditions depending on the month (Table 11-2D-13). At Red Bluff, total degree-days under Alternative 2D would be 77% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-2D-21).

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be 4% to 23% greater (absolute value) than mortality under Existing Conditions depending on water year type, with a 13% increase in the mortality rate for all water year types combined (Table 11-2D-22).

SacEFT predicts that there would be a 17% decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-23). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under A2D_ELT relative to Existing Conditions. SacEFT predicts that there would be a 33% decrease in the percentage of years with good (lower) egg incubation conditions under A2D_ELT relative to Existing Conditions, respectively. SacEFT predicts that there would be an 18% decrease in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to Existing Conditions. These results indicate that spawning and egg incubation conditions for spring-run Chinook salmon would be poor relative to Existing Conditions. However, it is not known whether spawning habitat is limiting to the spring-run Chinook salmon population in the Sacramento River, especially given the recent sharp decline in annual escapement estimates.

Clear Creek

Flows in Clear Creek during the spring-run Chinook salmon spawning and egg incubation period (September through January) under A2D_ELT would generally be similar to or greater than flows under Existing Conditions except during September of critical water years (18% reduction) (Appendix *B, Supplemental Modeling for New Alternatives*).

The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under A2D_ELT would be 33% to 100% greater (worse) than Existing Conditions in above normal, dry, and critical years, and would be similar to and 53% lower (better) than that under Existing Conditions in wet and below normal water years, respectively (Table 11-2D-24).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River low-flow channel under A2D_ELT are not different from Existing Conditions during the spring-run spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Flows in October through January (800 cfs) would be equal to or greater than the spawning flows in September (773 cfs) for all model scenarios.

Oroville Reservoir storage volume at the end of September would be 5% higher to 28% lower under A2D_ELT relative to Existing Conditions depending on water year type (Table 11-2D-25).

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. Mean flows in the low-flow channel during September and during October through January were identical between A2D_ELT and Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 2D on redd dewatering in the Feather River low-flow channel.

Water temperatures were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) during September through January (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under A2D_ELT would be similar to (<5% difference) those under Existing Conditions in all months and water year types during the period.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during September through January (Table 11-2D-26). The percent of months exceeding the threshold under Alternative 2D would be similar to or up to 11% higher (absolute scale) than under Existing Conditions during September through November. There would be no difference in the percent of months exceeding the threshold between Existing Conditions and Alternative 2D during December and January.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during September through January (Table 11-2D-27). Total degree-months (all water years combined) exceeding the threshold under A2D_ELT would be 12% to 425% greater than those under Existing Conditions during September through November. There would be no difference in total degree-months between Existing Conditions and A2D_ELT during December and January.

Summary of CEQA Conclusion

Under Alternative 2D (including climate change effects), there are flow and storage reductions, as well as temperature increases in the Sacramento River that would lead to biologically meaningful increases in egg mortality and overall reduced habitat conditions for spawning spring-run and egg incubation, as compared to Existing Conditions. Flows in the Feather River low-flow channel do not differ between Alternative 2D and Existing Conditions. However, water temperature analyses in the Feather River low-flow channel using thresholds developed in coordination with NMFS indicate that there would be moderate to large negative effects on temperature conditions during spring-run Chinook salmon spawning and egg incubation.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of spring-run as a result of egg mortality.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS

BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would be similar between NAA_ELT and Alternative 2D. There would be no effects of Alternative 2D on spawning and egg incubation conditions in Clear Creek, and small beneficial or no effects on flows, reservoir storage, and water temperatures in the Feather River. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-59: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Spring-Run ESU)

In general, Alternative 2D would not affect the quantity and quality of rearing habitat for fry and juvenile spring-run Chinook salmon relative to NAA_ELT.

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix *B, Supplemental Modeling for New Alternatives*). Flows between December and March under A2D_ELT would generally be similar to or greater than those under NAA_ELT. Flows during November would be up to 24% lower under A2D_ELT than under NAA_ELT.

As reported in Impact AQUA-40, May Shasta storage volume under A2D_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-2D-9).

As reported in Impact AQUA-58, September Shasta storage volume would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19).

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the November through March spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile rearing WUA conditions under A2D_ELT would be 16% higher than that under NAA_ELT, although this would be a 4% difference on an absolute scale (Table 11-2D-23). SacEFT predicts that, the percentage of years with good (lower) juvenile stranding risk conditions under A2D_ELT would be 10% higher than under NAA_ELT, although this would be a 2% difference on an absolute scale.

SALMOD predicts that spring-run smolt equivalent habitat-related mortality would be 5% lower under A2D_ELT than NAA_ELT.

Clear Creek

Flows in Clear Creek below Whiskeytown during the November through March spring-run rearing period under A2D_ELT would generally be similar to flows under NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during November through June were reviewed to determine flow-related effects on larval and juvenile spring-run rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout this period under A2D_ELT would not differ from those under NAA_ELT. In the high flow channel, flows under A2D_ELT would be similar to or up to 121% greater than flows under NAA_ELT during November through June, with few exceptions during which flows would be up to 17% lower under A2D_ELT.

May Oroville storage under A2D_ELT would be similar to storage under NAA_ELT (Table 11-2D-28).

As reported in Impact AQUA-58, September Oroville storage volume would be similar to or up to 17% higher than under NAA_ELT depending on water year type (Table 11-2D-25).

Table 11-2D-28. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-22 (-1%)	-3 (0%)
Above Normal	-118 (-3%)	-59 (-2%)
Below Normal	-155 (-5%)	11 (0%)
Dry	-346 (-13%)	4 (0%)
Critical	-133 (-7%)	6 (0%)

Water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during May and June (Table 11-2D-29). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-2D-10, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months through August. The percent of months exceeding the threshold under Alternative 2D would generally be similar to or lower (up to 21% lower on an absolute scale) than the percent under NAA_ELT.

Table 11-2D-29. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
May	2 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
June	4 (7%)	6 (23%)	2 (50%)	1 (NA)	0 (NA)
July	0 (0%)	0 (0%)	0 (0%)	17 (24%)	25 (63%)
August	0 (0%)	9 (10%)	15 (26%)	17 (61%)	10 (100%)
NAA_ELT vs. A2D_ELT					
May	-1 (-33%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
June	-20 (-25%)	-21 (-39%)	-21 (-74%)	-2 (-67%)	0 (NA)
July	0 (0%)	0 (0%)	-1 (-1%)	-9 (-9%)	-10 (-13%)
August	0 (0%)	-2 (-3%)	-7 (-9%)	-9 (-16%)	-10 (-33%)

Total degree-months exceeding 63°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during May and June (Table 11-2D-30). As discussed above, although this table includes results through August, only May and June results apply to spring-run Chinook salmon. The steelhead analysis below includes the remaining months. Total degree-months (all water years combined) under Alternative 2D would be similar to or lower than those under NAA_ELT, depending on the month.

Table 11-2D-30. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
May	Wet	0 (NA)	0 (NA)
	Above Normal	1 (NA)	0 (0%)
	Below Normal	0 (NA)	0 (NA)
	Dry	2 (NA)	1 (100%)
	Critical	2 (NA)	0 (0%)
	All	4 (NA)	0 (0%)
June	Wet	10 (67%)	-7 (-22%)
	Above Normal	4 (29%)	-4 (-18%)
	Below Normal	6 (46%)	-7 (-27%)
	Dry	13 (57%)	-2 (-5%)
	Critical	9 (150%)	-1 (-6%)
	All	41 (58%)	-22 (-16%)
July	Wet	22 (18%)	-1 (-1%)
	Above Normal	10 (23%)	0 (0%)
	Below Normal	15 (25%)	0 (0%)
	Dry	21 (30%)	2 (2%)
	Critical	24 (46%)	6 (9%)
	All	91 (26%)	6 (1%)
August	Wet	17 (19%)	7 (7%)
	Above Normal	9 (36%)	2 (6%)
	Below Normal	15 (39%)	1 (2%)
	Dry	26 (65%)	2 (3%)
	Critical	15 (36%)	-5 (-8%)
	All	82 (35%)	7 (2%)

NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because rearing habitat conditions would not be substantially reduced. There would be no substantial effects of Alternative 2D on rearing habitat for spring-run Chinook salmon in the Sacramento River. This conclusion is based on the similarity between Alternative 2D and the NEPA baseline in water temperatures during all months of the rearing period and in flows during all months except November. Results of SacEFT and SALMOD also support this conclusion. In the Feather River, habitat conditions would improve under Alternative 2D relative to the NEPA baseline. There would be no effects to spring-run Chinook salmon rearing in Clear Creek.

CEQA Conclusion: Collectively, the results of the Impact AQUA-59 CEQA analysis show that the difference between the CEQA baseline and Alternative 2D could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of juvenile rearing habitat for spring-run Chinook salmon relative to

Existing Conditions, However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 2D would not affect the quantity and quality of juvenile rearing habitat for spring-run Chinook salmon relative to the CEQA conclusion.

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would be generally similar to or greater than those under Existing Conditions, except during November, in which flows would be up to 18% lower under A2D_ELT than under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*).

As reported in Impact AQUA-40, Shasta Reservoir storage volume at the end of May under A2D_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% and 9% in dry and critical water years, respectively (Table 11-2D-9). As reported in Impact AQUA-58, storage volume at the end of September under A2D_ELT would be 7% to 12% lower relative to Existing Conditions (Table 11-2D-19).

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, there would be no differences (<5%) in mean monthly water temperature between Existing Conditions and Alternative 2D, except for 6% and 5% increases at Keswick during August and September of critical water years and 6% at Bend Bridge during August of critical water years.

SacEFT predicts that under A2D_ELT both the percentage of years with good juvenile rearing WUA conditions and the percentage of years with good (lower) juvenile stranding risk conditions would be greater than those under Existing Conditions (Table 11-2D-23).

SALMOD predicts that spring-run smolt equivalent habitat-related mortality under A2D_ELT would be 11% lower than under Existing Conditions.

Clear Creek

Flows in Clear Creek during the November through March rearing period under A2D_ELT would generally be similar to or greater than flows under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Relatively constant flows in the low flow channel throughout the November through June period under A2D_ELT would not differ from those under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). In the high flow channel (at Thermalito Afterbay), flows under A2D_ELT would be mostly lower than flows under Existing Conditions during November through

February (up to 47% lower) and would be similar to or greater than flows under Existing Conditions (up to 157%) during March through June.

May Oroville storage volume under A2D_ELT would be similar to Existing Conditions in wet, above normal and below normal water years and would be 13% and 7% lower than Existing Conditions in dry and critical water years, respectively (Table 11-2D-28).

As reported in Impact AQUA-58, September Oroville storage volume would be similar to Existing Conditions in dry and critical water years and would be 23%, 28%, and 19% lower than Existing Conditions in wet, above normal, and below normal water years, respectively (Table 11-2D-25).

Water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during the November through June juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature under Alternative 2D would be similar to those under Existing Conditions during all months and water year types, throughout the period at both locations.

The percent of months exceeding the 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during May and June (Table 11-2D-29). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-2D-10, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months. The percent of months exceeding the threshold under A2D_ELT would be similar to those under Existing Conditions.

Total degree-months exceeding 63°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during May and June (Table 11-2D-30). As discussed above, although this table includes results through August, only May and June results apply to spring-run Chinook salmon. The steelhead analysis below includes the remaining months. Total degree-months (all water years combined) under A2D_ELT would be similar to those under Existing Conditions during May, but 58% higher during June.

Summary of CEQA Conclusion

Under Alternative 2D, there would be large flow reductions in the Feather River in several months, depending on water year type. Both SacEFT and SALMOD predict improvements to rearing habitat availability for spring-run Chinook salmon in the Sacramento River under Alternative 2D. Exceedances above NMFS temperature thresholds would be higher under Alternative 2D relative to Existing Conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of spring-run Chinook salmon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on spring-run Chinook salmon juvenile rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-60: Effects of Water Operations on Migration Conditions for Chinook Salmon (Spring-Run ESU)

In general, Alternative 2D would degrade migration conditions for spring-run Chinook salmon relative to NAA_ELT.

Upstream of the Delta

Sacramento River

Flows in the Sacramento River upstream of Red Bluff were evaluated during the December through May juvenile Chinook salmon spring-run migration period. Mean flows under A2D_ELT during December through May would be similar to or greater than flows under NAA_ELT throughout the migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Flows in the Sacramento River upstream of Red Bluff were evaluated during the April through August adult spring-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or greater than flows under NAA_ELT, except for 11% lower flow during August of dry water year types.

Water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Clear Creek

Mean flows in Clear Creek during the November through May juvenile Chinook salmon spring-run migration period under A2D_ELT would be similar to flows under NAA_ELT throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek during the April through August adult spring-run Chinook salmon upstream migration period under A2D_ELT would be similar to flows under NAA_ELT, except for 14% lower flow in July of critical water years and 11% greater flow in August of critical years (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile Chinook salmon spring-run migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or greater than flows under NAA_ELT throughout the period, with minor exceptions.

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Flows in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during April through June would be similar to or up to 88% greater than (June of below normal water years) flows under NAA_ELT. Mean flows under A2D_ELT during July and August would generally be lower than flows under NAA_ELT by up to 48% (July of critical water years).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period, except for a 5% higher water temperature under A2D_ELT in July of critical water years.

Through-Delta

The effects of Alternative 2D on through-Delta migration were evaluated using the approach described in Alternative 1A, Impact AQUA-42.

Juveniles

Flows under Alternative 2D would decrease up to 33% depending on month and water-year type downstream of the north Delta facilities compared to baseline conditions (NAA_ELT). The intake structures would replace aquatic habitat and likely attract piscivorous fish around the intake structures. As described for Alternative 1A, the five NDD intakes would remove or modify habitat along that portion of the migration corridor (13 acres aquatic habitat and 2.3 linear miles of shoreline). Potential predation losses at the north Delta intakes, as estimated by the bioenergetics model with median density of predators (119 striped bass per 1,000 feet of intake), would be less than 0.5% compared to the annual production estimated for the Sacramento Valley (Table SR_bioenergetics). A conservative assumption of 5% loss per intake (based on data from GCID; Vogel 2008) would yield a cumulative loss of 19.2% of juvenile spring-run Chinook that reach the north Delta. This assumption is uncertain and represents an upper bound estimate. See additional discussion in Impact AQUA-42 for winter-run Chinook salmon in Alternative 4A.

Table SR_bioenergetics. Spring-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes (Five Intakes for Alternative 2D)

Striped Bass at NDD (Five Intakes)			Spring-Run Chinook Consumed	
Density Assumption	Bass per 1,000 Feet of Intake	Total Number of Bass	Number	Percentage of Annual Production Entering the Delta[1]
Low	18	154	2,145	0.05%
Median	119	1,017	14,180	0.34%
High	219	1,872	26,096	0.62%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 4.2 million juveniles. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

Through-Delta survival to Chipps Island (DPM) by emigrating juvenile spring-run Chinook salmon under Alternative 2D would average 29% across all years, 23% in drier years, and 38% in wetter years (Table 11-2D-31). Compared to NAA_ELT, juvenile survival would decrease, 1.9% lower across all years (a 6% relative decrease) and 3.1% lower (8% relative decrease) in wetter years. As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that are assumed to be included under NAA that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 2D and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Table 11-2D-31. Through-Delta Survival (%) of Emigrating Juvenile Spring-Run Chinook Salmon under Alternative 2D

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Type	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wetter Years	42.1	41.4	38.3	-3.8 (-10%)	-3.1 (-8%)
Drier Years	24.8	24.3	23.2	-1.7 (-6%)	-1.2 (-4%)
All Years	31.3	30.7	28.9	-2.5 (-7%)	-1.9 (-6%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

When climate change effects are accounted for (NAA_ELT), during the overall spring-run upstream migration from March-June the proportion of Sacramento River water would decrease 5% to 10% compared to NAA_ELT (Table 11-2D-17). Although Sacramento River attraction flows would be reduced during these months relative to Existing Conditions, the Sacramento River would still represent 56% to 68% of Delta flows. For a discussion of the topic see the analysis for Alternative 1A.

NEPA Effects: Overall, the results indicate that the effect of Alternative 2D is adverse due to the cumulative effects associated with five north Delta intake facilities, including mortality related to near-field effects (e.g., impingement and predation) and far-field effects (reduced survival due to reduced flows downstream of the intakes) associated with the five NDD intakes.

Upstream of the Delta, migration conditions for spring-run Chinook salmon under Alternative 2D would not be adverse because flow and temperature conditions would generally be similar to those under the NEPA baseline.

Adult attraction flows under Alternative 2D would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

Near-field effects of Alternative 2D on spring-run Chinook salmon related to impingement and predation associated with five new intakes could result in substantial effects on juvenile migrating spring-run Chinook salmon, although there is high uncertainty regarding the potential effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to very significant effects (~ 19% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structures will be implemented as part of the final NDD screen design effort. As with Alternative 4A, Alternative 2D also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for spring-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains highly uncertain. See additional discussion under Impact AQUA-42 of Alternative 4A for winter-run Chinook salmon.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 2D would be lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 2D on juvenile spring-run Chinook salmon migration suggests a potential adverse effect of small magnitude. This adverse effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 2D of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of spring-run Chinook salmon juveniles into the low-survival interior Delta.

Overall, primarily as a result of unacceptable levels of uncertainty regarding the cumulative impacts of near-field and far-field effects on spring-run Chinook salmon associated with the presence and operation of the five intakes, this effect is adverse. While implementation of the environmental commitments noted above and mitigation measures listed below would address these impacts, these are not anticipated to reduce the impacts to a level considered not adverse.

CEQA Conclusion:

Upstream of the Delta

In general, Alternative 2D would affect migration conditions for spring-run Chinook salmon relative to the Existing Conditions.

Sacramento River

Mean flows in the Sacramento River upstream of Red Bluff during the December through May juvenile spring-run Chinook salmon migration period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except during March of below normal water years (7% decrease) and May of wet years (10% decrease) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the April through August adult spring-run Chinook salmon upstream migration period under A2D_ELT would generally be similar to or slightly greater than Existing Conditions, except during May of wet years (10% decrease) and August of dry (12% decrease) and critical (12% decrease) water years.

Water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period, except for a 5% higher water temperature under A2D_ELT during August of critical water years.

Clear Creek

Mean flows in Clear Creek during the November through May juvenile Chinook salmon spring-run migration period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 40% greater flow in January of wet water years (Appendix *B, Supplemental Modeling for New Alternatives*).

Flows in Clear Creek during the April through August adult spring-run Chinook salmon upstream migration period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows were examined for the Feather River at the confluence with the Sacramento River during the November through May juvenile Chinook salmon spring-run migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under Existing Conditions, with some exceptions (up to 17% lower and up to 18% greater).Mean monthly water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period. Flows were examined for the Feather River at the confluence with the Sacramento River during the April through August adult spring-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows during April through June under A2D_ELT would generally be similar to or up to 82% greater than (June of below normal water years) flows under Existing Conditions, except for 10% lower flow in May of wet years. Flows during July and August under A2D_ELT would generally be lower by up to 53% than flows under Existing Conditions, except for 13% greater flow in August of wet years.

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period, except for a 6% higher water temperature under A2D_ELT in July of critical water years.

Through-Delta

Through Delta survival by emigrating juvenile spring-run Chinook salmon would decrease 2.3% (7% relative decrease) under Alternative 2D across all years compared to Existing Conditions (Table 11-2D-31). Losses due to predation at the five north Delta intakes could hypothetically range from less than 2% up to 19.2% of juvenile spring-run Chinook that reach the north Delta, as calculated for Impact AQUA-60 for Alternative 1A.

Attraction flow, as estimated by the percentage of Sacramento River water at Collinsville, declined 10% to 12% during the April and May migration period for spring-run adults under Alternative 2D compared to Existing Conditions (Table 11-2D-17). The reductions in percentage are small in comparison with the magnitude of change in dilution reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to significantly impact adult migration. Sacramento River attraction flows would still represent 59% to 67% of Delta flows. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. This topic is discussed further in Impact AQUA-42 in Alternative 1A.

Summary of CEQA Conclusion

Overall, Alternative 2D would significantly affect the migration conditions for spring-run Chinook salmon, relative to the Existing Conditions. Through-Delta survival of emigrating juveniles has the potential to be appreciably reduced, compared to Existing Conditions. There would be little effect of Alternative 2D on adult olfactory cues in the Delta. Upstream of the Delta, the results indicate that the effect would be less than significant because it would not substantially reduce the suitability of migration habitat or interfere with the movement of fish. Flows in the Sacramento River and Clear Creek and water temperatures in the Sacramento and Feather Rivers would generally not be affected by Alternative 2D. Flows in the Feather River would be substantially lower in 2 months of the 5-month adult migration period and substantially higher in one month of the period. There would be occasional moderately lower flow reductions in other months of the juvenile and adult migration periods.

Implementation of *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers* (all of which are summarized further in Section 4.1.3.3, in this RDEIR/SDEIS) would address the through-Delta impacts, but are not anticipated to reduce them to a level considered less than significant because of the presence of five intakes. As a result of these changes in migration conditions, this impact is significant and unavoidable.

In addition to the environmental commitments above, the mitigation measures identified below would provide an adaptive management process that would be conducted as a part of the Adaptive Management and Monitoring Program, for assessing impacts and developing appropriate minimization measures. However, this would not necessarily result in a less than significant determination, so it is concluded that the impact is significant and unavoidable.

Mitigation Measure AQUA-60a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Spring-Run Chinook Salmon to Determine Feasibility of Mitigation to Reduce Impacts to Migration Conditions

Please refer to Mitigation Measure AQUA-60a under Alternative 1A (Impact AQUA-60) for spring-run Chinook salmon.

Mitigation Measure AQUA-60b: Conduct Additional Evaluation and Modeling of Impacts on Spring-Run Chinook Salmon Migration Conditions Following Initial Operations of Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-60b under Alternative 1A (Impact AQUA-60) for spring-run Chinook salmon.

Mitigation Measure AQUA-60c: Consult with NMFS and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Spring-Run Chinook Salmon Migration Conditions Consistent with Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-60c under Alternative 1A (Impact AQUA-60) for spring-run Chinook salmon.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-61: Effects of Construction of Restoration Measures on Chinook Salmon (Spring-Run ESU)

Impact AQUA-62: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Spring-Run ESU)

Impact AQUA-63: Effects of Restored Habitat Conditions on Chinook Salmon (Spring-Run ESU)

Impact AQUA-64: Effects of Methylmercury Management on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 12)

Impact AQUA-67: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 15)

Impact AQUA-68: Effects of Nonphysical Fish Barriers on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on spring-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Fall-/Late Fall–Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-73: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

The potential effects of construction of the water conveyance facilities on fall-/late fall–run Chinook salmon would be similar to those described for Alternative 4A (Impact AQUA-73) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in

Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to fall-/late fall–run Chinook salmon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-73, the effect would not be adverse for fall-/late fall–run Chinook salmon and critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-73, the impact of construction of the water conveyance facilities on fall-/late fall–run Chinook salmon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-74: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-56, the effect would not be adverse for fall-/late fall–run Chinook salmon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-74 for fall-/late fall–run Chinook salmon, the impact of the maintenance of water conveyance facilities on fall-/late fall–run Chinook salmon would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-75: Effects of Water Operations on Entrainment of Chinook Salmon (Fall-/Late Fall–Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Alternative 2D (A2D_ELT) would decrease entrainment of fall-run Chinook salmon by approximately 56% and late fall–run Chinook salmon by approximately 41% compared to NAA_ELT (Table 11-2D-32). Entrainment reductions under Alternative 2D would be greater in wetter years, ranging from little difference in dry years up to 85% decrease compared to Existing Conditions.

Table 11-2D-32. Juvenile Chinook Salmon Annual Entrainment Index at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)[a]	
Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Fall-Run Chinook Salmon		
Wet	-108,653 (-85%)	-114,129 (-86%)
Above Normal	-20,655 (-63%)	-21,452 (-64%)
Below Normal	-4,906 (-36%)	-4,737 (-35%)
Dry	303 (2%)	-1,390 (-7%)
Critical	-12,950 (-32%)	-10,896 (-28%)
All Years	-30,369 (-55%)	-31,696 (-56%)
Late Fall–Run Chinook Salmon		
Wet	-4,033 (-67%)	-4,204 (-68%)
Above Normal	-315 (-55%)	-313 (-55%)
Below Normal	-27 (-49%)	-29 (-50%)
Dry	-35 (-26%)	-26 (-21%)
Critical	-33 (-20%)	-22 (-15%)
All Years	-661 (-34%)	-682 (-35%)
	Shading indicates 10% or greater increased entrainment.	

[a] Estimated annual number of fish lost, based on normalized data.

For juvenile late fall-run Chinook salmon, entrainment under Alternative 2D would decrease by 35% compared to NAA_ELT averaged across all years (Table 11-2D-32). Entrainment reductions would be substantially greater in wetter years, ranging from approximately 26% decrease in dry years to 67% decrease in wet years compared to Existing Conditions.

The proportion of the annual juvenile population (assumed to be 23 million fall-run juveniles and 1 million late fall–run juveniles) lost at the south Delta facilities is very low under baseline conditions (<0.25% for both runs), and would be reduced under Alternative 2D.

Water Exports from SWP/CVP North Delta Intake Facilities

Impacts from the proposed north Delta intake facilities for fall-/late fall–run Chinook salmon, such as impingement and predation exposure risks, would be expected to be similar to those described above for winter-run Chinook salmon. Impacts would also be the same as described for Alternative 2D. State-of-the-art fish screens would be expected to eliminate entrainment risk for juvenile fall-/late fall–run Chinook salmon to these intakes.

Predation Associated with Entrainment

Entrainment-related predation loss of fall- and late fall-run Chinook salmon at the south Delta facilities would be lower than baseline due to a reduction in entrainment loss (see analysis above). Predation at the north Delta would be increased at the proposed North Delta intake facilities on the Sacramento River, as discussed below in Impact AQUA-78.

NEPA Effects: Under Alternative 2D potential entrainment and associated predation loss of juvenile Chinook salmon of all races (winter, spring, fall and late fall–run) would be similar or reduced compared to baseline at the SWP/CVP south delta facilities. Entrainment of Chinook salmon at the proposed SWP/CVP north Delta intakes would not be expected to occur due to the state-of-the-art fish screens; there would be a potential for impingement, but this risk would be minimized due to the design and operation of the facilities. It is concluded that the improvements at the south Delta would offset losses due to predation at the north Delta. Therefore the effect on fall-/late fall–run Chinook salmon entrainment from Alternative 2D would not be adverse.

***CEQA Conclusion**:* As described above, entrainment and associated predation loss of juvenile Chinook salmon of all races (winter, spring, fall and late fall–run) would be similar or reduced compared to baseline at the SWP/CVP south delta facilities. Entrainment of Chinook salmon at the proposed SWP/CVP north delta intakes would not be expected to occur due to the state-of-the-art fish screens; there would be a potential for impingement, but this risk would be minimized due to the design and operation of the facilities. Predation at the north Delta intakes could occur. Overall, impacts of water operations on entrainment of juvenile Chinook salmon (fall-/late fall–run ESU) would be beneficial due to a general reduction in entrainment and no mitigation would be required.

Impact AQUA-76: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 2D would not affect spawning and egg incubation habitat for fall-/late fall–run Chinook salmon relative to NAA_ELT.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be greater than or similar to flows under NAA_ELT in October, December, and January. During November, flows under A2D_ELT would be 6% to 18% lower than under NAA_ELT, depending on water year type. These results indicate that there would generally be no flow-related effects of Alternative 2D on spawning and egg incubation habitat except during November, in which there would be small intermittent flow reductions.

Shasta Reservoir storage at the end of September could affect flows during the fall-run spawning and egg incubation period. As reported in Impact AQUA-58 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a “level of concern” as defined in Table 11-2D-11. Differences between baselines and A2D_ELT in the levels of concern across all months and all 82 modeled years are presented in Table 11-2D-20. There would be no difference in the number of years with a “red” level of concern under A2D_ELT, 2 (18%) fewer years with an “orange” level of concern, and 2 (7%) more years with a “yellow” level of concern.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water years combined) under A2D_ELT would be 10 degree-days (18%) higher than those under NAA_ELT during March, and would be similar for the remaining 6 months (Table 11-2D-21). This total degree-day difference during March across 82 years would correspond to a negligible difference per day. Therefore, this would not result in a negative effect to fall-run Chinook salmon spawning and egg incubation.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be lower than or similar to mortality under NAA_ELT in all water year types, including below normal years for which the mortality rate would increase by 2% (absolute scale), which is not substantial (Table 11-2D-33). Therefore, these results indicate that A2D_ELT would have negligible effects on fall-run Chinook salmon egg mortality.

Table 11-2D-33. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	4 (39%)	0.1 (1%)
Above Normal	5 (46%)	1 (7%)
Below Normal	7 (62%)	2 (11%)
Dry	7 (48%)	-0.2 (-1%)
Critical	5 (18%)	-0.3 (-1%)
All	5 (39%)	0.4 (2%)

SacEFT predicts that there would be a 33% increase in the percentage of years with good spawning availability for fall-run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-34). SacEFT predicts that there would be a 12% reduction in the percentage of years with good (lower) redd scour risk under A2D_ELT relative to NAA_ELT. SacEFT predicts that there would be no difference between A2D_ELT and NAA_ELT in the number of years with good egg incubation conditions. SacEFT predicts that there would be a 7% reduction in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to NAA_ELT.

Table 11-2D-34. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Spawning WUA	9 (19%)	14 (33%)
Redd Scour Risk	-3 (-5%)	-8 (-12%)
Egg Incubation	-5 (-5%)	0 (0%)
Redd Dewatering Risk	0 (0%)	-2 (-7%)
Juvenile Rearing WUA	1 (3%)	-4 (-11%)
Juvenile Stranding Risk	-8 (-26%)	0 (0%)

WUA = Weighted Usable Area.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be greater than or similar to flows under NAA_ELT throughout the period.

Shasta Reservoir storage at the end of September would affect flows during the late fall–run spawning and egg incubation period. As reported in Impact AQUA-58 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19).

The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be similar to mortality under NAA_ELT in all water years, including above normal water years in which, although there would be a 15% relative reduction in the mortality rate, the absolute reduction would be only 1% of the late fall-run population (Table 11-2D-35).

Table 11-2D-35. Difference and Percent Difference in Percent Mortality of Late Fall–Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	1 (72%)	-0.2 (-6%)
Above Normal	1 (49%)	-1 (-15%)
Below Normal	2 (119%)	0 (0%)
Dry	2 (67%)	-0.1 (-2%)
Critical	1 (57%)	-0.2 (-5%)
All	1 (71%)	-0.2 (-5%)

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-20. There would be no difference in the number of years with a "red" level of concern under A2D_ELT, 2 (18%) fewer years with an "orange" level of concern, and 2 (7%) more years with a "yellow" level of concern.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water years combined) under A2D_ELT would be 10 degree-days (18%) higher than those under NAA_ELT during March, and would be similar for the remaining 6 months (Table 11-2D-21). This total degree-day difference during March across 82 years would correspond to a negligible difference per day. Therefore, this would not result in a negative effect to late fall-run Chinook salmon spawning and egg incubation.

SacEFT predicts that there would be a 6% decrease in the percentage of years with good spawning availability for late fall–run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-36). SacEFT predicts that there would be a negligible (<5%) differences in the percentage of years with good (lower) egg incubation conditions and redd scour and dewatering risks between A2D_ELT and NAA_ELT.

Table 11-2D-36. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Late Fall–Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Spawning WUA	-7 (-13%)	-3 (-6%)
Redd Scour Risk	-3 (-4%)	-1 (-1%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-5 (-8%)	1 (2%)
Juvenile Rearing WUA	-2 (-4%)	-14 (-25%)
Juvenile Stranding Risk	-21 (-29%)	-9 (-15%)

WUA = Weighted Usable Area.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Clear Creek flows below Whiskeytown Reservoir were examined for the September through February fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to flows under NAA_ELT, except for 10% lower flow in September of critical water years.

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest monthly reduction in Clear Creek flows during September through February under A2D_ELT would be the same as the greatest reduction under NAA_ELT for all water year types, except for a 33% larger maximum reduction (50% relative increase in greatest reduction) in dry water years (Table 11-2D-37).

Table 11-2D-37. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September through February Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-100 (NA)	-33 (-50%)
Critical	-33 (-50%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Fall-Run

Flows in the Feather River in the low flow and high flow channels were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows in the low-flow channel under A2D_ELT would be identical to those under NAA_ELT. Mean flows in the high-flow channel under A2D_ELT would generally be similar to or up to 26% greater (during December of critical water years) than those under NAA_ELT, except for a 17% reduction in flow during January of below normal water years.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Flows in the low-flow channel during October through January were identical between A2D_ELT and NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 2D on redd dewatering in the Feather River low-flow channel.

Water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River at Gridley was evaluated during October through April (Table 11-2D-38). The percent of months exceeding the threshold under A2D_ELT would be similar to or less than (up to 14% less, absolute scale) the percent under NAA_ELT.

Table 11-2D-38. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
October	-4 (-4%)	5 (6%)	2 (3%)	15 (36%)	17 (93%)
November	7 (200%)	2 (200%)	0 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (33%)	5 (133%)	2 (200%)	1 (NA)	0 (NA)
April	6 (9%)	6 (11%)	14 (44%)	6 (36%)	4 (33%)
NAA_ELT vs. A2D_ELT					
October	-5 (-5%)	-4 (-4%)	-9 (-10%)	-11 (-17%)	-14 (-28%)
November	-5 (-31%)	-2 (-40%)	-2 (-100%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-9 (-47%)	0 (0%)	-1 (-25%)	-1 (-50%)	-1 (-100%)
April	-2 (-3%)	-5 (-7%)	-6 (-12%)	-6 (-21%)	-1 (-8%)

NA = could not be calculated because the denominator was 0.

The effects of Alternative 2D on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months in the Feather River at Gridley for months that exceed the 56°F NMFS threshold during the October through April fall-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-2D-39). Total degree-months (all water year types combined) would be similar between NAA_ELT and A2D_ELT for all months of the period.

Table 11-2D-39. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
October	Wet	31 (42%)	-3 (-3%)
	Above Normal	10 (23%)	-4 (-7%)
	Below Normal	14 (25%)	-3 (-4%)
	Dry	21 (40%)	-1 (-1%)
	Critical	17 (41%)	-1 (-2%)
	All	92 (35%)	-13 (-4%)
November	Wet	2 (NA)	1 (100%)
	Above Normal	3 (150%)	0 (0%)
	Below Normal	3 (300%)	0 (0%)
	Dry	6 (NA)	0 (0%)
	Critical	3 (300%)	-1 (-20%)
	All	17 (425%)	0 (0%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	-1 (-100%)	0 (NA)
	Below Normal	7 (700%)	1 (14%)
	Dry	6 (150%)	-1 (-9%)
	Critical	6 (150%)	0 (0%)
	All	19 (190%)	0 (0%)
April	Wet	15 (107%)	0 (0%)
	Above Normal	9 (39%)	1 (3%)
	Below Normal	6 (15%)	0 (0%)
	Dry	19 (39%)	3 (5%)
	Critical	14 (48%)	3 (8%)
	All	65 (42%)	9 (4%)

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under A2D_ELT would be similar on an absolute scale (ranging from a 2% reduction to a 1% increase, depending on water year type) to mortality under NAA_ELT despite the large relative differences (-25% to 26%). The absolute differences are used here as more reliable estimators of differences in mortality rates because they are directly related to the size of the egg population (Table 11-2D-40). An increase of 1% in the mortality rate would not cause an overall effect to fall-run Chinook salmon.

Table 11-2D-40. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Feather River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	2 (126%)	0 (16%)
Above Normal	2 (139%)	0 (18%)
Below Normal	2 (119%)	1 (26%)
Dry	3 (117%)	-2 (-25%)
Critical	5 (94%)	-1 (-12%)
All	2 (113%)	0 (-4%)

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or up to 27% greater (critical water years) than flows under NAA_ELT during October and would be lower (up to 15% lower) than flows under NAA_ELT during November of wet, above normal and below normal water years. Mean flows during December and January would generally be similar between A2D_ELT and NAA_ELT, with minor exceptions.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period, except for 5% higher water temperatures in October of wet, below normal and dry water years.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-2D-41). The percent of months exceeding the threshold under A2D_ELT would similar to or up to 12% lower (absolute scale) than the percent under NAA_ELT.

Table 11-2D-41. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
November	26 (57%)	25 (91%)	21 (155%)	16 (650%)	9 (700%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (20%)	2 (33%)	4 (150%)	1 (100%)	1 (NA)
April	11 (16%)	6 (10%)	10 (22%)	10 (31%)	4 (14%)
NAA_ELT vs. A2D_ELT					
November	-11 (-13%)	-9 (-14%)	-9 (-20%)	-12 (-40%)	-9 (-47%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-20%)	-4 (-27%)	-4 (-38%)	0 (0%)	-1 (-50%)
April	-6 (-7%)	-6 (-8%)	-9 (-13%)	-7 (-15%)	-1 (-4%)

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-2D-42). Total degree-months would be similar between NAA_ELT and Alternative 2D for all months.

Table 11-2D-42. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
November	Wet	33 (132%)	-6 (-9%)
	Above Normal	14 (127%)	-3 (-11%)
	Below Normal	22 (275%)	-4 (-12%)
	Dry	23 (177%)	-3 (-8%)
	Critical	18 (113%)	0 (0%)
	All	110 (151%)	-16 (-8%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	4 (100%)	-1 (-11%)
	Critical	7 (70%)	0 (0%)
	All	18 (95%)	-1 (-3%)
April	Wet	19 (68%)	-3 (-6%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	15 (42%)	-1 (-2%)
	Dry	14 (18%)	-1 (-1%)
	Critical	14 (24%)	-2 (-3%)
	All	76 (34%)	-7 (-2%)

NA = could not be calculated because the denominator was 0.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. The greatest (maximum) monthly reductions in

American River flows during November through January under A2D_ELT would be 30% to 49% larger (absolute difference) than under NAA_ELT in wet, below normal, and critical water years and 2% to 9% smaller than NAA_ELT in above normal and dry water years (Table 11-2D-43).

Table 11-2D-43. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in the American River at Nimbus Dam during the October through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-18 (-83%)	-40 (NA)
Above Normal	15 (50%)	9 (37%)
Below Normal	-25 (-131%)	-30 (-197%)
Dry	21 (44%)	2 (6%)
Critical	-13 (-25%)	-49 (-312%)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in October, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under A2D_ELT would be similar to mortality under NAA_ELT in all water years (Table 11-2D-44).

Table 11-2D-44. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the American River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	15 (99%)	-0.2 (-1%)
Above Normal	14 (130%)	-1 (-2%)
Below Normal	12 (101%)	0 (0%)
Dry	9 (57%)	-0.1 (-1%)
Critical	4 (19%)	0 (0%)
All	11 (76%)	-0.2 (-1%)

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be largely the same as flows under NAA_ELT throughout the period.

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and Alternative 2D throughout the October through January period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). There would be no difference in mean flows between A2D_ELT and NAA_ELT for all water year types throughout the period.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, it is concluded that the effect is not adverse because spawning and egg incubation habitat conditions are not substantially reduced. There are no reductions in flows under Alternative 2D or increases in temperatures that would translate into adverse biological effects on fall-/late fall-run Chinook salmon spawning and egg incubation habitat. The Reclamation egg mortality model predicts no effects of Alternative 2D on fall-/late fall-run Chinook salmon spawning and egg incubation habitat in the Sacramento, Feather, and American Rivers and SacEFT predicts generally small or beneficial impacts on spawning and egg incubation habitat in the Sacramento River.

CEQA Conclusion: In general, the results for the Alternative 2D analysis indicate that Alternative 2D could affect spawning and egg incubation habitat for fall-/late fall–run Chinook salmon relative to the Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of spawning and egg incubation habitat for fall-/late fall-run Chinook salmon relative to the CEQA baseline.

Sacramento River

Fall-Run

Flows were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows in the Sacramento River upstream of Red Bluff under A2D_ELT would generally be similar to Existing Conditions during December and January During October and November, flows under A2D_ELT would be generally lower (by up to 15%) than under Existing Conditions, depending on water year type. These results indicate that there would generally be no flow-related effects of Alternative 2D on spawning and egg incubation habitat, except for intermittent negligible-to-small flow reductions during October and November. Storage volume at the end of September would be 7% to 12% lower under A2D_ELT relative to Existing Conditions, depending on water year type (Table 11-2D-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-20. There would be 75% and 83% increases in the number of years with "red" and "orange" levels of concern under A2D_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water year types combined) under A2D_ELT would be 77% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-2D-21).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be 18% to 62% greater than mortality under Existing Conditions, and 4% to 7% greater on an absolute scale (Table 11-2D-33).

SacEFT predicts that there would be a 19% increase in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-34). SacEFT predicts that there would be a 5% reduction in the percentage of years with good (lower) redd scour risk under A2D_ELT relative to Existing Conditions. SacEFT predicts that there would be a 5% decrease in the percentage of years with good (lower) egg incubation conditions under A2D_ELT relative to Existing Conditions. SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to Existing Conditions.

Late Fall–Run

Flows in the Sacramento River upstream of Red Bluff were examined during the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be greater than or similar to flows under Existing Conditions, except in below normal years during March (7% lower) and wet years during May (10% lower).

Storage volume at the end of September would be 7% to 12% lower under A2D_ELT relative to Existing Conditions (Table 11-2D-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-20. There would be 75% and 83% increases in the number of years with "red" and "orange" levels of concern under A2D_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under A2D_ELT would be 77% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-2D-21).

The Reclamation egg mortality model predicts that late fall–run Chinook salmon egg mortality in the Sacramento River under A2D_ELT would be 49% to 119% greater than mortality under Existing Conditions, depending on water year type (Table 11-2D-35). However, absolute differences in the percent of the late-fall population subject to mortality would be no more than 2% for any water year type.

SacEFT predicts that there would be a 13% decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-36). SacEFT predicts that there would be a 4% decrease in the percentage of years with good (lower) redd scour risk under A2D_ELT relative to Existing Conditions. SacEFT predicts that there would be no difference in the percentage of years with good (lower) egg incubation conditions under A2D_ELT relative to Existing Conditions. SacEFT predicts that there would be an 8% decrease in the percentage of years with good (lower) redd dewatering risk under A2D_ELT relative to Existing Conditions.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir under A2D_ELT during the September through February fall-run spawning and egg incubation period would generally be similar to or up to 40% greater than (January of wet years) flows under Existing Conditions, except during September of critical water years and October of below normal years (19% and 6% lower, respectively).

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning occurred. The greatest monthly reduction in Clear Creek flows during October through February under A2D_ELT would be similar to or smaller than that under Existing Conditions in wet and below normal water years, but the reduction would be 41%, 100%, and 33% greater (absolute, not relative, differences) under A2D_ELT in above normal, dry, and critical water years, respectively (Table 11-2D-37).

Feather River

Fall-Run

Flows in the low-flow channel during October through January under A2D_ELT would be identical to those under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives* Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows in the high-flow channel under A2D_ELT would generally be lower than flows under Existing Conditions by up to 47% during November through January, and would generally be similar to or greater than flows under Existing Conditions during October. These results indicate that there would be intermittent negligible-to-moderate flow-related effects of Alternative 2D on spawning and egg incubation habitat during November, December and January.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Minimum flows in the low-flow channel were identical between A2D_ELT and Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 2D on redd dewatering in the Feather River low-flow channel.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under A2D_ELT would be 94% to 139% greater than mortality under Existing Conditions, depending on water year type, and 2% to 5% greater on an absolute scale (Table 11-2D-40).

Water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A2D_ELT relative to Existing Conditions would be no different (<5%) in either the low-flow or high-flow channel throughout the period

The percent of months exceeding the 56°F temperature threshold in the Feather River at Gridley was evaluated during October through April (Table 11-2D-38). The percent of months exceeding the threshold under A2D_ELT would similar to or up to 17% higher (absolute scale) than the percent under Existing Conditions during all months except December through February, during which there would be no difference in the percent of months exceeding the threshold.

Total degree-months exceeding 56°F were summed by month and water year type at Gridley during October through April (Table 11-2D-39). Total degree-months (all water year types combined) exceeding the 56°F threshold under A2D_ELT would be 35% to 425% higher than total degree-months under Existing Conditions, except during December through February, in which there would be no differences.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be lower by up to 23%

than flows under Existing Conditions during October, November, and January, with some exceptions. These results indicate that there would be intermittent negligible-to-moderate flow-related effects of Alternative 2D on spawning and egg incubation habitat during October, November, and January.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under A2D_ELT would be 5% to 7% greater than those under Existing Conditions in October, depending on water year type, and would be similar to those under Existing Conditions during the other three months of the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-2D-41). The percent of months exceeding the threshold under A2D_ELT would be up to 26% greater (absolute scale) than the percent under Existing Conditions during November, March, and April and similar to the percent under Existing Conditions during December through February.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-2D-42). Total degree-months (all water year types combined) under Alternative 2D would be 34% to 151% greater than total degree-months under Existing Conditions during November, March and April and similar to total degree months under Existing Conditions during December through February.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. The greatest monthly reduction in American River flows during November through January would be 83%, 131%, and 25% larger (absolute differences) under A2D_ELT in wet, below normal, and critical water years, respectively, than those under Existing Conditions, and would be smaller in above normal and dry years (Table 11-2D-43).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under A2D_ELT would be 19% to 130% greater (4% to 15% absolute differences) than mortality under Existing Conditions (Table 11-2D-44).

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to those under Existing Conditions, except for January of below normal and critical water years when flows would be 8% and 12% lower, respectively.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A2D_ELT would not be different (<5% difference) from those under Existing Conditions for all months and water year types.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be generally similar to or slightly higher than flows under Existing Conditions.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions during October, November and January, and would be up to 28% higher (wet years) during December.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 2D, there would be small to moderate flow reductions and increases in the exceedances of NMFS temperature thresholds in the Sacramento, Feather and American rivers that would interfere with fall-/late fall-run Chinook salmon spawning and egg incubation. The Reclamation egg mortality model predicts moderate to substantial negative impacts of Alternative 2D on fall-/late fall-run Chinook salmon in the Sacramento, Feather, and American Rivers and SacEFT predicts reduced egg incubation habitat conditions for fall-run Chinook salmon and reduced spawning habitat conditions for late fall-run Chinook salmon in the Sacramento River. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of egg mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be no effect of Alternative 2D on flows, reservoir storage, and water temperatures that would cause a substantial reduction in fall-/late fall-run Chinook salmon. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-77: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 2D would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall–run Chinook salmon relative to NAA_ELT.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be greater than or similar to flows under NAA_ELT throughout the period.

Shasta Reservoir storage at the end of September would affect flows during the fall-run larval and juvenile rearing period. As reported in Impact AQUA-59 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

SacEFT predicts that there would be an 11% decrease (4% on an absolute scale) in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-34). SacEFT predicts that there would be no difference in the percentage of years with “good” (lower) juvenile stranding risk under A2D_ELT relative to NAA_ELT.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under A2D_ELT would be similar to mortality under NAA_ELT.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the late fall–run Chinook salmon juvenile rearing period of March through July (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT were generally similar to or greater than those under NAA_ELT throughout the rearing period.

Shasta Reservoir storage at the end of September and May would affect flows during the late fall–run larval and juvenile rearing period. As reported in Impact AQUA-156, end of September Shasta Reservoir storage would be similar to storage under NAA_ELT in all water year types (Table 11-2D-19). Similarly, as reported in Impact AQUA-59, Shasta storage at the end of May under A2D_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-2D-9).

Water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

SacEFT predicts that there would be a 25% decrease (11% on an absolute scale) in the percentage of years with good juvenile rearing availability for late fall–run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-36). SacEFT predicts that there would be a 15% reduction in the percentage of years with "good" (lower) juvenile stranding risk under A2D_ELT relative to NAA_ELT. SALMOD predicts that late fall–run smolt equivalent habitat-related mortality under A2D_ELT would be similar (<1% difference) to mortality under NAA_ELT.

Both SacEFT and SALMOD are considered to be reliable models for late fall-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about late fall-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile rearing habitat availability may be reduced under Alternative 2D, when combined with all early life stage effects in SALMOD, there would be no effect of the alternative on late-fall-run Chinook salmon habitat-related survival of all early life stages, including juveniles. Further, results from SALMOD are consistent with results described above that indicate that there would be no differences in instream flows or reservoir storage between NAA_ELT and Alternative 2D.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined the January through May fall-run Chinook salmon rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT throughout the rearing period.

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout this period under A2D_ELT would not differ from those under NAA_ELT. In the high flow channel, mean flows under A2D_ELT would be mostly similar to or up to 121% greater (June of below normal water years) than flows under NAA_ELT, except for January and March of below normal water years whose flows would be up to 17% lower under A2D_ELT.

As reported in Impact AQUA-59 for spring-run Chinook salmon, May Oroville storage volume under A2D_ELT would be similar to storage under NAA_ELT, (Table 11-2D-28).

As reported in Impact AQUA-58 for spring-run Chinook salmon, September Oroville storage volume under A2D_ELT would be similar to, 6% lower than, or up to 17% higher than that under NAA_ELT, depending on water year type (Table 11-2D-25).

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT during January through May, with minor exceptions. However, during April and May of critical water years, flows would be 22% higher and 24% lower, respectively.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Stanislaus River

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for Alternative 2D are not different from those under NAA_ELT, for the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*).

Mean water temperatures throughout the Stanislaus River would be similar between NAA_ELT and Alternative 2D throughout the January through May fall-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Mean flows in the San Joaquin River at Vernalis for Alternative 2D are not different from those under NAA_ELT, for the January through May fall-run larval and juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River at the Delta for Alternative 2D are not different from those under NAA_ELT, for the January through May fall-run larval and juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Taken together, these modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat of fish. The changes in flow rates and water temperatures are generally small and infrequent under Alternative 2D relative to the NAA_ELT. SacEFT predicts that there would be a 25% decrease in the percentage of years with good juvenile rearing habitat availability for late fall-run and a 15% reduction in the number of years with good juvenile stranding risk between Alternative 2D and the NEPA baseline. However, review of these SacEFT results in combination with the results of SALMOD, which evaluates habitat-related survival of all early life stages and found no effects of Alternative 2D, it is concluded that the effect to juvenile habitat conditions predicted by SacEFT would not have a substantial effect on early life stages combined, include juveniles, as predicted by SALMOD. As such, the effect in not adverse because it does not have the potential to substantially reduce the amount of suitable habitat of fish.

CEQA Conclusion: In general, Alternative 2D would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall–run Chinook salmon relative to the Existing Conditions.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be greater than or similar to flows under Existing Conditions, except in below normal years during March (7% lower) and wet years during May (10% lower).

As reported in Impact AQUA-59, end of September Shasta Reservoir storage would be 7% to 12% lower under A2D_ELT relative to Existing Conditions, depending on water year type (Table 11-2D-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

SacEFT predicts that there would be a 3% increase in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-34). SacEFT predicts that there would be a 26% reduction in the percentage of years with “good” (lower) juvenile stranding risk under A2D_ELT relative to Existing Conditions.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under A2D_ELT would be similar to mortality under Existing Conditions.

Late Fall–Run

Year-round Sacramento River flows upstream of Red Bluff were examined for the late fall–run Chinook salmon juvenile March through July rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows during March through June under A2D_ELT were generally similar to or greater than those under Existing Conditions, with minor exceptions.

As reported in Impact AQUA-59, end of September Shasta Reservoir storage would be 7% to 12% lower under A2D_ELT relative to Existing Conditions, depending on water year type (Table 11-2D-19).

As reported in Impact AQUA-41, end of May Shasta storage under A2D_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% to 9% in dry and critical water years (Table 11-2D-9).

Water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

SacEFT predicts that there would be an 4% reduction in the percentage of years with good juvenile rearing availability for late fall–run Chinook salmon, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-36). SacEFT predicts that there would be a 29% reduction in the percentage of years with “good” (lower) juvenile stranding risk under A2D_ELT relative to Existing Conditions.

SALMOD predicts that late fall–run smolt equivalent habitat-related mortality under A2D_ELT would be 5% higher than mortality under Existing Conditions.

Clear Creek

No temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined the January through May fall-run Chinook salmon rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or slightly greater than flows under Existing Conditions for the entire period, except for 40% higher flow in January of wet years (Appendix *B, Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout the period under A2D_ELT would not differ from those under Existing Conditions. In the high flow channel, mean flows under A2D_ELT would be mostly lower (up to 47% in January of below normal water years) during December through March and mostly similar to or up to 157% greater (June of below normal years) than flows under Existing Conditions during April through June, with minor exceptions.

As reported under in Impact AQUA-59, May Oroville storage volume under A2D_ELT would be lower than Existing Conditions by 5% to 13%, depending on water year type, except in wet and above normal years, in which storage would be similar to Existing Conditions (Table 11-2D-25).

As reported in Impact AQUA-59, September Oroville storage volume would be 19% to 28% lower under A2D_ELT relative to Existing Conditions, depending on water year type, except in dry and critical water years, in which storage would be similar to or 5% greater than that under Existing Conditions (Table 11-2D-28).

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). In both the low-flow channel and the high-flow channel, mean water temperatures under Alternative 2D would be the same (<5% difference) as those under Existing Conditions throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except during January in below normal, dry and critical years (12% to 14% lower), February and March of critical years (7% and 11% lower, respectively), and May of all water year types (up to 16% lower in critical years).

Water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no difference (<5%) in mean water temperatures between Alternative 2D and Existing Conditions throughout the rearing period.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be lower than those under Existing Conditions for most water years throughout the period (up to 29% lower in February of critical years), with some exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under Alternative 2D be the same (<5% difference) as those under Existing Conditions in all months during the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be slightly lower (up to 12% lower) than those under Existing Conditions for most water years throughout the period, with some exceptions Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during January through April, and would be up to 11% lower than flows under Existing Conditions during May.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 2D, including climate change effects, there would be moderate flow reductions in the Feather River, which would interfere with fall-run Chinook salmon juvenile rearing habitat conditions. Flows in the Feather River would be lower in the majority of water year types during January and February, with flows in January up to 47% lower. SacEFT predicts that, for fall-run, there would be a 26% reduction in years with low juvenile stranding risk, indicating that flows would be more variable during the rearing period. Both SacEFT and SALMOD predict reduced rearing habitat conditions under Alternative 2D relative to Existing Conditions for late fall-run Chinook salmon. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable rearing habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of degraded juvenile rearing conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required. Therefore, the effects of Alternative 2D on fall-/late fall-run Chinook salmon juvenile rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-78: Effects of Water Operations on Migration Conditions for Chinook Salmon (Fall-/Late Fall–Run ESU)

Upstream of the Delta

In general, Alternative 2D would degrade migration conditions for fall-/late fall–run Chinook salmon relative to NAA_ELT.

Sacramento River

Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile fall-run migrants during February through May under A2D_ELT would be similar to or greater than flows under NAA_ELT throughout the February through May juvenile fall-run migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult fall-run Chinook salmon upstream migration period (August through December) under A2D_ELT would generally be similar to those under NAA_ELT, except during September (up to 17% lower) and November (up to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under A2D_ELT would generally be similar to or slightly greater than flows under NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under A2D_ELT would be similar to or slightly greater than those under NAA_ELT throughout the migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento*

River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Flows in the Clear Creek below Whiskeytown Reservoir were examined for juvenile fall-run migrants during February through May. Mean flows under A2D_ELT would be similar to flows under NAA_ELT during all months and water year types of the migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon upstream migration period (August through December) under A2D_ELT would be similar to those under NAA_ELT except for critical water years in August, September and October, in which flows would be 11% higher, 10% lower, and 6% lower, respectively (Appendix *B, Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run juvenile migration period (February through May) under A2D_ELT would generally be similar to or greater than flows under NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Mean flows in the Feather River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period under A2D_ELT would be lower by up to 32% than flows under NAA_ELT in August and September, except during critical years in which flow would be up to 14% higher, and flow would be similar to or up to 21% greater than flows under NAA_ELT in the other months of the migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be generally similar to flows under NAA_ELT during February through April, except for 22% greater flow in April of critical water years. Flows during May would be similar or slightly greater than those under NAA_ELT, except for 24% lower flow in critical years.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type of the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be up to 27% lower than those under NAA_ELT during August, September, and November and would be similar or up to 27% higher during October and December.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under Alternative 2D would be similar to those under NAA_ELT throughout the year. Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under Alternative 2D would be similar to those under NAA_ELT throughout the year.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under Alternative 2D would be similar to those under NAA_ELT throughout the year.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

The effects of Alternative 2D on through-Delta migration were evaluated using the approach described in Alternative 1A, Impact AQUA-42.

Fall-Run

Juveniles

Juvenile fall-run Chinook salmon migrating down the Sacramento River would generally experience lower flows below the north Delta intakes compared to Existing Conditions. Estimates of potential predation losses ranged from 0.4% (bioenergetics model, Table FR_bioenergetics) up to 20.3% (conservative assumption of 5% loss per intake, based on GCID data from Vogel 2008) of fall-run annual production.

Table FR_bioenergetics. Fall-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes (Five Intakes for Alternative 2D)

Striped Bass at NDD (Five Intakes)			Fall-Run Chinook Consumed	
Density Assumption	Bass per 1,000 Feet of Intake	Total Number of Bass	Number	Percentage of Annual Production Entering the Delta[1]
Low	18	154	39,232	0.06%
Median	119	1,017	259,368	0.42%
High	219	1,872	477,324	0.77%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 61.6 million. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

Through-Delta survival by juvenile fall-run Chinook salmon under Alternative 2D averaged across years would be 24.2% from the Sacramento River and 16.5% from the Mokelumne River, which is little different from NAA_ELT (Table 11-2D-45). In wetter years, mean survival would be 2.8% lower from the Sacramento (8% relative decrease) and 1.9% greater (10% relative increase) from the Mokelumne. As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that are assumed to be included under NAA that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 2D and NAA_ELT for fall-run Chinook salmon migrating down the Sacramento River would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Overall, Alternative 2D would have a negative effect on fall-run Chinook salmon juvenile survival due to the near-field and far-field effects of the NDD intakes.

Table 11-2D-45. Through-Delta Survival (%) of Emigrating Juvenile Fall-Run Chinook Salmon under Alternative 2D

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Type	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River					
Wetter Years	34.5	33.0	30.2	-4.3 (-12%)	-2.8 (-8%)
Drier Years	20.6	20.6	20.6	0.0 (1%)	-0.1 (0%)
All Years	25.8	25.3	24.2	-1.6 (-4%)	-1.1 (-3%)
Mokelumne River					
Wetter Years	17.2	16.3	18.2	1.0 (4%)	1.9 (10%)
Drier Years	15.6	15.7	15.5	-0.1 (0%)	-0.2 (-1%)
All Years	16.2	15.9	16.5	0.3 (1%)	0.6 (3%)
San Joaquin River					
Wetter Years	19.3	20.7	16.4	-2.9 (-6%)	-4.3 (-10%)
Drier Years	10.0	9.8	10.9	1.0 (10%)	1.1 (11%)
All Years	13.5	13.9	13.0	-0.5 (4%)	-0.9 (3%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

Attraction flow for fall-run adults, as estimated by the percentage of Sacramento River water at Collinsville, was 5% lower in September and decreased 0% to 2% in October to December under Alternative 2D compared to NAA_ELT (Table 11-2D-17). The Sacramento River would still represent a substantial proportion (60% to 65%) of Delta outflows. The reductions in percentage are small in comparison with the magnitude of change in dilution (20% or more) reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to affect adult Chinook salmon migration. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. This topic is discussed further in Impact AQUA-42 in Alternative 1A.

Late Fall–Run

Juveniles

Juvenile salmonids migrating down the Sacramento River would generally experience lower flows below the north Delta intakes compared to Existing Conditions. Through-Delta survival by emigrating juvenile late fall–run Chinook salmon under Alternative 2D (A2D_ELT) would average

22% across all years, ranging from 19% in drier years to 26% in wet years. Juvenile survival would decrease slightly in wetter (1.3% less survival, or 4% less in relative percentage) and similar in drier years (0.6% less survival, or 2% less in relative percentage) compared to NAA_ELT (Table 11-2D-46). Estimates of potential predation losses ranged from 1% (bioenergetics model, Table LFR_bioenergetics) up to ~20% (conservative assumption of 5% loss per intake) of fall-run annual production.

Table LFR_bioenergetics. Late Fall-Run Chinook Salmon Predation Loss at the Proposed North Delta Diversion (NDD) Intakes (Five Intakes for Alternative 2D)

Striped Bass at NDD (Five Intakes)			Late Fall-Run Chinook Consumed	
Density Assumption	Bass per 1,000 Feet of Intake	Total Number of Bass	Number	Percentage of Annual Production Entering the Delta[1]
Low	18	154	6,596	0.15%
Median	119	1,017	43,610	1.01%
High	219	1,872	80,257	1.87%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 4.3 million for late fall-run. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

Table 11-2D-46. Through-Delta Survival (%) of Emigrating Juvenile Late Fall–Run Chinook Salmon under Alternative 2D

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Type	EXISTING CONDITIONS	NAA_ELT	A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wetter Years	28.8	27.5	26.2	-2.6 (-7%)	-1.3 (-4%)
Drier Years	18.8	20.0	19.4	0.7 (5%)	-0.6 (-2%)
All Years	22.5	22.8	22.0	-0.5 (0%)	-0.9 (-2%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

The adult late fall–run migration is from November through March, peaking in January through March. The proportion of Sacramento River water in the Delta at Collinsville would be similar (10% or less difference) to NAA_ELT throughout the adult late fall–run migration (Table 11-2D-17). Alternative 2D would not have an adverse effect on late fall–run adult migration. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. This topic is discussed further in Impact AQUA-42 in Alternative 1A.

San Joaquin River

Fall-Run

Juveniles

The only changes on San Joaquin River flows at Vernalis would result from the modeled effects of climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows. There are no flow changes associated with the alternatives. Survival was similar between Alternative 2D and NAA_ELT when averaged across all years, but was considerably less under Alternative 2D in wetter years. As described in more detail for Alternative 4A, this reflects the assumptions of the DPM, wherein there is a positive relationship between survival and exports, based on current relationships; but there is considerable uncertainty in effects on San Joaquin River Chinook salmon survival at the very low levels of south Delta exports in wetter years under Alternative 2D because the studies upon which the DPM flow- and export-survival relationships are based did not include these very low levels of exports. As noted under Alternative 4A, SalSim, a different analysis tool, would be expected to illustrate a benefit of Alternative 2D across any modeled year for Alternative 2D, which is more in keeping with the anticipated effect of the alternative. Overall and in light of these uncertainties, Alternative 2D would not have an adverse effect on through-Delta migration for San Joaquin River fall-run Chinook salmon because the reduction in south Delta exports generally would be expected to benefit through-Delta survival.

Adults

Alternative 2D would slightly increase the proportion of San Joaquin River water in the Delta in September through December by 1.7 to 5.2% compared to NAA_ELT). As noted under Alternative 4A, although the relative change is substantial (i.e., a severalfold increase in the percentage of flow from the San Joaquin River under Alternative 2D compared to NAA_ELT), the percentage of flow attributable to San Joaquin River water under all scenarios is quite low (no more than around 5%). However, even the seemingly small increase in San Joaquin River flow could provide moderate benefits: as illustrated in *BDCP Appendix 5.C, Section 5C.5.3.13.1.5 hereby incorporated by reference*, based on the study of Marston et al. (2012), greater olfactory cues under Alternative 2D could decrease severalfold the straying rate of adult San Joaquin River Chinook salmon to the Sacramento River. This would not be an adverse effect on adult fall-run Chinook salmon migrating to the San Joaquin River.

NEPA Effects: Overall, the results indicate that the effect of Alternative 2D is adverse due to the cumulative effects associated with five north Delta intake facilities, including mortality related to near-field effects (e.g. impingement and predation) and far-field effects (reduced survival due to reduced flows downstream of the intakes) associated with the five NDD intakes.

Upstream of the Delta, flows in the American River would be up to 27% lower during the majority (three of the five) months of the fall-run Chinook salmon adult migration period. These reductions in flow may impact the ability of adult fall-run Chinook salmon to migrate upstream successfully. There would be no other adverse effects of Alternative 2D on upstream flows or water temperatures during the juvenile or adult migration periods for fall- and late fall-run Chinook salmon.

Adult attraction flows under Alternative 2D would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

Near-field effects of Alternative 2D on fall-run/late fall-run Chinook salmon related to impingement and predation associated with five new intakes could result in substantial effects on juvenile migrating fall-run/late fall-run Chinook salmon, although there is high uncertainty regarding the potential effects. Estimates within the effects analysis range from very low levels of effects (<1% mortality) to very significant effects (~ 20% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structures will be implemented as part of the final NDD screen design effort. As with Alternative 4A, Alternative 2D also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for fall-run/late fall-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains highly uncertain. See additional discussion under Impact AQUA-42 of Alternative 4A for winter-run Chinook salmon.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 2D would be lower than survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 2D on juvenile fall-run/late fall-run Chinook salmon migration suggests a potential adverse effect of small magnitude. This adverse effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 2D of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of fall-run/late fall-run Chinook salmon juveniles into the low-survival interior Delta.

Overall, primarily as a result of substantially reduced upstream flows and unacceptable levels of uncertainty regarding the cumulative impacts of near-field and far-field effects associated with the presence and operation of the five intakes on fall-run/late fall-run Chinook salmon, this effect is adverse. While implementation of the environmental commitments noted above and mitigation measures listed below would address these impacts, these are not anticipated to reduce the impacts to a level considered not adverse.

CEQA Conclusion: In general, Alternative 2D would affect migration conditions for fall-/late fall–run Chinook salmon relative to the Existing Conditions.

Upstream of the Delta

Sacramento River

Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile fall-run migrants during February through May under A2D_ELT would generally be similar to or greater than those under

Existing Conditions, except during March of below normal water years (7% lower) and during May of wet water years (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult fall-run Chinook salmon upstream migration period (August through December) under A2D_ELT would generally be similar to flows under Existing Conditions during December and lower than those under Existing Conditions in the other months of the migration period (up to 22% lower in September of dry years), except for higher flows during September of wet and above normal years (20% and 27% higher, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the August through November adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D during September or October of any water year type.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under A2D_ELT would generally be similar to or slightly greater than those under Existing Conditions throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir during the juvenile fall-run Chinook salmon upstream migration period (February through May) under A2D_ELT would be similar to or greater than those under Existing Conditions throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon upstream migration period (August through December) under A2D_ELT would generally be similar to those under Existing Conditions, except during September of critical water years (19% lower)(Appendix *B, Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run juvenile migration period (February through May) under A2D_ELT would generally be similar to or greater than flows under Existing Conditions, except in below normal years during February and March (11% and 16% lower, respectively) and in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

Mean flows in the Feather River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period under A2D_ELT would generally be similar to or greater than flows under Existing Conditions (up to 102% greater for September of wet years), except in below normal and dry years during August and September (up to 43% lower).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and Alternative 2D during September or October of any water year type.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during February through April would generally be similar to or greater than flows under Existing Conditions, except for slightly lower flows during February of dry and critical water years, March of critical years, and April of above normal years. Flows would be lower under A2D_ELT during May of all water year types (up to 16% lower).

Water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during August, September, and November of all water year types would be lower than flows under Existing Conditions (up to 52% lower in August of dry years). Mean flows under A2D_ELT during October and December would be up to 14% lower than those under Existing Conditions in some water years and up to 16% higher in other water years.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under Alternative 2D would be similar (<5% difference) to those under Existing Conditions during September, November and December, and would be 5% higher than those under Existing Conditions during August of dry water years and 5% to 6% higher during October of all water year types except critical years.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be lower than those under Existing Conditions (up to 29% lower) for most water year types in all months of the period, although flows under A2D_ELT in February and March of wet years would be up to 17% greater.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be 9%, 7% and 6% lower than those under Existing Conditions during, respectively, August and September of wet years and October of below normal water years.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under AD2D_ELT would be 5% to 12% lower than those under Existing Conditions during February through May of below normal, dry and critical years, except for February of below normal years for which flows under AD2_ELT would be similar to those under Existing Conditions.

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be up to 14% lower than those under Existing Conditions during August and September and would be similar to or greater than those under Existing Conditions during the remainder of the migration period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under Alternative 2D would be similar to those under Existing Conditions during February and up to 6%, 7%, and 11% lower than those under Existing Conditions during March, April and May, respectively.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be up to 32% lower than those under Existing Conditions during August and September, would be generally similar during October and November, and would be up to 28% greater during December.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Based on the proportion of Sacramento River flows, olfactory cues would be similar (10% or less difference) to Existing Conditions for nearly all months of the year. The 10% decrease in March would affect the last month of the late fall-run adult migration. Through the Delta, Sacramento River flows below the NDD would be reduced compared to baseline conditions during adult and juvenile migration periods. Modeled juvenile survival (DPM) is expected to be similar or slightly lower in all water year types (4% relative decrease across all years, 12% decrease in wetter years). Estimated predation losses of juveniles migrating past the five intakes could hypothetically range from <1% to ~20% of annual production, although the latter estimate is a conservative upper bound. The adaptive management program would provide a mechanism for making adjustments to minimize this effect to some extent. In addition, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* would be implemented to reduce potential effects. However, the benefits of these actions are uncertain. As a result of changes in predation and habitat associated with five NDD structures, this impact is significant.

Summary of CEQA Conclusion

Overall, Alternative 2D would significantly affect the migration conditions for fall-run/late fall-run Chinook salmon, relative to the Existing Conditions. Through-Delta survival of emigrating juveniles has the potential to be appreciably reduced, compared to Existing Conditions. There would be little negative effect of Alternative 2D on adult olfactory cues in the Delta. Upstream of the Delta, there would be substantial reductions in flows in multiple waterways under Alternative 2D relative to Existing Conditions that would slow or inhibit migration of juveniles and adult fall-/late fall-run Chinook salmon. In the American River, there would be increases in temperatures during the adult fall-run migration period that would increase thermal stress on migrants.

Implementation of *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers* (all of which are summarized further in Section 4.1.3.3 of this RDEIR/SDEIS) would address the through-Delta impacts, but are not anticipated to reduce them to a level considered less than significant because of the presence of five intakes. As a result of these changes in migration conditions, this impact is significant and unavoidable.

In addition to the environmental commitments above, the mitigation measures identified below would provide an adaptive management process that would be conducted as a part of the Adaptive Management and Monitoring Program, for assessing impacts and developing appropriate minimization measures. However, this would not necessarily result in a less than significant determination, so it is concluded that the impact is significant and unavoidable.

Mitigation Measure AQUA-78a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Fall-/Late Fall–Run Chinook Salmon to Determine Feasibility of Mitigation to Reduce Impacts to Migration Conditions

Please refer to Mitigation Measure AQUA-78a under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Mitigation Measure AQUA-78b: Conduct Additional Evaluation and Modeling of Impacts on Fall-/Late Fall–Run Chinook Salmon Migration Conditions Following Initial Operations of Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-78b under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Mitigation Measure AQUA-78c: Consult with NMFS and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Fall-/Late Fall–Run Chinook Salmon Migration Conditions Consistent with Water Conveyance Facility Operations

Please refer to Mitigation Measure AQUA-78c under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-79: Effects of Construction of Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-80: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-81: Effects of Restored Habitat Conditions on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-82: Effects of Methylmercury Management on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 12)

Impact AQUA-85: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 15)

Impact AQUA-86: Effects of Nonphysical Fish Barriers on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on fall/late fall-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Steelhead

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-91: Effects of Construction of Water Conveyance Facilities on Steelhead

The potential effects of construction of the water conveyance facilities on steelhead or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-91) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to steelhead.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-91, the effect would not be adverse for steelhead or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-91, the impact of the construction of water conveyance facilities on steelhead and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-92: Effects of Maintenance of Water Conveyance Facilities on Steelhead

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-92, the effect would not be adverse for steelhead.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-92 for steelhead, the impact of the maintenance of water conveyance facilities on steelhead or critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-93: Effects of Water Operations on Entrainment of Steelhead

Water Exports from SWP/CVP South Delta Facilities

Alternative 2D would reduce overall entrainment of juvenile steelhead at the south Delta export facilities by 67%, as estimated by the salvage density method (Table 11-2D-48) across all years compared to NAA_ELT. Under Alternative 2D, the greatest reductions in entrainment would be in wetter years (91% decrease in wet years; 79% decrease in above normal years). Pre-screen loss at the south Delta facilities, typically attributed to predation, would be reduced commensurate with reductions in entrainment.

Table 11-2D-48. Juvenile Steelhead Annual Entrainment at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A2D	NAA_ELT vs. A2D
Wet	-5,618 (-90%)	-5,917 (-91%)
Above Normal	-10,182 (-78%)	-10,575 (-79%)
Below Normal	-6,084 (-51%)	-6,229 (-52%)
Dry	-1,690 (-22%)	-1,457 (-20%)
Critical	-912 (-16%)	-822 (-14%)
All Years	-6,002 (-67%)	-6,193 (-67%)

Note: Estimated annual number of fish lost, based on non-normalized data.

Steelhead predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Average pre-screen predation loss for steelhead entrained at the Clifton Court Forebay is about 80% (Clark et al. 2009) while predation loss for fish entrained at the CVP is assumed to be 15%. By reducing entrainment at the south Delta facilities, Alternative 2D would reduce predation losses commensurate with reductions in entrainment.

Water Exports from SWP/CVP North Delta Intake Facilities

The potential effects of the proposed North Delta diversions would be similar to these described for winter-run Chinook salmon juveniles (see Impact AQUA-39). The north Delta intakes would be screened and would be expected to exclude fish of around 22 mm and larger, which would prevent entrainment of steelhead juveniles.

Predation Associated with Entrainment

Pre-screen loss of juvenile steelhead at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 2D, commensurate with entrainment reductions. Predation at the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River.

NEPA Effects: The effect under Alternative 2D would not be adverse, because it is concluded that the reduction in south Delta exports and associated predation mortality would offset entrainment-related negative effects of the north Delta intakes.

CEQA Conclusion: As described above, entrainment and associated pre-screen predation losses of juvenile steelhead would decrease under Alternative 2D (A2D_ELT) compared to Existing Conditions at the south Delta export facilities (Table 11-2D-48). The north Delta screened intakes, as designed, would exclude juvenile salmonids. Impacts of water operations on entrainment of steelhead would be less than significant due to an overall reduction in entrainment and no mitigation would be required.

Impact AQUA-94: Effects of Water Operations on Spawning and Egg Incubation Habitat for Steelhead

In general, the effect of Alternative 2D on steelhead spawning habitat would be negligible relative to NAA_ELT.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam, where the majority of steelhead spawning in the mainstem Sacramento River occurs, were examined during the primary steelhead spawning and egg incubation period of January through April (Appendix *B, Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds, leading to mortality. Mean flows under A2D_ELT throughout the period would generally be similar to or greater than those under NAA_ELT, with minor exceptions.

Water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at either location.

SacEFT predicts that there would be a 4% decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A2D_ELT relative to NAA_ELT (Table 11-2D-49). SacEFT predicts that there would be negligible (<5%) differences between NAA_ELT and A2D_ELT in the percentage of years with good (lower) redd scour risk, good (lower) egg incubation conditions, or good (lower) redd dewatering risk. These results indicate Alternative 2D would result in a small reduction in spawning habitat quantity, but no difference in redd scour or dewatering risk or temperature-related egg incubation conditions.

Table 11-2D-49. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Steelhead Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Spawning WUA	-2 (-4%)	-2 (-4%)
Redd Scour Risk	-3 (-4%)	0 (0%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-2 (-4%)	-1 (-2%)
Juvenile Rearing WUA	1 (2%)	-3 (-7%)
Juvenile Stranding Risk	-6 (-18%)	-1 (-3%)

WUA = Weighted Usable Area.

Overall, these results indicate that the effects of Alternative 2D on steelhead spawning and egg incubation habitat in the Sacramento River would be negligible.

Clear Creek

Flows in Clear Creek were examined during the steelhead spawning and egg incubation period (January through April). Mean flows under A2D_ELT would be similar to flows under NAA_ELT throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Results of the flow analyses for the risk of redd dewatering for Clear Creek indicate that the greatest monthly flow reduction would be identical between NAA_ELT and A2D_ELT for all water year types (Table 11-2D-50).

Table 11-2D-50. Comparisons of Greatest Monthly Reduction (Percent Change) in Instream Flow under Alternative 2D Model Scenarios in Clear Creek during the January–April Steelhead Spawning and Egg Incubation Period[a]

Water Year Type	A2D_ELT vs. EXISTING CONDITIONS	A2D_ELT vs. NAA_ELT
Wet	-25 (-38%)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

No water temperature modeling was conducted in Clear Creek.

Overall, these results indicate that the effects of Alternative 2D on steelhead spawning and egg incubation habitat in Clear Creek would be negligible.

Feather River

Steelhead spawning and egg incubation on the Feather River occurs primarily in Hatchery Ditch and the low-flow channel in the general vicinity of the Feather River Hatchery. Effects of A2D_ELT on flow during the spawning and egg incubation period (January through April) in the Feather River were evaluated using the results of CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (low-flow channel) based on estimated flows above Thermalito Afterbay (Appendix *B, Supplemental Modeling for New Alternatives*). Although recent surveys have found that very few steelhead (0 to 28%) spawn in the high-flow channel, (J. Kindopp pers. comm.), flows were also evaluated in the high-flow channel based on information in the Feather River at Thermalito Afterbay (Appendix *B, Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Flows in the low-flow channel under A2D_ELT would not differ from NAA_ELT because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006). Mean flows under A2D_ELT at Thermalito Afterbay would generally be similar to or greater than (up to 35% greater in February of above normal water years) flows under NAA_ELT, except in wet years during January (17% lower) and in below normal years during March (13% lower).

Oroville Reservoir storage volume at the end of September and end of May influences flows downstream of the dam during the steelhead spawning and egg incubation period. Mean storage volume at the end of September under A2D_ELT would be similar to or up to 6% lower (above normal years) and 17% higher (dry years) than storage under NAA_ELT, depending on water year type (Table 11-2D-25). May Oroville storage under A2D_ELT would be similar to storage under NAA_ELT in all water years types (Table 11-2D-28).

Water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during January through April (Table 11-2D-51). The percent of months exceeding the threshold under A2D_ELT would generally be similar to or lower (up to 5% lower on an absolute scale) than the percent under NAA_ELT, depending on month and degrees above the threshold.

Table 11-2D-51. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, January through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
April	6 (71%)	1 (25%)	1 (NA)	0 (NA)	0 (NA)
NAA_ELT vs. A2D_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
April	-5 (-25%)	-5 (-44%)	-2 (-67%)	-1 (-100%)	0 (NA)

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during January through April (Table 11-2D-52). Total degree-months would be similar between NAA_ELT and A2D_ELT in all months.

Table 11-2D-52. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, January through April

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (0%)	-1 (-50%)
	All	0 (0%)	-1 (-50%)
April	Wet	0 (NA)	0 (NA)
	Above Normal	2 (100%)	1 (33%)
	Below Normal	3 (75%)	0 (0%)
	Dry	6 (120%)	-1 (-8%)
	Critical	7 (NA)	0 (0%)
	All	18 (164%)	0 (0%)

NA = could not be calculated because the denominator was 0.

Overall, these modeling results indicate that the effects of Alternative 2D on steelhead spawning and egg incubation habitat in the Feather River would be negligible.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or greater than (up to 22% greater for April of critical water years) flows under NAA_ELT during the period, except in below normal and dry years during January (11% and 6% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives)*.

Water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period ((Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-2D-41). Steelhead spawn and eggs incubate in the American River between January and April. During this period, the percent of months exceeding the threshold under A2D_ELT would be similar to or up to 9% lower (absolute scale) than the percent under NAA_ELT.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-2D-42). During the January through April steelhead spawning and egg incubation period, total degree-months would be similar between NAA_ELT and A2D_ELT.

Overall, these results indicate that the effects of Alternative 2D on steelhead spawning and egg incubation habitat in the American River would be negligible.

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT throughout this period would be nearly identical to flows under NAA_ELT.

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and Alternative 2D throughout the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT throughout this period would be nearly identical to flows under NAA_ELT.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. There would be negligible effects of Alternative 2D on upstream flows, water temperatures, and reservoir stage that would affect steelhead spawning and egg incubation in any of the rivers analyzed. Further, SacEFT predicts no effects of Alternative 2D on steelhead spawning and egg incubation habitat in the Sacramento River.

CEQA Conclusion: In general, these modeling results indicate that Alternative 2D could reduce the quantity and quality of steelhead spawning habitat relative to the Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of spawning and egg incubation habitat for steelhead relative to the CEQA conclusion.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam, where the majority of steelhead spawning occurs, were examined during the primary steelhead spawning and egg incubation period of January through April. (Appendix *B, Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds, leading to mortality. At Keswick, mean flows under A2D_ELT during the steelhead spawning and egg incubation period would generally be similar to or greater than flows under Existing Conditions, except for flows up to 13% lower in February of dry years, March of below normal and dry years, and April of above normal and below normal years. Upstream of Red Bluff Diversion Dam, mean flows under A2D_ELT would generally be similar to or slightly greater than those under Existing Conditions.

Water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period at either location.

SacEFT predicts negligible changes (<5%) in spawning habitat, redd scour risk, and redd dewatering risk between Existing Conditions and Alternative 2D, and no difference in egg incubation conditions (Table 11-2D-15).

Overall in the Sacramento River, Alternative 2D would have small reductions in mean monthly flow that would not affect steelhead spawning conditions in a biological meaningful way. SacEFT indicates that steelhead egg incubation and redd survival metrics would not be substantially affected by Alternative 2D. Impacts of Alternative 2D on water temperature would be less than significant.

Clear Creek

Flows in Clear Creek were examined during the steelhead spawning and egg incubation period (January through April). Mean flows under A2D_ELT would be similar to or up to 40% greater than flows under Existing Conditions throughout the period (Appendix *B, Supplemental Modeling for New Alternatives*).

Results of the flow analyses for the risk of redd dewatering for Clear Creek indicate that the greatest monthly flow reduction would be identical between Existing Conditions and A2D_ELT for all water year types except wet, in which the greatest reduction would be 38% lower (worse) under A2D_ELT than under Existing Conditions (Table 11-2D-50).

No water temperature modeling was conducted in Clear Creek.

Based on mean flows and increased maximum flow reductions only in wet years, there would be little effect of Alternative 2D on steelhead spawning and egg incubation habitat conditions.

Feather River

Flows were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) during the steelhead spawning and egg incubation period (January through April) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows in the low-flow channel under A2D_ELT would not differ from Existing Conditions because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006). Mean flows under A2D_ELT at Thermalito Afterbay would generally be lower than flows under Existing Conditions (up to 47%

lower in January of below normal water years) during January through March, and would be similar to or greater than flows under Existing Conditions in April (up to 31% greater in April of dry years).

Oroville Reservoir storage volume at the end of September and end of May influences flows downstream of the dam during the steelhead spawning and egg incubation period. Oroville Reservoir mean storage volume at the end of September would be similar to or up to 28% lower under A2D_ELT relative to Existing Conditions depending on water year type (Table 11-2D-25). Mean May Oroville storage volume under A2D_ELT would be similar to storage under Existing Conditions in wet and above normal water years and up to 13% lower in below normal, dry and critical years (Table 11-2D-28).

Water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during January through April (Table 11-2D-51). The percent of months exceeding the threshold under A2D_ELT would generally be similar to the percent under Existing Conditions during January, February and March, and would be similar to or up to 6% greater (absolute scale) than the percent under Existing Conditions during April, depending on month and the degrees above the threshold.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during January through April (Table 11-2D-52). Total degree-months (all water years combined) would be similar between Existing Conditions and A2D_ELT during January, February and March, and 164% higher under A2D_ELT compared to Existing Conditions during April.

Overall, the effects of Alternative 2D on flows in the Feather River below Thermalito Afterbay would include substantial decreases in mean flow during some months and water year types. There would be minor increases in the exceedance of water temperature thresholds in the low-flow channel during April, coupled with reductions in coldwater pool availability in the Oroville Reservoir, especially in September.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be lower than flows under Existing Conditions during January, similar to or greater than flows under Existing Conditions during February through April, with some exceptions.

Water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-2D-41). Steelhead spawn and eggs incubate in the American River between January and April. During January and February, there would be no differences in the percent of months exceeding the threshold between Existing Conditions and A2D_ELT. During March and April, the percent of months exceeding the threshold under A2D_ELT would be up to 11% greater (absolute scale) than the percent under Existing Conditions.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-2D-42). During the January and February, there would be no differences in total degree-months (all water years combined) above the threshold between Existing Conditions and A2D_ELT. During March and April, total degree-months under A2D_ELT would be 95% and 34% greater than those under Existing Conditions, respectively.

Overall, these results indicate that the effects of Alternative 2D on flows would be small and inconsistent. Mean flows would be greater in some months and water years types than flows under Existing Conditions and would be lower in other months and water years types. Water temperatures would not differ significantly from Existing Conditions. However, Alternative 2D would increase exposure of spawning steelhead and their eggs to critical water temperatures.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT throughout this period would be lower than flows under Existing Conditions (up to 29% lower for February of critical water years) in all months, with minor exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River was evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no difference (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or up to 15% higher than flows under Existing Conditions during January through March and up to 7% lower during April.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 2D, there are flow and cold water pool availability reductions in the Feather and Stanislaus Rivers, as well as temperature increases in the Feather River that would lead to biologically meaningful increases in egg mortality and overall reduced habitat conditions for spawning steelhead and egg incubation, as compared to Existing Conditions. Alternative 2D would not have significant effects on steelhead spawning conditions in the Sacramento River, Clear Creek, or the Mokelumne River. The effects of Alternative 2D on American River flows and water temperatures would be variable and would likely have a negligible net effect on steelhead spawning conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of steelhead as a result of egg mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on mean monthly flows, water temperatures, and reservoir storage. Further, the SacEFT model predicts that there would be no effects to spawning and egg incubation habitat in the Sacramento River. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-95: Effects of Water Operations on Rearing Habitat for Steelhead

In general, Alternative 2D would not reduce the quantity and quality of steelhead rearing habitat relative to NAA_ELT.

Sacramento River

Juvenile steelhead rear within the Sacramento River for 1 to 2 years before migrating downstream to the ocean. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry or juveniles leading to mortality. Year-round Sacramento River flows within the reach where the majority of steelhead spawning and juvenile rearing occurs (Keswick Dam to upstream of RBDD) were evaluated (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or greater than those under NAA_ELT during most of the year, with minor exceptions, but would generally be lower under A2D_ELT during September and November (up to 24% lower at Keswick and 18% lower at Red Bluff.). The flow reductions would be mostly small and transitory and, therefore, would not have biologically meaningful effects on steelhead fry and juvenile rearing habitat.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile steelhead rearing WUA conditions under A2D_ELT would be 7% lower (3% on absolute scale) than that under NAA_ELT (Table 11-2D-49). This reduction would be too small to be considered substantial. The difference in percentage of years with good (lower) juvenile stranding risk conditions between A2D_ELT and NAA_ELT would be negligible (<5%). These results indicate that Alternative 2D would have little effect on rearing habitat availability in the Sacramento River.

Based on mean monthly flows, SacEFT rearing metrics, and water temperature effects, project-related effects under Alternative 2D in the Sacramento River would not have biologically meaningful negative effects on steelhead rearing conditions.

Clear Creek

Mean flows in Clear Creek below Whiskeytown during the year-round steelhead rearing period under A2D_ELT would be similar to flows under NAA_ELT, except for lower flows (up to 14% lower) in July, September and October of critical water years and higher flows (10% higher) in August of critical years (Appendix *B, Supplemental Modeling for New Alternatives*).

Evaluation of the minimum instream flows in Clear Creek indicates that A2D_ELT would have no effect (0%) on minimum instream flows in any water year type, except for a decrease (-50 cfs or -100%) for dry water years (Table 11-2D-53).

Table 11-2D-53. Difference (cfs) and Percent Difference in Minimum Monthly Mean Flow in Clear Creek during the Year-Round Juvenile Steelhead Rearing Period

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (0%)	0 (0%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-70 (-100%)	0 (NA)
Dry	-50 (-100%)	-50 (-100%)
Critical	-50 (-100%)	0 (NA)

Note: Minimum flows occurred between October and March.
NA = could not be calculated because the denominator was 0.

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-1A-4). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study the flow regime could be adjusted in the future. We expect that the modeled flows will be suitable for the existing steelhead populations in Clear Creek. No change in effect on steelhead in Clear Creek is anticipated.

No water temperature modeling was conducted in Clear Creek.

These results indicate that the effects of Alternative 2D on flows would not affect juvenile steelhead rearing habitat conditions in Clear Creek.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) were reviewed to determine flow-related effects on steelhead juvenile rearing habitat (Appendix *B, Supplemental Modeling for New Alternatives*). Although there is relatively little natural steelhead production in the river, most steelhead spawning and rearing appears to occur in the low-flow channel in habitats associated with well-vegetated side channels (Cavallo et al. 2003; California Department of Water Resources unpublished data). Because these habitats are relatively uncommon they could limit natural steelhead production. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality.

There would be no change in flows for A2D_ELT relative to NAA_ELT in the low-flow channel. Flow in the low-flow channel is projected to remain between 700 and 800 cfs except during occasional flood control releases. Mean May Oroville storage under A2D_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-2D-28). Mean September Oroville storage volume would be 6% lower than storage under NAA_ELT in above normal years, similar to NAA_ELT in wet and below normal years, and up to 17% higher than storage under NAA_ELT in dry years (Table 11-2D-25).

The river channel downstream of Thermalito (high-flow channel) offers few of the habitat types upon which steelhead appear to rely in the low-flow channel. Experiments and fish observations also indicate that predation risk for juvenile steelhead is higher downstream of the Thermalito outlet (California Department of Water Resources 2004). Increased predation risk is likely a function of water temperature, whereby warm water nonnative species such as striped bass, largemouth bass, and smallmouth bass are more prevalent, and in general, have greater metabolic requirements. Thus, summer temperatures that exceed 65°F and the absence of preferred steelhead habitat currently appear to limit steelhead rearing in the river downstream of the Thermalito outlet. Comparisons of CALSIM data by month and water year type (Appendix *B, Supplemental Modeling for New Alternatives*) indicate that mean flows in the high-flow channel under A2D_ELT would generally be similar to or greater than (up to 121% greater for June of below normal water years) those under NAA_ELT in all months except July through September. During July through September, flows under A2D_ELT would be up to 49% lower than those under NAA_ELT, depending on month and water-year type.

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* In the high-flow channel there would be a 6% increase in mean monthly water temperature between NAA_ELT and A2D_ELT in July of critical water years, but no difference (<5%) in any other month or water year type throughout the period at either location.

An additional analysis evaluated the percent of months exceeding a 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) (May through August) and exceeding a 56°F threshold at Gridley (October through April) for each model scenario. In the low-flow channel, the percent of months exceeding the threshold under A2D_ELT would generally be similar to or lower (up to 21% lower on an absolute scale) than the percent under NAA_ELT (Table 11-2D-29). At Gridley, the percent of months exceeding the threshold under A2D_ELT would similar to or up to 14% lower (absolute scale) than the percent under NAA_ELT (Table 11-2D-38).

Total degree-months exceeding 63°F were summed by month and water year type in the Feather River above Thermalito Afterbay (low-flow channel) during May through August, and total degree-months exceeding 56°F were summed at Gridley during October through April. In the low flow channel (Table 11-2D-30) and at Gridley (Table 11-2D-39), there would be small increases and decreases in exceedances above the thresholds, but no overall biologically meaningful effects.

Overall, these results indicate that Alternative 2D would have both increases and reductions of flow in the high-flow channel of the Feather River, depending on the month and water year type, but that there would be no net effect on juvenile steelhead rearing habitat.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the year-round steelhead rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT during December through April, with some exceptions, greater than flows under NAA_ELT during June and July, and lower (up to 27% lower) than flows under NAA_ELT during August, September and November. Depending on water year type, the mean flows under A2D_ELT during May and October would be lower than or greater than flows under NAA_ELT.

Water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period at the confluence location, but there would be 5% higher water temperatures during October of wet, below normal and dry years at the Watt Avenue Bridge.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-2D-54). During May, June, and July, the percent of months exceeding the threshold under A2D_ELT would be similar to or up to 25% lower (absolute scale) than the percent under NAA_ELT. During August through October, the percent of months exceeding the threshold would mostly be similar between NAA_ELT and A2D_ELT.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-2D-55). Total degree-months (all water year types combined) exceeding the threshold would be similar between NAA_ELT and A2D_ELT or up to 51 degree-months lower under A2D_ELT in all months except August and September, in which degree-months would be 24 and 25 degree-months higher under A2D_ELT.

Table 11-2D-54. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 65°F Threshold, May through October

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
May	20 (100%)	17 (117%)	5 (44%)	6 (100%)	1 (25%)
June	19 (29%)	19 (35%)	12 (30%)	6 (20%)	5 (24%)
July	0 (0%)	0 (0%)	7 (12%)	15 (41%)	11 (64%)
August	0 (0%)	2 (3%)	17 (21%)	46 (95%)	49 (160%)
September	9 (10%)	26 (49%)	25 (77%)	23 (146%)	19 (250%)
October	12 (250%)	9 (350%)	5 (NA)	1 (NA)	1 (NA)
NAA_ELT vs. A2D_ELT					
May	-7 (-16%)	-5 (-13%)	-7 (-32%)	0 (0%)	-2 (-29%)
June	-9 (-9%)	-6 (-8%)	-10 (-16%)	-16 (-30%)	-17 (-40%)
July	0 (0%)	-1 (-1%)	-25 (-26%)	-15 (-23%)	-19 (-39%)
August	0 (0%)	0 (0%)	0 (0%)	1 (1%)	4 (5%)
September	0 (0%)	-2 (-3%)	-1 (-2%)	1 (3%)	0 (0%)
October	-6 (-26%)	-2 (-18%)	-1 (-20%)	0 (0%)	1 (NA)

NA = could not be calculated because the denominator was 0.

Table 11-2D-55. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 65°F in the American River at the Watt Avenue Bridge, May through October

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
May	Wet	9 (150%)	0 (0%)
	Above Normal	7 (NA)	-2 (-22%)
	Below Normal	7 (233%)	-2 (-17%)
	Dry	20 (91%)	-1 (-2%)
	Critical	17 (89%)	3 (9%)
	All	60 (120%)	-2 (-2%)
June	Wet	29 (171%)	-9 (-16%)
	Above Normal	12 (50%)	-8 (-18%)
	Below Normal	12 (41%)	-16 (-28%)
	Dry	9 (13%)	-18 (-19%)
	Critical	32 (64%)	0 (0%)
	All	94 (50%)	-51 (-12%)
July	Wet	33 (42%)	-15 (-12%)
	Above Normal	9 (33%)	1 (3%)
	Below Normal	12 (35%)	-4 (-8%)
	Dry	30 (48%)	2 (2%)
	Critical	22 (27%)	-4 (-4%)
	All	106 (38%)	-20 (-5%)
August	Wet	65 (82%)	3 (2%)
	Above Normal	20 (49%)	3 (5%)
	Below Normal	28 (50%)	1 (1%)
	Dry	64 (94%)	16 (14%)
	Critical	39 (49%)	1 (1%)
	All	216 (67%)	24 (5%)
September	Wet	33 (138%)	10 (21%)
	Above Normal	14 (88%)	4 (15%)
	Below Normal	28 (100%)	9 (19%)
	Dry	32 (76%)	2 (3%)
	Critical	25 (51%)	0 (0%)
	All	132 (83%)	25 (9%)
October	Wet	5 (500%)	0 (0%)
	Above Normal	5 (NA)	0 (0%)
	Below Normal	2 (NA)	0 (0%)
	Dry	10 (NA)	1 (11%)
	Critical	10 (200%)	1 (7%)
	All	31 (517%)	1 (3%)

NA = could not be calculated because the denominator was 0.

These results indicate that effects of Alternative 2D on flow and water temperatures would not reduce juvenile steelhead rearing habitat in the American River.

Stanislaus River

Mean flows in the Stanislaus River under A2D_ELT would not differ from those under NAA_ELT throughout the year (Appendix *B, Supplemental Modeling for New Alternatives*).

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and A2D_ELT throughout the year-round period (Appendix 11D, Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).

San Joaquin River

Mean flows in the San Joaquin River under A2D_ELT would not differ significantly from those under NAA_ELT throughout the year (Appendix *B, Supplemental Modeling for New Alternatives)*.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River under Alternative 2D would not differ from those under NAA_ELT throughout the year (Appendix *B, Supplemental Modeling for New Alternatives)*.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 2D is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of fry and juvenile mortality. Effects of Alternative 2D on flows would be small and transitory in the Sacramento River and Clear Creek, and effects in the Feather River and the American River would be more variable, but in general are not expected to affect steelhead rearing habitat. Effects of Alternative 2D on water temperatures in the Sacramento, Feather, American and Stanislaus Rivers would be small. Overall, Alternative 2D is not expected to have biologically meaningful negative effects on steelhead rearing conditions in the ELT.

The effect of Alternative 2D in the LLT on steelhead rearing conditions would be adverse. Instream flows in the Sacramento and Feather Rivers during summer and fall months would decline from ELT to LLT such that flows would be substantially reduced under Alternative 2D relative to the NEPA baseline in the LLT. This effect is described in detail under Impact AQUA-95 for Alternative 2A.

CEQA Conclusion: In general, the modeling results presented below suggest that Alternative 2D could reduce the quantity and quality of rearing habitat for steelhead relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of rearing habitat for steelhead relative to the CEQA conclusion.

Sacramento River

Comparisons of CALSIM outputs of year-round flow for the Sacramento River between Keswick and upstream of Red Bluff, averaged by month and water year type, were used to evaluate effects of A2D_ELT compared to Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows for A2D_ELT at Keswick would generally be similar to or up to 16% greater than those for Existing Conditions. However, during September, flows would be up to 29%

higher in wet and above normal years and up to 24% lower in below normal, dry and critical years, and during August, October and November, flows would be up to 18% lower. The results for mean flows at Red Bluff would be similar to those for flows at Keswick, except that the differences between A2D_ELT and Existing Conditions would be smaller. The most substantial effects on juvenile rearing habitats would occur from the flow reductions in dry and critical water years of August through November. Based on the overall small size of the August through November flow reductions, and the beneficial increases in mean flow for other months and water year types, the flow reductions are not expected to have biologically meaningful negative effects on juvenile steelhead rearing conditions in the Sacramento River.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, mean water temperatures under A2D_ELT would generally be similar to those under Existing Conditions, except at Keswick during August and September of critical water years, in which there would be 6% and 5% higher temperatures, respectively, under Alternative 2D, and at Red Bluff during August of critical years, in which there would be 5% higher temperatures.

SacEFT predicts that there would be no difference (<5%) in the percentage of years with good rearing availability, measured as weighted usable area, under A2D_ELT relative to Existing Conditions (Table 11-2D-49). SacEFT predicts that there would be an 18% reduction in the number of years with good (lower) juvenile stranding risk under A2D_ELT relative Existing Conditions.

Overall, these results indicate that Alternative 2D would not have biologically meaningful effects on juvenile rearing success in the Sacramento River. Alternative 2D would cause small reductions in mean monthly flows during four months of the year and SacEFT predicts that stranding risk would be increased by 18%. Water temperatures would be higher in 2 months during critical water years.

Clear Creek

Mean flows in Clear Creek during the year-round rearing period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 40% greater flow in January of wet years and 19% lower flow in September of critical years (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Juvenile rearing habitat is assumed to increase in Clear Creek as instream flows increase, and therefore the use of the lowest monthly instream flow as an index of habitat constraints for juvenile rearing was selected for use in this analysis. Results of the analysis of minimum monthly instream flows affecting juvenile rearing habitat are shown in Table 11-2D-53. Results indicate that Alternative 2D would have no effect on juvenile rearing habitat, based on minimum instream flows, compared to Existing Conditions in wet and above normal water years. Minimum flows would be 100% lower in below normal years (reduction from 70 cfs to 0 cfs), and 100% lower in dry and critical water years (reduction from 50 cfs to 0 cfs).

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-1A-4). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study the flow regime could be adjusted in the future. We expect that the modeled flows will be suitable for the existing steelhead populations in Clear Creek. No change in effect on steelhead in Clear Creek is anticipated.

Overall in Clear Creek, Alternative 2D would result in no biologically meaningful changes in mean monthly flow that would affect juvenile rearing habitats.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under A2D_ELT would be the same as flows under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) under A2D_ELT would generally be similar to or up to 157% greater than flows under Existing Conditions during April through June, and would generally be lower than flows under Existing Conditions (up to 50% lower) during January through March, July, November and December. Mean flows would also be lower under AD2_ELT in August and September of below normal and dry years. During September of wet, above normal, and critical water years and August of wet years, flows under A2D_ELT would be up to 196% higher than flows under Existing Conditions.

Mean May Oroville storage volume under A2D_ELT would be similar to that under Existing Conditions in wet and above normal water years, and would be 5% to 13% lower in below normal, dry, and critical water years (Table 11-2D-28).

As reported in Impact AQUA-58 for spring-run Chinook salmon, mean September Oroville storage volume would be 19% to 28% lower under A2D_ELT relative to Existing Conditions in wet, above normal and below normal water years, and would be similar relative to Existing Conditions in dry and critical years (Table 11-2D-25).

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis.* There would be no differences (<5%) in mean water temperatures for any month or water year type in the low-flow channel. In the high-flow channel, mean water temperatures under AD2_ELT would be similar to those under Existing Conditions except for 6% higher temperature in July of critical water years and 5% higher temperature in August of dry years.

An additional analysis evaluated the percent of months exceeding a 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) (May through August) and exceeding a 56°F threshold at Gridley (October through April). In the low-flow channel, the percent of months exceeding the threshold under A2D_ELT would generally be similar to the percent under Existing Conditions during May, and similar or up to 25% (absolute scale) higher than the percent under Existing Conditions during June through August (Table 11-2D-29). At Gridley, the percent of months exceeding the threshold under A2D_ELT would be similar to the percent under Existing Conditions during December through February, but similar to or up to 17% greater (absolute scale) than the percent under Existing Conditions in the remaining four months (Table 11-2D-38).

Total degree-months exceeding 63°F were summed by month and water year type in the Feather River above Thermalito Afterbay (low-flow channel) during May through August and total degree-months exceeding 56°F were summed at Gridley during October through April. In the low-flow channel, total degree-months (all water years types combined) under A2D_ELT would be similar to those under Existing Conditions during May and 26% to 58% higher during June through August (Table 11-2D-30). At Gridley, total degree-months under A2D_ELT would be similar to those under Existing Conditions during December through and February and 35% to 425% greater than those under Existing Conditions in the remaining four months of the period (Table 11-2D-39).

Overall, these results indicate that Alternative 2D could affect juvenile steelhead rearing conditions in the Feather River, although very few steelhead rear in this reach of the Feather River (Cavallo et al. 2003; California Department of Water Resources unpublished data). Fish rearing in the high-low channel under Alternative 2D would experience lower flows during multiple months and fish rearing in both the low- and high-flow channels would experience increased exceedances of water temperature thresholds.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the year-round steelhead rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 16% greater than to flows under Existing Conditions during February and March and up to 52% lower than flows under Existing Conditions during May, August through November, and January. Mean flows during March, June, July, and December would be lower (6% to 36% lower) under A2D_ELT than under Existing Conditions for some water year types and would be greater (8% to 23% greater) for other water year types.

Water temperatures in the American River at the confluence with the Sacramento River and at the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be little difference in water temperatures (<5%) at either location, except during October of wet, above normal, below normal and dry years, for which there would 5% to 7% temperature increases at the Watt Avenue Bridge and 5% to 6% increases at the confluence location. There would also be a 5% increase in mean water temperature in July of dry years at the confluence location.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-2D-54). In comparison to Existing Conditions, the temperature thresholds would be exceeded in a greater percentage of months under A2D_ELT in all the threshold categories and months by up to 49% on the absolute scale, with minor exceptions during July and August.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-2D-55). Total degree-months (all water year types combined) would be higher in all months, by 38% to 517%, under A2D_ELT compared to Existing Conditions.

Overall, these results indicate that there would be substantial effects of Alternative 2D on juvenile steelhead rearing habitat in the American River during much of the year.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows would generally be lower under A2D_ELT relative to Existing Conditions during January through July (up to 29% for February of critical water years) and would generally be similar during August through December, with minor exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperatures between A2D_ELT and Existing Conditions throughout the year.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be 6% to 23% lower than flows under Existing Conditions during February through September and similar to or greater than flows under Existing Conditions during October through January, with minor exceptions.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be 5% to 34% lower than flows under Existing Conditions during April through September, up to 28% greater than flows under Existing Conditions during December, and similar to flows under Existing Conditions during October, November, and January through March, with minor exceptions.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Under Alternative 2D, there would be flow reductions in the Feather, American, Stanislaus, San Joaquin, and Mokelumne rivers and water temperature increases in the Sacramento, Feather and American rivers that would lead to reductions in quantity and quality of fry and juvenile steelhead rearing habitat relative to Existing Conditions. Contrary to the NEPA conclusion set forth above, these results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of steelhead as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows would be small and infrequent in the Sacramento, Stanislaus, San Joaquin and Mokelumne rivers and Clear Creek. Effects in the Feather and American rivers would be variable, but net effects on rearing habitat are expected to be minor. Water temperatures in the Sacramento, Feather, American, and Stanislaus rivers would not be affected by Alternative 2D. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on steelhead juvenile rearing habitat conditions would be less than significant in the ELT and no mitigation is necessary.

Upstream flows, reservoir operations, and water temperatures in the Sacramento and Feather rivers, and their effects on for rearing juvenile steelhead, would decline from ELT to LLT to a level that is considered significant. For more information, see the evaluation of Impact AQUA-95 under Alternative 2A.

Impact AQUA-96: Effects of Water Operations on Migration Conditions for Steelhead

In general, Alternative 2D would degrade steelhead migration conditions relative to NAA_ELT.

Upstream of the Delta

Sacramento River

Juveniles

Flows in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period. Mean flows under A2D_ELT would be 6% to 18% lower than flows under NAA_ELT during November, 5% to 12% higher than flows under NAA_ELT during May, and generally similar to flows under NAA_ELT during the remaining six months of the juvenile migration period (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Adults

Flows in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be 5% to 18% lower than flows under NAA_ELT during September and November, depending on water year type, and similar to flows under NAA_ELT in the remaining five months of the period.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period

Kelts

Flows in the Sacramento River upstream of Red Bluff were evaluated during the March and April steelhead kelt (post-spawning adult) downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean Flows during these two months would not differ between NAA_ELT and A2D_ELT.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period

Overall in the Sacramento River, these results indicate that Alternative 2D would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration in the Sacramento River.

Clear Creek

Water temperatures were not modeled in Clear Creek.

Juveniles

Mean flows in Clear Creek during the October through May juvenile steelhead migration period under A2D_ELT would be similar to flows under NAA_ELT except in critical years during October (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Adults

Mean flows in Clear Creek during the September through March adult steelhead migration period under A2D_ELT would be similar to flows under NAA_ELT except in critical years during September (10% lower) and October (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Kelt

Mean flows in Clear Creek during the March through April steelhead kelt downstream migration period under A2D_ELT would be similar to flows under NAA_ELT except in below normal years in March (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

Overall in Clear Creek, these results indicate that effects of Alternative 2D on flows would not affect juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Flows in the Feather River at the confluence with the Sacramento River were examined during the October through May juvenile steelhead migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 21% greater than flows under NAA_ELT in all months and water years of the migration period, with minor exceptions.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Adults

Flows in the Feather River at the confluence with the Sacramento River were examined during the September through March adult steelhead upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean Flows under A2D_ELT would be 8% to 32% lower than flows under NAA_ELT during September, 6% to 16% higher than flows under NAA_ELT during October, 21% higher than flows under NAA_ELT in December of critical water years, and generally similar to flows under NAA_ELT in the remaining water year types and months of the period.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period

Kelt

Flows in the Feather River at the confluence with the Sacramento River were examined during the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 6% greater than those under NAA_ELT in both months of the kelt downstream migration period.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in either month of the period.

Overall in the Feather River, Alternative 2D would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration.

American River

Juveniles

Flows in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period. Mean flows under A2D_ELT during October would be 6% to 8% lower than flows under NAA_ELT in wet, above normal and dry years and 19% and 27% higher than flows under NAA_ELT in below normal and critical years. Mean flows under A2D_ELT during November would be 10% to 15% lower than flows under NAA_ELT in wet, above normal and below normal years and would be similar to flows under NAA_ELT in dry and critical years. In the remaining six months of the period, flows would generally be similar between A2D_ELT and NAA_ELT, except that flow in April of critical years would be 22% greater under A2D_ELT and flow in May of critical years 24% lower (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Adults

Flows in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during September and November would be 10% to 27% lower than flows under NAA_ELT depending on water year type. Mean flows under A2D_ELT during October would be 6% to 8% lower than flows under NAA_ELT in wet, above normal and dry years, and would be 19% to 27% higher than flows under NAA_ELT in below normal and critical years. Flows would generally be similar in the remaining four months of the period.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Kelt

Flows in the American River at the confluence with the Sacramento River were evaluated for the March and April kelt migration period. Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT except for 22% higher flow in April of critical years (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in either month of the period.

Overall in the American River, these results indicate that Alternative 2D would not have a biologically meaningful effect on juvenile, adult, or kelt steelhead migration.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River for A2D_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of Alternative 2D on juvenile, adult, or kelt migration in the Stanislaus River.

Further, mean monthly water temperatures in the Stanislaus River at the confluence with the San Joaquin River for A2D_ELT are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of Alternative 2D on juvenile, adult, or kelt migration in the Stanislaus River.

San Joaquin River

Flows in the San Joaquin River at Vernalis for Alternative 2D are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of Alternative 2D on juvenile, adult, or kelt migration in the San Joaquin River.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta for Alternative 2D are not different from flows under NAA_ELT for any month. Therefore, there would be no effect of Alternative 2D on juvenile, adult, or kelt migration in the Mokelumne River.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Juveniles

Flows in the Sacramento River below the north Delta intakes during the juvenile steelhead migration period (October through May) under Alternative 2D would be appreciably lower than NAA_ELT, with all-year average flows ranging from around 15% less in December to 28% less in November. Juvenile steelhead and juvenile winter-run Chinook salmon migrate downstream during similar months and would be exposed to similar conditions. As discussed above in Impact AQUA-42, the five north Delta intakes structures of Alternative 2D would increase potential predation loss of migrating juvenile salmonids and would displace 13 acres/2.3 linear miles of aquatic habitat. However, juvenile steelhead would be less vulnerable than winter-run Chinook salmon to predation associated with the intake facilities because of their greater size and strong swimming ability.

Adults

As assessed by DSM2 fingerprinting analysis, the average percentage of Sacramento River–origin water at Collinsville was always slightly lower under Alternative 2D than for NAA_ELT during the September-March steelhead upstream migration period. Attraction flow, as estimated by the percentage of Sacramento River water at Collinsville, under Alternative 2D was not different in October and declined 2% to 9% during other months (Table 11-2D-17). The reductions in percentage are small in comparison with the magnitude of change in dilution reported to cause a significant change in migration by Fretwell (1989) and, therefore, are not expected to affect steelhead upstream migration. While the proportion of Sacramento River flows would be reduced under Alternative 2D, the Sacramento River would still represent a substantial 60% to 73% of Delta flows and olfactory cues would still be strong for upstream migrating adults. However, uncertainty remains with regard to adult salmon behavioral response to anticipated changes in lower Sacramento River flow percentages. For further discussion of the topic see the analysis for Alternative 1A.

San Joaquin River

Juveniles

San Joaquin River flows at Vernalis would not differ between Alternative 2D and NAA_ELT, as there are no flow changes associated with any of the Alternatives. Alternative 2D would have no effect on steelhead migration success through the Delta from the perspective of changing inflows into the Delta. However, juvenile steelhead migration success would be aided by the inclusion in the water conveyance facilities of an operable barrier at the head of Old River, which would keep flow and fish in the mainstem San Joaquin River.

Adults

The percentage of water at Collinsville that originated from the San Joaquin River during the fall-run migration period (September to December) is small, typically 0.2% to less than 1% under NAA_ELT (Table 11-2D-17). Alternative 2D operations conditions would incrementally increase olfactory cues associated with the San Joaquin River, which would benefit adult steelhead migrating to the San Joaquin River.

NEPA Effects: Overall, the results indicate that the effect of Alternative 2D is adverse due to the cumulative effects associated with five north Delta intake facilities, including mortality related to near-field effects (e.g. impingement and predation) and far-field effects (reduced survival due to reduced flows downstream of the intakes) associated with the five NDD intakes.

Upstream of the Delta, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. Effects of Alternative 2D in all locations analyzed would consist primarily of small and variable effects on mean monthly flow and no effects on water temperatures for the juvenile, adult, and kelt steelhead migration periods. Adult attraction flows under Alternative 2D would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

Near-field effects of Alternative 2D on steelhead related to impingement and predation associated with five new intakes could result in substantial effects on juvenile migrating steelhead, although there is high uncertainty regarding the potential effects. As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structures will be implemented as part of the final NDD screen design effort. As with Alternative 4A, Alternative 2D also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for juvenile steelhead. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains highly uncertain.

The adverse effect to juvenile steelhead migrating through the Delta via the Sacramento River would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 2D of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of steelhead juveniles into the low-survival interior Delta.

Overall, primarily as a result of unacceptable levels of uncertainty regarding the cumulative impacts of near-field and far-field effects associated with the presence and operation of the five intakes on steelhead, this effect is adverse. While implementation of the environmental commitments noted above and mitigation measures listed below would address these impacts, these are not anticipated to reduce the impacts to a level considered not adverse.

CEQA Conclusion: Under Alternative 2D water operations, there would be a significant negative effect on the quantity and quality of steelhead migration habitat relative to the CEQA baseline.

Upstream of the Delta

Sacramento River

Juveniles

Flows in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period. Mean flows under A2D_ELT would be generally similar to or slightly higher than flows under Existing Conditions, except for 5% to 15% lower flows, depending on water year type, in October and November (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in all months of the period.

Adults

Flows in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT during September would be 20% to 27% higher in wet and above normal years than flows under Existing Conditions and 6% to 22% lower in the remaining three water year types. Mean flows under A2D_ELT during October and November would be 5% to 15% lower than flows under Existing Conditions, depending on water year type. Flows would be generally similar in the remaining four months of the migration period.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento*

River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT throughout the migration period.

Kelts

Flows in the Sacramento River upstream of Red Bluff were evaluated during the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to those under Existing Conditions during both months of the period.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in either month of the period.

Overall in the Sacramento River, Alternative 2D would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Clear Creek

Water temperatures were not modeled in Clear Creek.

Juveniles

Mean flows in Clear Creek during the October through May juvenile steelhead migration period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions except for 40% and 13% greater flows in January and February, respectively, of wet years (Appendix *B, Supplemental Modeling for New Alternatives*).

Adults

Mean flows in Clear Creek during the September through March adult steelhead migration period under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 19% lower flow in September of critical water years and 40% and 13% greater flows in January and February, respectively, of wet years (Appendix *B, Supplemental Modeling for New Alternatives*).

Kelt

Flows in Clear Creek during the March through April steelhead kelt downstream migration period under A2D_ELT would generally be similar to or 7% greater than flows under Existing Conditions (Appendix *B, Supplemental Modeling for New Alternatives*).

Overall in Clear Creek, Alternative 2D would not affect flow conditions for juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Flows in the Feather River at the confluence with the Sacramento River were examined during the October through May juvenile steelhead migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Differences in mean flow in the Feather River between A2D_ELT and Existing Conditions during the juvenile steelhead migration period would be highly variable, with many months expected to have both increases and decreases in flow, depending on the water year type. Mean flows would be higher under A2D_ELT by 6% to 19% in October and January through May, depending on the water year type, and would be lower by 5% to 17% in November through March and May, depending on the water year type.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT throughout the migration period.

Adults

Flows in the Feather River at the confluence with the Sacramento River were examined during the September through March adult steelhead upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Differences in mean flow in the Feather River between A2D_ELT and Existing Conditions during the adult steelhead migration period would be even more variable than those for the juvenile migration period. In particular, mean flow under A2D_ELT during September would be 21% and 28% lower than flows under Existing Conditions in below normal and dry years and would be 14%, 77% and 102% higher in critical, above normal and wet years. For the other months of the migration period, mean flows would be higher under A2D_ELT by 6% to 19% in October and January through March, depending on the water year type, and would be lower by 5% to 17% in November through March, depending on the water year type.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT throughout the migration period.

Kelts

Flows in the Feather River at the confluence with the Sacramento River were examined during the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or slightly greater than flows under Existing Conditions, except for 16% lower flow in March of below normal water years.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and Alternative 2D in either month of the kelt migration period.

Overall, these results indicate that migration conditions for steelhead in the Feather River would not be affected by Alternative 2D. Changes in flow from Existing Conditions to Alternative 2D would be highly variable, but no net negative effect is expected. Water temperatures would be similar between Existing Conditions and Alternative 2D.

American River

Juveniles

Flows in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to or up to 16% greater than flows under Existing Conditions during February through April. Flows under A2D_ELT would generally be lower, by up to 23% lower (November of dry years), than flows under Existing Conditions during October through January and May, with some exceptions.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A2D_ELT would be 5% to 6% higher than those under Existing Conditions during October of all water year types except critical year types, and would be similar (<5% difference) in the remaining months of the migration period.

Adults

Flows in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows during September under A2D_ELT would range from 18% lower to 47% lower, depending on water year type. Flows would generally be lower, by up to 23% lower (November of dry years), than flows under Existing Conditions during October through January, with exceptions for some water year types, and flows under A2D_ELT would generally be similar to or up to 16% greater than flows under Existing Conditions during February and March.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A2D_ELT would be 5% to 6% higher than those under Existing Conditions during October of all water year types except critical year types, and would be similar (<5% difference) in the remaining months of the migration period.

Kelts

Flows in the American River at the confluence with the Sacramento River were evaluated for the March and April kelt migration period. Mean flows under A2D_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 11% lower flow in March of critical years and 7% lower flow in April of above normal years (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March and April kelt migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in either month of the kelt migration period.

Overall in the American River, the effect of Alternative 2D on flows would include frequent moderate reductions in flows that would affect juvenile and adult migration conditions, particularly in drier water years, but would generally not affect kelt migration.

Stanislaus River

Juveniles

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the October through May steelhead juvenile downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under Existing Conditions during October through December, and would generally be lower than flows under Existing Conditions during January through May (up to 29% lower in February of critical water years), with some exceptions.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the October through May steelhead juvenile downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT throughout the migration period.

Adults

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be similar to flows under Existing Conditions during September through December, and would generally be lower than flows under Existing Conditions during January through March (up to 29% lower in February of critical water years), with some exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT throughout the migration period.

Kelts

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean monthly flows under A2D_ELT would be up to 23% and 12% lower than flows under Existing Conditions during March and April, respectively.

Mean Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in either month of the kelt migration period.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Juveniles

Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead juvenile downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or slightly greater than flows under Existing Conditions during October through January, and up to 12% lower than flows under Existing Conditions during February through May.

Adults

Flows in the San Joaquin River at Vernalis were evaluated for the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or slightly greater than flows under Existing Conditions during October through January, and up to 12% lower than flows under Existing Conditions during September, February, and March.

Kelt

Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be up to 12% and 8% lower than flows under Existing Conditions during March and April, respectively.

Mokelumne River

Water temperature modeling was not conducted in the Mokelumne River.

Juveniles

Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead juvenile downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 28% greater than (December of above normal years) flows under Existing Conditions during October through March and would be up to 11% lower than flows under Existing Conditions during April and May.

Adults

Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead adult upstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 28% greater (December of above normal years) than flows under Existing Conditions during October through March and would be up to 22% lower than flows under Existing Conditions during September.

Kelt

Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt downstream migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to flows under Existing Conditions during March and up to 7% lower than flows under Existing Conditions during April.

Through-Delta

Sacramento River

Juveniles

Juvenile steelhead migrating down the Sacramento River (October through May) would generally experience appreciably lower flows below the north Delta intakes compared to Existing Conditions. Analyses completed for juvenile Chinook salmon (e.g., Impact AQUA-42 for winter-run Chinook salmon) indicate that at these magnitudes of flow reductions predicted for Alternative 2D would reduce survival relative to Existing Conditions. The five intake structures would attract predators and would displace about 13 acres/2.3 linear miles of aquatic habitat.

Adults

Based on the proportion of Sacramento River water at Collinsville, olfactory cues would be similar (10% or less difference) to Existing Conditions for nearly all months of the year. The proportion of Sacramento River water at Collinsville in the main steelhead upstream migration period would range from no different in September to 10% less in March (Table 11-2D-17).

San Joaquin River

Juveniles

The only changes on San Joaquin River flows at Vernalis would result from the modeled effects of climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows. As noted above in the NEPA Effects conclusion, Alternative 2D would have no effect on steelhead migration success through the Delta from the perspective of changing inflows into the Delta. However, juvenile steelhead migration success would be aided by the inclusion in the water conveyance facilities of an operable barrier at the head of Old River, which would keep flow and fish in the mainstem San Joaquin River.

Adults

The percentage of water at Collinsville that originated from the San Joaquin River during the fall-run migration period (September to December) is small, typically 0.2% to less than 3% under Existing Conditions. Alternative 2D operations conditions would incrementally increase olfactory cues associated with the San Joaquin River, which has the potential to benefit adult steelhead migrating to the San Joaquin River based on analyses conducted for adult Chinook salmon from the San Joaquin River (Marston et al. 2012).

Summary of CEQA Conclusion

Overall, Alternative 2D would significantly affect the migration conditions for steelhead, relative to the Existing Conditions, primarily as a result of effects in the Delta.

In upstream areas, there would be reductions in flow in the American, Stanislaus, and San Joaquin Rivers that would lead to biologically meaningful reductions in migration conditions, thereby reducing survival relative to Existing Conditions. Alternative 2D would not affect migration conditions for steelhead in the Sacramento, Feather, and Mokelumne Rivers or Clear Creek. Reduced migration conditions would delay or eliminate successful migration necessary to complete the steelhead life cycle. In the Sacramento and Feather rivers there would also be increases in flow that would potentially offset the effects of the flow reductions. However, taking account of the flow effects of all the rivers, the net effect would be reduced flow, resulting in reduced juvenile and adult migration conditions. Water temperatures under Alternative 2D would generally be similar to those under Existing Conditions in all rivers examined, with minor exceptions.

However, this interpretation of the biological modeling for upstream areas is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible upstream effects on mean flow and water temperatures for the juvenile, adult, and kelt migration periods.

Through-Delta survival of emigrating juvenile steelhead has the potential to be appreciably reduced, compared to Existing Conditions. There would be little negative effect of Alternative 2D on adult olfactory cues in the Delta. Implementation of *Environmental Commitment 6 Channel Margin Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and *Environmental Commitment 16 Nonphysical Barriers* (all of which are summarized further in Section 4.1.3.3 of this RDEIR/SDEIS) would address the through-Delta impacts, but are not anticipated to reduce them to a level considered less than significant because of the presence of five intakes. As a result of these changes in migration conditions, this impact is significant and unavoidable.

In addition to the environmental commitments above, the mitigation measures identified below would provide an adaptive management process that would be conducted as a part of the Adaptive Management and Monitoring Program, for assessing impacts and developing appropriate minimization measures. However, this would not necessarily result in a less than significant determination, so it is concluded that the impact is significant and unavoidable.

Mitigation Measure AQUA-96a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Steelhead to Determine Feasibility of Mitigation to Reduce Impacts to Migration Conditions

Although analysis conducted above as part of the EIR/EIS determined that Alternative 2D would have significant and unavoidable adverse effects on migration habitat, this conclusion was based on the best available scientific information at the time and may prove to have been over- or understated. Upon the commencement of operations of the proposed water conveyance facilities and continuing through the life of the permit, the project proponents will monitor effects on migration habitat in order to determine whether such effects would be as extensive as concluded at the time of preparation of this document and to determine any potentially feasible means of reducing the severity of such effects. This mitigation measure requires a series of actions to accomplish these purposes, consistent with the operational framework for Alternative 2D.

The development and implementation of any mitigation actions shall be focused on those incremental effects attributable to implementation of Alternative 2D operations only. Development of mitigation actions for the incremental impact on migration habitat attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 2D.

Mitigation Measure AQUA-96b: Conduct Additional Evaluation and Modeling of Impacts on Steelhead Migration Conditions Following Initial Operations of Water Conveyance Facilities

Following commencement of initial operations of the proposed water conveyance facilities and continuing through the life of the permit, the project proponents will conduct additional evaluations to define the extent to which modified operations could reduce impacts to migration habitat under Alternative 2D. The analysis required under this measure may be conducted as a part of the Adaptive Management and Monitoring Program.

Mitigation Measure AQUA-96c: Consult with NMFS and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Steelhead Migration Conditions Consistent with Water Conveyance Facility Operations

In order to determine the feasibility of reducing the effects of Water Conveyance Facilities operations on steelhead habitat, the BDCP proponents will consult with NMFS and the Department of Fish and Wildlife to identify and implement any feasible operational means to minimize effects on migration habitat. Any such action will be developed in conjunction with the ongoing monitoring and evaluation of habitat conditions required by Mitigation Measure AQUA-96a.

If feasible means are identified to reduce impacts on migration habitat consistent with the overall operational framework of Alternative 2D without causing new significant adverse impacts on other covered species, such means shall be implemented. If sufficient operational flexibility to reduce effects on steelhead habitat is not feasible under Alternative 2D operations, achieving further impact reduction pursuant to this mitigation measure would not be feasible under this Alternative, and the impact on steelhead would remain significant and unavoidable.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-97: Effects of Construction of Restoration Measures on Steelhead

Impact AQUA-98: Effects of Contaminants Associated with Restoration Measures on Steelhead

Impact AQUA-99: Effects of Restored Habitat Conditions on Steelhead

Impact AQUA-100: Effects of Methylmercury Management on Steelhead (Environmental Commitment 12)

Impact AQUA-103: Effects of Localized Reduction of Predatory Fish on Steelhead (Environmental Commitment 15)

Impact AQUA-104: Effects of Nonphysical Fish Barriers on Steelhead (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on steelhead for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Sacramento Splittail

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-109: Effects of Construction of Water Conveyance Facilities on Sacramento Splittail

The potential effects of construction of the water conveyance facilities on Sacramento splittail would be similar to those described for Alternative 4A (Impact AQUA-109) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to Sacramento splittail.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-109, the effect would not be adverse for Sacramento splittail.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-109, the impact of the construction of water conveyance facilities on Sacramento splittail would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-110: Effects of Maintenance of Water Conveyance Facilities on Sacramento Splittail

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-110, the effect would not be adverse for Sacramento splittail.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-110 for Sacramento splittail, the impact of the maintenance of water conveyance facilities on Sacramento splittail would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-111: Effects of Water Operations on Entrainment of Sacramento Splittail

Water Exports from SWP/CVP South Delta Facilities

As with Alternative 4A, the analysis of juvenile splittail entrainment for Alternative 2D used the per capita method, which evaluates how changes in exports would affect entrainment potential independent of other factors (*BDCP Effects Analysis, Appendix 5B – Entrainment; Section 5.B.5.4.5 hereby incorporated by reference*). The per capita method was used because Yolo Bypass inundation is not included in the method, thus allowing an appropriate comparison between NAA_ELT (for which Yolo Bypass improvements would occur, but were not modeled) and A2D_ELT (for which Yolo Bypass improvements would also occur as part of a program separate from Alternative 2D, and which was included in the modeling). The per capita rate of juvenile splittail entrainment under A2D_ELT, which is an index of entrainment risk of an individual splittail and is directly related to the amount of water exported, averaged across all years would be reduced 51% (Table 11-2D-58) compared to NAA_ELT. The decrease in per capita entrainment of juvenile splittail is due to reductions in south Delta water exports during the main May–June entrainment period. For adult splittail, the reductions under A2D_ELT relative to NAA_ELT averaged 68% across all years (Table 11-2D-59), again because of reduced exports.

Table 11-2D-58. Juvenile Sacramento Splittail Entrainment Indexa (per Capita Method) at the SWP and CVP Salvage Facilities and Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-1,306,268 (-65%)	-1,197,705 (-63%)
Above Normal	-68,756 (-52%)	-57,301 (-47%)
Below Normal	-1,881 (-19%)	-1,294 (-14%)
Dry	-639 (-32%)	-365 (-21%)
Critical	-594 (-45%)	-439 (-37%)
All Years	-276,477 (-51%)	-221,621 (-45%)

Shading indicates entrainment increased 10% or more.

[a] Estimated annual number of fish lost, based on normalized data, estimated from delta inflow.

Table 11-2D-59. Adult Sacramento Splittail Entrainment Index[a] (Salvage Density Method) at the SWP and CVP Salvage Facilities and Differences between Model Scenarios for Alternative 2D

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-3,614 (-91%)	-3,809 (-92%)
Above Normal	-4,133 (-86%)	-4,097 (-86%)
Below Normal	-1,710 (-51%)	-1,702 (-50%)
Dry	-684 (-28%)	-620 (-26%)
Critical	-578 (-17%)	-478 (-15%)
All Years	-2,357 (-68%)	-2,399 (-68%)

Shading indicates entrainment increased 10% or more.

[a] Estimated annual number of fish lost, based on normalized data. Average (December–March).

Water Exports from SWP/CVP North Delta Intake Facilities

The impact from entrainment of splittail to the proposed SWP/CVP north Delta intakes is similar to Impact AQUA-111 under Alternative 2D. Splittail larvae would be vulnerable to entrainment to these intakes, although little is known about their densities around this vicinity. Entrainment and impingement monitoring would be implemented to determine the extent to which splittail larvae are present.

Predation Associated with Entrainment

As described for Alternative 2D (Impact AQUA-111), Sacramento splittail predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Splittail entrainment at the south Delta would be reduced under Alternative 2D by 45% (juveniles) and 68% (adults) compared to NAA_ELT; predation losses would be expected to decrease at a similar proportion.

The impact from potential predation associated with the north Delta intake structures (5 intakes) would be the same as described for Alternative 2D (Impact AQUA-111 These losses would be offset by the reduction in entrainment and predation loss at the SWP/CVP south Delta intakes, habitat restoration under Environmental Commitment 6, and reduction in potential predation under Environmental Commitment 15. Further, as described for Alternative 1A and as noted for Alternative 4A, the fishery agencies concluded that predation was not a factor currently limiting splittail abundance.

NEPA Effects: In conclusion, the effect from entrainment and predation loss under Alternative 2D would not be adverse, because while predation loss of splittail would be potentially increased at the north Delta facilities, it would be offset by substantial reductions in per capita entrainment and associated predation at the south Delta facilities compared to the NAA_ELT actions, as well as other conservation measures (Environmental Commitment 6, Environmental Commitment 15, and potentially Environmental Commitment 16).

CEQA Conclusion: Operational activities associated with reduced south Delta water exports would result in an overall decrease in the proportion of splittail population entrained for all water year types. Although entrainment of smaller life stages at the north Delta intakes is likely to occur during lower flow years when floodplain inundation is less, the bulk of reproduction occurs when floodplains are inundated, which would occur more often under NAA_ELT and Alternative 2D because of Yolo Bypass improvements; splittail emerging from the Yolo Bypass at its downstream terminus in the Cache Slough subregion would not be susceptible to north Delta intake entrainment. Under Scenario A2D_ELT, estimated juvenile entrainment and hence pre-screen predation losses would be 45% lower and adult entrainment and pre-screen predation losses would be 68% lower than Existing Conditions. The impact and conclusion for predation associated with entrainment would be the same as described above.

In conclusion, the impact of Alternative 2D from entrainment and predation loss would be less than significant because of improvements in overall proportional entrainment, and no mitigation is required.

Impact AQUA-112: Effects of Water Operations on Spawning and Egg Incubation Habitat for Sacramento Splittail

In general, Alternative 2D would have little to no effect on splittail spawning habitat relative to the NAA_ELT because improvements to the Yolo Bypass would occur under the NAA_ELT and therefore would not differentiate Alternative 2D from NAA_ELT. There would be negligible effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River, and negligible effects on water temperatures in the Feather River, relative to NAA_ELT. There would be beneficial effects on spawning conditions in channel margin and side-channel habitats from increases in flow during the spawning period in both the Sacramento River and the Feather River. There would also be a beneficial effect from reductions in the occurrence of critically high water temperatures in the Feather River in wetter water year types.

Sacramento splittail spawn in floodplains and channel margins and in side-channel habitat upstream of the Delta, primarily in the Sacramento River and Feather River. Floodplain spawning overwhelmingly dominates production in wet years. During low-flow years when floodplains are not inundated, spawning in side channels and channel margins is much more critical.

Floodplain Habitat

Effects of Alternative 2D on floodplain spawning habitat were evaluated for Yolo Bypass, using the same approach detailed for Alternative 4A. There would be little to no difference in floodplain habitat availability or acreage between NAA_ELT and Alternative 2D because Yolo Bypass improvements would be present in both (Table 11-2D-60; Table 11-2D-61).

Table 11-2D-60. Differences in Frequencies of Inundation Events (for 82-Year Simulations) of Different Durations on the Yolo Bypass under Different Scenarios and Water Year Types, February through June, from 15 2-D and Daily CALSIM II Modeling Runs

Number of Days of Continuous Inundation	Change in Number of Inundation Events for Each Scenario	
	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
30–49 Days		
Wet	-5	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	4	Little to no difference[a]
Dry	1	Little to no difference[a]
Critical	1	Little to no difference[a]
50–69 Days		
Wet	-5	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]
≥70 Days		
Wet	8	Little to no difference[a]
Above Normal	2	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]

[a] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the number of inundation events between NAA_ELT and A2D_ELT.

Table 11-2D-61. Increase in Splittail Weighted Habitat Area (HUs[c] and Percent) in Yolo Bypass from Existing Biological Conditions to Alternative 2D by Water Year Type from 15 2-D and Daily CALSIM II Modeling Runs

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	1,113 (72%)	Little to no difference[b]
Above Normal	721 (63%)	Little to no difference[b]
Below Normal	340 (259%)	Little to no difference[b]
Dry	9 (NA[a])	Little to no difference[b]
Critical	5 (NA[a])	Little to no difference[b]

[a] NA = percent differences could not be computed because no splittail weighted habitat occurred in the bypass for NAA_ELT and EXISTING CONDITIONS in those years (dividing by 0).

[b] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the weighted habitat area between NAA_ELT and H3_ELT.

[c] HUs = Habitat Units. HUs were computed as the product of habitat acreage and a Habitat Suitability Index (based on water depth) that ranges from 0 to 1, where maximum suitability = 1. Therefore, HUs are always less than or equal to habitat acreage.

As noted for Alternative 4A, a potential effect of Yolo Bypass improvements is changes in inundation of the Sutter Bypass as a result of increased flow diversion at the modified Fremont Weir. Because modification of the Fremont Weir would occur under Alternative 2D and the NAA_ELT, there would be little to no difference in inundated acreage in the lower Sutter Bypass between A2D_ELT and NAA_ELT. Therefore, Alternative 2D would not affect splittail spawning and rearing habitat in the Sutter Bypass relative to NAA_ELT.

Channel Margin and Side-Channel Habitat

In addition to spawning on floodplains, splittail spawning and larval and juvenile rearing also occur in channel margin and side-channel habitat upstream of the Delta. These habitats are likely to be especially important during dry years, when flows are too low to inundate the floodplains (Sommer et al. 2007). Side-channel habitats are affected by changes in flow because greater flows cause more flooding, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. Effects of Alternative 2D on flow in side-channel habitat are expected to be most important to the splittail population in years with low flows because in years of high flows, when most production comes from floodplain habitats, the upstream side-channel habitats contribute relatively little production. However, as noted by Sommer (1997), splittail have high fecundity and so can respond rapidly to improvements in environmental conditions (e.g., floodplain inundation), so that very high recruitment occurs in years with floodplain inundation.

Effects on channel margin and side-channel habitat were evaluated by comparing flow conditions for the Sacramento River at Wilkins Slough and the Feather River at the confluence with the Sacramento River for the time-frame February through June. These are the most important months for splittail spawning and larval rearing (Sommer pers. comm.), and juveniles likely emigrate from the side-channel habitats during May and June if conditions become unfavorable.

Differences between model scenarios for monthly average flows during February through June by water-year type were determined for the Sacramento River at Wilkins Slough and for the Feather River at the confluence.

Flows under A2D_ELT relative to Existing Conditions in the Sacramento River at Wilkins Slough were compared for the February through June spawning period (Appendix *B, Supplemental Modeling for New Alternatives*). Modeling results indicate that A2D_ELT would have negligible effects (<5%) on mean flows during February through April. During May and June, flows under A2D_ELT would be up to 16% greater than flows under NAA_ELT. Due to the mostly small size of the flow increases during May and June, they are not expected to have a biologically meaningful effect on splittail spawning conditions. Modeling results also show that Sacramento splittail spawning temperature tolerances would not be exceeded in the Sacramento River under Alternative 2D.

For the Feather River at the confluence, mean flows during February through April under A2D_ELT would generally be similar to or greater than flows under NAA_ELT. During May, and especially June, mean flows under A2D_ELT would be greater than flows under NAA_ELT (up to 88% in June of below normal years), which, due to the size and frequency of the increases, would benefit splittail. The flow increases would substantially increase the amount of channel margin and side channel habitat available for splittail spawning especially during the latter part of the spawning period.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively were used to investigate the potential effects of Alternative 2D on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected for evaluating the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between NAA_ELT and A2D_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F temperature range regardless of water year type (Table 11-2D-62). In the Feather River, there would be no differences between NAA_ELT and A2D_ELT in the frequency of temperatures below 45°F. There would be a 7% reduction (absolute scale) in the frequency of exceeding the 75°F threshold for above normal water years, but due to the low magnitude of this reduction in frequency, it is not expected to have a biologically meaningful effect on splittail.

These results indicate that A2D_ELT would have no negative effects on splittail spawning conditions in channel margin and side-channel habitats resulting from changes in flow and water temperatures. Effects of A2D_ELT on mean monthly flow would consist of negligible effects or increases in flow (increases up to 16% in the Sacramento River and to 88% in the Feather River) for some months and water year types in the spawning period that would have beneficial effects on spawning habitat conditions. There would be negligible or beneficial project-related effects on exceedance of critical water temperatures in the Sacramento River.

Table 11-2D-62. Difference (Percent Difference) in Percent of Days or Months[a] during February to June in Which Temperature Would Be below 45°F or above 75°F in the Sacramento River at Hamilton City and Feather River at the Confluence with the Sacramento River[b]

	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River at Hamilton City		
Temperatures below 45°F		
Wet	-2.8 (-61%)	0 (-1%)
Above Normal	-2.8 (-60%)	0 (0%)
Below Normal	-2.7 (-52%)	-0.1 (-6%)
Dry	-1.3 (-45%)	0 (0%)
Critical	-1.1 (-51%)	0 (0%)
All	-2.2 (-55%)	0 (-2%)
Temperatures above 75°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Feather River at Sacramento River Confluence		
Temperatures below 45°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Temperatures above 75°F		
Wet	2.3 (NA)	0 (0%)
Above Normal	0 (NA)	-7.3 (-100%)
Below Normal	1.4 (NA)	-4.3 (-75%)
Dry	4.4 (100%)	-1.1 (-11%)
Critical	6.7 (400%)	0 (0%)
All	3.0 (240%)	-2.0 (-32%)

NA = could not be calculated because the denominator was 0.

[a] Days were used in the Sacramento River and months were used in the Feather River.

[b] Based on the modeling period of 1922 to 2003.

Stranding Potential

As indicated above, rapid reductions in flow can dewater channel margin and side-channel habitats, potentially stranding splittail eggs and rearing larvae. Yolo Bypass improvements would occur under the NAA_ELT and therefore would exist under Alternative 2D, so there would be little to no difference in stranding potential between Alternative 2D and NAA_ELT and these effects would not be adverse.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. The effects of Alternative 2D on splittail spawning and rearing habitat would consist of negligible effects and beneficial effects in some months on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough (generally <5% change in flow) and the Feather River (increases in mean monthly flow up to 119%), and negligible effects on water temperatures in the Sacramento and Feather Rivers (generally <5% change). There would be little difference in inundation potential for the Yolo Bypass because Yolo Bypass improvements (e.g., modification of Fremont Weir) would occur regardless of Alternative 2D and therefore would be part of Alternative 2D and NAA_ELT.

CEQA Conclusion: In general, Alternative 2D would have no effect on splittail spawning habitat relative to Existing Conditions. There would be negligible flow- and temperature-related effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River. Yolo Bypass improvements (e.g., modification of Fremont Weir) would occur irrespective of Alternative 2D, but are not included in Existing Conditions, so there would be generally beneficial effects to splittail coinciding with the implementation of Alternative 2D (but not as a result of Alternative 2D).

Floodplain Habitat

Comparisons of the frequencies of inundation for A2D_ELT and Existing Conditions show relatively small increases in drier years under A2D_ELT (Table 11-2D-60). In wet years, there are reductions under A2D_ELT in the frequencies of the shorter inundation periods and an increase in the frequency of the longest inundation periods (70 days or more) because a number of what would be shorter inundation periods under Existing Conditions merge to produce longer inundation periods under A2D_ELT. Coincident with implementation of Alternative 2D, there would also be increased availability of suitable spawning habitat compared to Existing Conditions (Table 11-2D-61), with increases of between 5 and 1,113 Habitat Units (HUs; see footnote in Table 11-2D-61) of suitable spawning habitat depending on water year type. Increased HUs for wet, above normal, and below normal water years are predicted to be 72%, 63%, and 259%, respectively, for A2D_ELT. Comparisons for dry and critical water years indicate increases of 9 and 5 HUs of suitable spawning habitat, respectively, compared to 0 HUs for Existing Conditions. These differences would provide beneficial effects on splittail habitat through increasing spawning habitats, but are not as a result of Alternative 2D; as noted above, these improvements would occur under Alternative 2D and NAA_ELT, but not Existing Conditions.

Channel Margin and Side-Channel Habitat

Flows were compared between A2D_ELT and Existing Conditions for the Sacramento River at Wilkins Slough (Appendix *B, Supplemental Modeling for New Alternatives*) during February through June. Mean flows under A2D _ELT would generally not differ (<5%) from those under Existing Conditions during February through April, and would be up to 17% great during May and June. Due to the small size and frequency of these flow increases, they are not expected to have a biologically meaningful effect on splittail spawning conditions.

Results for the Feather River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) show variable effects of A2D _ELT depending on month and water year type. Results for all months except April include negligible effects (<5%), small to large increases in mean monthly flow (to 82%), and small to moderate reductions (up to 16%), depending on water year type. During April, flows would generally be similar between A2D _ELT and Existing Conditions. Based on a prevalence of negligible (<5%) or beneficial effects on flow (increases to 82%), and isolated reductions that would be of small magnitude, these results indicate that effects of Alternative 2D on flow would not have biologically meaningful negative effects on splittail spawning conditions in channel margin and side-channel habitats in the Feather River.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively, were used to investigate the potential effects of A2D_ELT on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected as the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between Existing Conditions and A2D _ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F temperature range regardless of water year type (Table 11-2D-62). In the Feather River, there would be no differences between Existing Conditions and A2D _ELT in frequency of temperatures below 45°F, but there would be a 7% increase in the frequency of exceeding the 75°F threshold under A2D_ELT relative to Existing Conditions in dry water years. Due to the low magnitude of this increase in frequency, it is not expected to have a biologically meaningful effect on splittail.

Stranding Potential

As noted for other alternatives, and due to a lack of quantitative tools and historical data to evaluate possible stranding effects, the following provides a narrative summary of potential effects in relation to stranding potential. The Yolo Bypass is exceptionally well-drained because of grading for agriculture, which likely helps limit stranding mortality of splittail. Moreover, water stage decreases on the bypass are relatively gradual (Sommer et al. 2001). Stranding of Sacramento splittail in perennial ponds on the Yolo Bypass does not appear to be a problem under Existing Conditions (Feyrer et al. 2004). Yolo Bypass improvements would be designed, in part, to further reduce the risk of stranding by allowing water to inundate certain areas of the bypass to maximize biological benefits, while keeping water away from other areas to reduce stranding in isolated ponds. Actions to increase the frequency of Yolo Bypass inundation that are separate from Alternative 2D but that would coincide with Alternative 2D would increase the frequency of potential stranding events in relation to Existing Conditions. For splittail, an increase in inundation frequency would also increase the production of Sacramento splittail in the bypass. While total stranding losses may be greater under Alternative 2D than under Existing Conditions (although not as a result of Alternative 2D), the total number of splittail would be expected to be greater under Alternative 2D (again, not as a result of Alternative 2D, but coincident with it).

In the Yolo Bypass, Sommer et al. (2005) found these potential losses are offset by the improvement in rearing conditions. Henning et al. (2006) also noted the potential for stranding risk as wetlands desiccate and oxygen concentrations decline, but the seasonal timing of use by juveniles may decrease these risks. Sommer et al. (2005) addressed the question of stranding and concluded the potential improvements in habitat capacity outweighed the potential stranding problems that may exist in some years. Overall, these effects are less than significant.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact is not significant because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would greater than the CEQA baseline, but not as a result of Alternative 2D, and the net result would be expected to be beneficial. No mitigation is necessary.

Impact AQUA-113: Effects of Water Operations on Rearing Habitat for Sacramento Splittail

Because both Alternative 2D and NAA_ELT are assumed to include Yolo Bypass improvements including Fremont Weir modification, there would be little to no difference in the quantity and quality of rearing habitat in the Yolo Bypass. There would be no effect on rearing conditions in channel margin and side-channel habitats due to negligible changes in mean monthly flow and water temperatures during most of the rearing period in the Sacramento River and the Feather River.

Floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for A2D_ELT. The small and infrequent changes to flow under A2D_ELT described above would also not substantially affect splittail rearing habitat conditions.

NEPA Effects: Based on the analyses above, the effect of Alternative 2D on splittail rearing habitat is not adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion: In general, there would be no effect of Alternative 2D on splittail rearing habitat relative to Existing Conditions.

As described above, floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. Alternative 2D would not result in changes in floodplain habitat, although there would be a greater extent of floodplain habitat available coincident with implementation of Alternative 2D because of Yolo Bypass improvements (e.g., Fremont Weir modification) that would occur regardless of Alternative 2D but that are not current present under Existing Conditions. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for Alternative 2D.

Summary of CEQA Conclusion

Based on the analyses above, the impact of Alternative 2D on splittail rearing habitat is not significant because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 2D. No mitigation is necessary.

Impact AQUA-114: Effects of Water Operations on Migration Conditions for Sacramento Splittail

Upstream of the Delta

In general, Alternative 2D would not affect migration conditions for juvenile or adult splittail in the Sacramento River or the Feather River relative to the NAA_ELT based on negligible or beneficial effects on mean monthly flow during the migration period and negligible effects on exposure to critical water temperatures in the Feather River. Adults migrate upstream primarily in December through March and juvenile migrate primarily in April through July (Moyle et al. 2004).

The effects of Alternative 2D on splittail migration conditions would be the same as described for channel margin and side-channel habitats in the Sacramento River and Feather River for Impact AQUA-112 above. One additional month (July) is included here that was not considered in Impact AQUA-112. During July, mean flows under Alternative 2D would be up to 48% lower depending on water year type. Because this reduction would occur at the end of the migration period, particularly after multiple months of beneficially higher flows relative to NAA_ELT, the reduction is not likely to affect juvenile migration conditions. Therefore, overall, there would be no effect of Alternative 2D on migration conditions in either river.

Through-Delta

Alternative 2D is expected to generally reduce OMR reverse flows during the period of juvenile splittail migration through the Delta (May-July). OMR flows are improved in June and July compared to baseline conditions across all water years. While May flows are decreased slightly in all water year types except wet, OMR flows averaged across all water years are still positive and flowing towards the San Francisco estuary, and do not average more negative than -1,400 cfs in any given water year type. For juvenile splittail migrating down the Sacramento River past the north Delta intakes, migration flows downstream of the north Delta intakes under Alternative 2D generally would be somewhat reduced relative to NAA_ELT, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). The greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 2D because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences.

NEPA Effects: The effect of Alternative 2D is not adverse because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion:

Upstream of the Delta

In general, effects of Alternative 2D would have no effect on splittail migration conditions relative to Existing Conditions due to a lack of effects to flows and water temperatures in the Sacramento River and the Feather River during the splittail migration period.

Effects of Alternative 2D on splittail migration conditions are the same as described for channel margin and side-channel habitats in Impact AQUA-112.

Through-Delta

As described above, average OMR flows under Alternative 2D are expected to generally improve during the juvenile splittail migration through the Delta, especially during the summer months. In dry and below-normal water years in May, the reverse OMR flows would be increased under Alternative 2D compared to Existing Conditions; however overall monthly average OMR flows would be similar in May compared to Existing Conditions. In addition, the periods of increased reverse flows in May would remain within the NMFS and USFWS BiOp requirements. As described above in the discussion of the NEPA Effects, juvenile splittail migrating down the Sacramento River past the north Delta intakes would experience reduced migration flows downstream of the north Delta intakes under Alternative 2D, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). However, the greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 2D because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences. Thus the changes are expected to have a less-than-significant impact.

Summary of CEQA Conclusion

The impact is less than significant because it would not substantially reduce suitable migration habitat or substantially reduce the number of fish as a result of mortality and no mitigation is necessary. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 2D. No mitigation is necessary.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-115: Effects of Construction of Restoration Measures on Sacramento Splittail

Impact AQUA-116: Effects of Contaminants Associated with Restoration Measures on Sacramento Splittail

Impact AQUA-117: Effects of Restored Habitat Conditions on Sacramento Splittail

Impact AQUA-118: Effects of Methylmercury Management on Sacramento Splittail (Environmental Commitment 12)

Impact AQUA-121: Effects of Localized Reduction of Predatory Fish on Sacramento Splittail (Environmental Commitment 15)

Impact AQUA-122: Effects of Nonphysical Fish Barriers on Sacramento Splittail (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on Sacramento splittail for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Green Sturgeon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-127: Effects of Construction of Water Conveyance Facilities on Green Sturgeon

The potential effects of construction of the water conveyance facilities on green sturgeon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-127) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to green sturgeon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-127, the effect would not be adverse for green sturgeon or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-127, the impact of the construction of water conveyance facilities on green sturgeon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-128: Effects of Maintenance of Water Conveyance Facilities on Green Sturgeon

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-128, the effect would not be adverse for green sturgeon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-128 for green sturgeon, the impact of the maintenance of water conveyance facilities on green sturgeon or critical habitat would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-129: Effects of Water Operations on Entrainment of Green Sturgeon

Water Exports from SWP/CVP South Delta Facilities

Alternative 2D is expected to substantially reduce overall entrainment of juvenile green sturgeon at the south Delta export facilities. Average annual loss of juvenile green sturgeon, as estimated by the salvage density method, would be approximately 37 fish for the combined SWP and CVP south Delta facilities (Table 11-2D-63; A2D_ELT). Losses would be slightly greater in wetter water year types (34 fish) than in drier years (29 fish). Losses would decrease 51–55% for Alternative 2D as compared to Existing Conditions and NAA_ELT. Entrainment reductions would be greater in wetter years (69–71% decrease) compared to Existing Conditions and NAA_ELT.

Water Exports from SWP/CVP North Delta Intake Facilities

The overall potential entrainment effects of operating the new north Delta intakes under Alternative 2D would be the same as described for Impact AQUA-129 under Alternative 2A. The intakes would have screens to avoid or reduce entrainment; there would be no adverse effect.

Predation Associated with Entrainment

Juvenile green sturgeon predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Sturgeon develop bony scutes at a young age which reduces their predation vulnerability. Based on their early development of scutes and rapid growth rates, the number of juvenile green sturgeon lost to predation at the south Delta facilities would change negligibly between Alternative 2D and NAA_ELT. The impact and conclusion for predation risk associated with the north Delta intakes would be the same as described for Alternative 2A (Impact AQUA-3 for green sturgeon).

NEPA Effects: The effect on entrainment and predation losses under Alternative 2D would not be adverse, because green sturgeon grow rapidly and develop bony scutes early in their development which reduces their predation risk; therefore the main effect would be reduced entrainment under Alternative 2D because of reduced south Delta exports.

CEQA Conclusion: As described above, annual entrainment losses of juvenile green sturgeon across all years would decrease 55% under Alternative 2D (A2D_ELT) (37 fish) relative to Existing Conditions (82 fish) (Table 11-2D-63). Impacts of water operations on green sturgeon would be less than significant due to an overall reduction in entrainment and no mitigation would be required.

Table 11-2D-63. Juvenile Green Sturgeon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities for Alternative 2D

	Entrainment Index			Absolute Difference (Percent Difference)	
Water Year[b]	EXISTING CONDITIONS	NAA_ ELT	A2D_ ELT	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet and Above Normal	116	111	34	-82 (-71%)	-77 (-69%)
Below Normal, Dry, and Critical	50	46	29	-21 (-42%)	-17 (-37%)
All Years	82	76	37	-45 (-55%)	-39 (-51%)

[a] Estimated annual number of fish lost.
[b] Sacramento Valley water year-types.

The impact of predation associated with entrainment would be the same as described immediately above because the rapid growth and development of bony scutes reduces the predation risk for juvenile green sturgeon. The impact would be less than significant.

Impact AQUA-130: Effects of Water Operations on Spawning and Egg Incubation Habitat for Green Sturgeon

In general, Alternative 2D would not affect spawning and egg incubation habitat for green sturgeon relative to NAA_ELT.

Sacramento River

Flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix *B, Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation. Mean flows under A2D_ELT would generally be similar to or slightly greater than flows under NAA_ELT during March through July at both locations

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

The number of days on which temperature exceeded 63°F by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above the 63°F threshold were further assigned a "level of concern" as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-64. There would be no substantial differences between NAA_ELT and Alternative 2D in the exceedances for any of the levels of concern.

Table 11-2D-64. Differences between Baseline and Alternative 2D Scenarios in the Number of Years in Which Water Temperature Exceedances above 63°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Red	4 (100%)	1 (13%)
Orange	0 (0%)	0 (0%)
Yellow	1 (50%)	-1 (-33%)
None	-5 (-7%)	0 (0%)

Total degree-days exceeding 63°F at Bend Bridge were summed by month and water year type during May through September (Table 11-2D-65). Combining all water years, total degree-days would be nearly the same under Alternative 2D relative to NAA_ELT during May through July, and would be 3% to 2% lower during August and September.

Table 11-2D-65. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
May	Wet	17 (131%)	0 (0%)
	Above Normal	0 (NA)	-2 (-100%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	2 (NA)	1 (100%)
	All	19 (146%)	-1 (-3%)
June	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
July	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	159 (1988%)	0 (0%)
	All	159 (1988%)	0 (0%)
August	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	29 (NA)	0 (0%)
	Critical	635 (316%)	-31 (-4%)
	All	664 (330%)	-31 (-3%)
September	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	4 (NA)	3 (300%)
	Dry	138 (445%)	8 (5%)
	Critical	506 (190%)	-35 (-4%)
	All	648 (217%)	-24 (-2%)

NA = could not be calculated because the denominator was 0.

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June green sturgeon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would be similar to or up to 121% greater (June of below normal years) than flows under NAA_ELT, with minor exceptions. Differences at the confluence with the Sacramento River would generally be similar to but smaller than those at Thermalito. These results indicate that flows in the Feather River would increase during the green sturgeon spawning and egg incubation period under Alternative 2D independent of climate change.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

The percent of months exceeding the 64°F temperature threshold in the Feather River at Gridley was evaluated during May through September (Table 11-2D-66). For this impact, only the months of May and June were examined because green sturgeon spawning and egg incubation does not generally extend beyond June in the Feather River. Subsequent months are examined under Impact AQUA-131. In both May and June, the percent of months exceeding the threshold under Alternative 2D would be similar to or lower (up to 33% lower on an absolute scale) than the percent under NAA_ELT.

Table 11-2D-66. Differences between Baseline and Alternative 2D Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A2D_ELT					
May	11 (35%)	7 (40%)	2 (25%)	7 (200%)	2 (100%)
June	-2 (-3%)	-11 (-13%)	-14 (-17%)	-10 (-15%)	-9 (-18%)
July	0 (0%)	0 (0%)	0 (0%)	5 (5%)	15 (21%)
August	0 (0%)	0 (0%)	5 (5%)	10 (12%)	14 (22%)
September	-16 (-23%)	-14 (-25%)	-2 (-9%)	6 (83%)	2 (100%)
NAA_ELT vs. A2D_ELT					
May	-17 (-29%)	-10 (-28%)	-10 (-44%)	-1 (-10%)	-1 (-20%)
June	-6 (-6%)	-19 (-19%)	-26 (-28%)	-32 (-37%)	-33 (-46%)
July	0 (0%)	0 (0%)	0 (0%)	-5 (-5%)	-1 (-1%)
August	0 (0%)	0 (0%)	-4 (-4%)	-5 (-5%)	-6 (-8%)
September	2 (5%)	1 (3%)	-2 (-9%)	-6 (-31%)	-4 (-43%)

Total degree-months exceeding 64°F were summed by month and water year type at Gridley during May through September (Table 11-2D-67). Only May and June were examined for spawning and egg incubation habitat here. Subsequent months are examined under Impact AQUA-131. Total degree-months exceeding the threshold under Alternative 2D would be 9% to 26% lower than those under NAA_ELT during May and June.

Table 11-2D-67. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
May	Wet	11 (183%)	0 (0%)
	Above Normal	2 (18%)	-6 (-32%)
	Below Normal	10 (125%)	-3 (-14%)
	Dry	17 (121%)	0 (0%)
	Critical	12 (71%)	-1 (-3%)
	All	51 (91%)	-11 (-9%)
June	Wet	3 (4%)	-41 (-34%)
	Above Normal	-10 (-20%)	-27 (-40%)
	Below Normal	-22 (-34%)	-40 (-48%)
	Dry	11 (12%)	-15 (-13%)
	Critical	20 (36%)	0 (0%)
	All	3 (1%)	-122 (-26%)
July	Wet	21 (12%)	16 (9%)
	Above Normal	5 (9%)	0 (0%)
	Below Normal	22 (32%)	7 (8%)
	Dry	51 (59%)	25 (22%)
	Critical	56 (71%)	30 (29%)
	All	155 (34%)	78 (15%)
August	Wet	11 (6%)	14 (8%)
	Above Normal	18 (40%)	10 (19%)
	Below Normal	27 (39%)	9 (10%)
	Dry	70 (103%)	27 (24%)
	Critical	21 (25%)	-5 (-5%)
	All	146 (33%)	54 (10%)
September	Wet	-27 (-69%)	6 (100%)
	Above Normal	-4 (-25%)	11 (1100%)
	Below Normal	9 (32%)	-4 (-10%)
	Dry	14 (50%)	3 (8%)
	Critical	17 (85%)	-1 (-3%)
	All	9 (7%)	15 (12%)

San Joaquin River

Flows in the San Joaquin River at Vernalis under Alternative 2D during March through June would not be different from flows under NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives)*.

No water temperatures modeling was conducted in the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that there would not be adverse effects on green sturgeon spawning and egg incubation habitat because the amount of suitable habitat would not be substantially reduced. Flow and temperature conditions would generally be similar between Alternative 2D and the NEPA baseline in the Sacramento River and San Joaquin River and would be beneficial under Alternative 2D relative the NEPA baseline in the Feather River. Alternative 2D would reduce the frequency of exceedances above NMFS temperature thresholds in the Sacramento and Feather Rivers.

CEQA Conclusion: Collectively, the results of the Impact AQUA-130 CEQA analysis show that the difference between the CEQA baseline and Alternative 2D could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 2D would not affect the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to the CEQA baseline.

Sacramento River

Mean flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D_ELT would generally be slightly lower than those under Existing Conditions during March and April, and would generally be similar to or slightly greater than those under Existing Conditions during June and July. Mean flows under A2D_ELT during May would be up to 13% lower (wet years) and 10% higher (below normal years) than flows under Existing Conditions. These modeling results indicate that there would be no effect on flows in the Sacramento River under A2D_ELT relative to Existing Conditions.

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between Existing Conditions and Alternative 2D in any month or water year type throughout the period.

There would be 4 more years with a "red" NMFS level of concern in the Sacramento River at Bend Bridge under A2D_ELT than under Existing Conditions.

Total degree-days exceeding the 63°F NMFS threshold in the Sacramento River at Bend Bridge under A2D_ELT (for all water years combined) would be up to 1,988% higher (in July) than under Existing Conditions (Table 11-2D-65). Such a large increase on the relative scale is a mathematical artifact resulting from the small value of the divisor (i.e., degree-days for Existing Conditions). On an absolute scale, the largest increase would be 664 degree days (in August), which corresponds to an average daily temperature increase over the 82-year period of about 0.3 degrees per day. This is a small change.

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June green sturgeon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). At Thermalito, mean flows under A2D_ELT would generally be lower than those under Existing Conditions during February and March (up to 40% lower in February of below normal years), with some exceptions, and would generally be similar to or greater than those under Existing Conditions during April through June (up to 157% greater in June of below normal years). At the confluence with the Sacramento River, flows under A2D_ELT would generally be similar to those under Existing Conditions in all months and water year types of the period, except June, in which flows under A2D_ELT would be up to 82% higher. These modeling results indicate that there would generally be lower flows in the Feather River under A2D_ELT relative to Existing Conditions early in the spawning and egg incubation period and greater flows later in the period.

Mean monthly water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would generally be no differences (<5%) in mean monthly water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

Water temperature-related effects of A2D_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were evaluated by determining the percent of months during May through September exceeding the 64°F temperature threshold in the Feather River at Gridley (Table 11-2D-66). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. During the period, the percent of months exceeding the threshold under Alternative 2D relative to Existing Conditions would be similar to or higher (up to 11% on an absolute scale) during May and similar to or lower (up to 14% lower on an absolute scale) during June. These results indicate a small to moderate beneficial effect for May and a small to moderate negative effect for June.

Water temperature-related effects of Alternative 2D on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-2D-67). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. Combining water years, total degree-months exceeding the threshold during May and June under A2D_ELT would be 1% to 91% greater relative to Existing Conditions. Within months, total degree-months under A2D_ELT would be consistently higher relative to Existing Conditions during May and would be higher for some water year types and lower for others during June. These results indicate that there would be a moderate negative effect of Alternative 2D on green sturgeon spawning and egg incubation temperature-related conditions in the Feather River during May and no net effect during June.

San Joaquin River

Flows under A2D_ELT were examined in the San Joaquin River at Vernalis during the March through June green sturgeon spawning and egg incubation period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows under A2D _ELT would be moderately lower (up to 16% lower in June of wet years) than those under Existing Conditions for all months of the period, with minor exceptions.

Summary of CEQA Conclusion

Under Alternative 2D, flows would generally not differ in the Sacramento River. Flows in the Feather River under Alternative 2D would be lower relative to Existing Conditions early in the spawning and egg incubation period and would higher later in the period. Water temperature conditions in the Sacramento and Feather rivers under Alternative 2D would not differ significantly relative to Existing Conditions. Flows under Alternative 2D in the San Joaquin River would be consistently lower than those under Existing Conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of green sturgeon in the San Joaquin River as a result of reduced flows.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flow and water temperature conditions under Alternative 2D would be similar to or better than those under NAA_ELT. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-131: Effects of Water Operations on Rearing Habitat for Green Sturgeon

In general, Alternative 2D would not affect the quantity and quality of green sturgeon larval and juvenile rearing habitat relative to NAA_ELT.

Water temperature was used to determine the potential effects of alternatives on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period, except for a 6% increase of temperature in July of critical water years.

Water temperature-related effects of Alternative 2D on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures exceed a 64°F temperature threshold at Gridley (Table 11-2D-66). The percent of months exceeding the 64°F temperature threshold would be similar to or lower (up to 33% lower on an absolute scale) than the percent under NAA_ELT in all months.

Water temperature-related effects of Alternative 2D on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-2D-67). Combining water years, total degree-months exceeding the threshold under A2D_ELT would be 9% to 26% lower relative to NAA_ELT during May and June and 10% to 15% higher during July through September. These results indicate that there would be both beneficial and negative temperature-related effects to green sturgeon rearing in the Feather River. However, the largest increase in degree-months (78 degree-months during July) would equate to an average increase of less than one degree per month. Given the highly variable nature of the Feather River outside of the low-flow channel, this change is not expected to be biologically meaningful. In fact, it is not unexpected that this amount of change would occur daily on a diel cycle.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River. However flows in all months and water year types, based on CALSIM II, were the same or very similar between NAA_ELT and A2D_ELT (Appendix *B, Supplemental Modeling for New Alternatives*) and, therefore, no temperature effects would occur as a result of Alternative 2D.

NEPA Effects: Collectively, the results indicate that the effect would not be adverse because it does not have the potential to substantially reduce the amount of suitable rearing habitat. Water temperatures in the Sacramento and Feather Rivers and exceedances of NMFS temperature thresholds in the Feather River under Alternative 2D would be similar to those under NAA_ELT.

CEQA Conclusion: In general, Alternative 2D could reduce the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions.

Water temperature was used to determine the potential effects of Alternative 2D on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT for any month or water year type of the period, except a 6% higher mean temperature for August of critical water years.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT for any month or water year type of the period, except for 7% and 6% higher temperatures for July of critical water years and August of dry years, respectively.

Water temperature-related effects of A2D_ELT on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures would exceed a 64°F temperature threshold at Gridley (Table 11-2D-66). The percent of months exceeding the threshold under A2D_ELT would be similar to or greater by up to 15% (absolute scale) than the percent under Existing Conditions during May, July and August, and would be lower by up to 16% (absolute scale) during June and September, except of a 6% increase in September for the >4.0°F exceedance category.

Water temperature-related effects of Alternative 2D on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-2D-67). Combining water years, total degree-months exceeding the threshold under A2D_ELT would be 1% to 91% higher in all months. The largest increase in degree-months (155 degree-months during July) would equate to an average increase of about 2 degree per month, which would be biologically meaningful. These results indicate that there would be negative temperature-related effects of Alternative 2D on green sturgeon rearing in the Feather River.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 2D, water temperatures would be slightly higher in the Sacramento and Feather rivers than those under the CEQA baseline, and the exceedances above NMFS temperature thresholds in the Feather River would be higher, which could increase stress, mortality, and susceptibility to disease for larval and juvenile green sturgeon. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce rearing habitat and substantially reduce the number of green sturgeon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on water temperatures would be negligible and exceedances above thresholds would be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NEPA baseline, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-132: Effects of Water Operations on Migration Conditions for Green Sturgeon

In general, Alternative 2D would not reduce green sturgeon migration conditions relative to NAA_ELT.

Upstream of the Delta

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through June adult migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River mean flows at Keswick under A2D_ELT would generally be similar to flows under NAA_ELT in all months except September and November, in which flows would be up to 24% lower (Appendix *B, Supplemental Modeling for New Alternatives*). Sacramento River flows at Wilkins Slough under A2D_ELT would generally be up to 18% lower than flows under NAA_ELT during September and November, up to 16% greater during May and June, and similar to flows under NAA_ELT in the remaining eight months (Appendix *B, Supplemental Modeling for New Alternatives*).

These flow reductions would be infrequent (2 out of 12 months) and, therefore, would not cause substantial effects to green sturgeon migration.

Differences between A2D_ELT and NAA_ELT in Feather River mean flows at Thermalito would vary a great deal with month and water year type. In general, mean flows under A2D_ELT would be up to 49% lower (September of below normal years) than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be up to 23% higher (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be up to 121% greater (June of below normal years) during May, June and October, and similar to flows under NAA_ELT in the remaining seven months, with a number of exceptions.

Feather River mean flows at the confluence with the Sacramento River under A2D_ELT would generally be up to 48% lower (July of critical water years) than flows under NAA_ELT during July through September, although flows in critical water years during August and September would be up to 14% higher (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would generally be up to 88% greater (June of below normal years) under A2D_ELT during May, June and October, and similar to flows under NAA_ELT in the remaining six months, with minor exceptions.

These changes represent a shift in the Oroville release pattern such that greater releases are made in the spring and less release is made in the summer. Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the project planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

Larval transport flows were also examined by utilizing the positive correlation between white sturgeon year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved green sturgeon larval transport that results in improved year class strength. However, there is high uncertainty about what the mechanism responsible for this relationship with white sturgeon year class strength is because many flow variable correlate throughout the Central Valley. One hypothesis suggests that the correlation is caused by high flows in the upper river resulting in improved migration, spawning, and rearing conditions in the upper river. Another hypothesis suggests that the positive correlation is a result of higher flows through the Delta triggering more adult sturgeon to move up into the river to spawn. In addition, this correlation was developed using data collected in the absence of north Delta intakes. Also, there are temporal and spatial differences between green and white sturgeon larval presence that make this analysis highly uncertain and potentially not applicable (Murphy et al. 2011). In particular, during April and May, green sturgeon would be spawning and larvae rearing in the upper Sacramento River and Feather River. This mismatch in timing and location limits the confidence in using this as a surrogate for green sturgeon and suggests that year-class strength correlated with flow at another location within the Sacramento River or during a different period, if at all.

Regardless, for lack of a known relationship for green sturgeon year-class strength, the results using white sturgeon as a surrogate for green sturgeon were examined here. Results for white sturgeon presented in Impact AQUA-150 below suggest that, using the positive correlation between Delta outflow and year class strength, green sturgeon year class strength would be lower under A2D_ELT than those under NAA_ELT (up to 50% lower) (Table 11-2D-73).

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows. The effect on green sturgeon would not be adverse.

NEPA Effects: Sacramento River flows would generally be similar between Alternative 2D and NAA_ELT, with few exceptions that would not be substantial. In the Feather River, there would be some summer flow reductions under Alternative 2D, but given the benthic nature of green sturgeon and that the flow regime is consistent with NMFS recommendations provided to mimic a more natural flow regime to benefit of natives species, these reductions are not expected to adversely affect green sturgeon.

Due to the removal of water at the North Delta intakes, there are substantial differences in through-Delta flows between Alternative 2D and NAA_ELT. The percentage of months exceeding the USFWS (1995) Delta outflow thresholds in April and May of wet and above normal years under Alternative 2D was appreciably lower than that under NAA_ELT. Analysis of white sturgeon year-class strength (USFWS 1995), used here as a surrogate for green sturgeon, found a positive correlation between year class strength and Delta outflow during April and May. However, there are several problems with approach, as described above that make this analysis highly uncertain and potentially not applicable.

Determining whether a relationship exists between green sturgeon year class strength and river/Delta outflow and addressing the scientific uncertainty regarding which mechanisms are responsible for the positive correlation between white sturgeon year class strength and river/Delta flow will occur through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations. Given the outcome of these investigations, Delta outflow would be appropriately set for Alternative 2D operations such that the effect on green sturgeon Delta flow conditions would not be adverse. This, combined with similarities in flow conditions between Alternative 2D and NAA_ELT in the Sacramento River, the benthic nature of green sturgeon, and a lack of confidence in using white sturgeon as a surrogate for green sturgeon given the differences in timing and location of the two species, indicate that Alternative 2D would not be adverse to migration conditions for green sturgeon.

CEQA Conclusion: In general, these modeling results indicate that Alternative 2D could reduce the quantity and quality of migration habitat for green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of migration habitat for green sturgeon.

Upstream of the Delta

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through July adult migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River mean flows at Keswick under A2D_ELT would generally be up to 18% lower than flows under Existing Conditions during October through November of all water year types, and up to 24% lower in September of below normal, dry and critical years (Appendix *B, Supplemental Modeling for New Alternatives*). During September of above normal and wet years, flows under A2D_ELT were up to 29% higher. In the other months and water year types, the mean flows would generally be similar between A2D_ELT and Existing Conditions, with several exceptions. Mean flows at Wilkins Slough under A2D_ELT would generally be up to 24% lower than flows under Existing Conditions during August through November, except for September of wet and above normal water years when flows under A2D_ELT would be up to 28% higher. Mean flow in June would be up to 17% higher under A2D_ELT, and flows would be similar in other months and water year types, with minor exceptions.

Feather River mean flows at Thermalito Afterbay under A2D_ELT would generally be up to 50% lower than flows under Existing Conditions during January, February, July, and November of most water years, and up to 47% lower in March, August, and September of below normal and dry years (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would be similar to or up to 196% higher than flows under Existing Conditions during April through June, as well as September of wet, above normal and critical years. Flows under A2D_ELT would be similar to, lower than, and higher than flows under Existing Conditions during October and December, depending on water year type. Mean flow under A2D_ELT at the confluence with the Sacramento River would generally be up to 102% greater than flows under Existing Conditions during June of most water years and September of below normal and dry years, and would generally be up to 53% lower than flows under Existing Conditions during July and during September of below normal and dry water years. Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the project planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

For Delta outflow, the percent of months exceeding outflow thresholds under A2D_ELT would consistently be lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (Table 11-2D-73).

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows. The effect on green sturgeon would not be adverse.

Summary of CEQA Conclusion

Under Alternative 2D, there would be frequent small to large reductions in flows in the Sacramento River upstream of the Delta that would reduce the ability of all three life stages of green sturgeon to migrate successfully. Exceedances of Delta outflow thresholds would be lower under Alternative 2D than under Existing Conditions, although there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows co-vary with another unknown factor. Also, the appropriateness of using white sturgeon as a surrogate for green sturgeon is questionable, as described for the NEPA Effects section above. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce upstream migration conditions for green sturgeon.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on green sturgeon migration conditions in upstream areas. Within the Plan Area, the Adaptive Management Program will evaluate water operations and make adjustments as necessary to protect green sturgeon abundance and ensure the impacts of water operations on migration conditions for green sturgeon are less than significant. Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-133: Effects of Construction of Restoration Measures on Green Sturgeon

Impact AQUA-134: Effects of Contaminants Associated with Restoration Measures on Green Sturgeon

Impact AQUA-135: Effects of Restored Habitat Conditions on Green Sturgeon

Impact AQUA-136: Effects of Methylmercury Management on Green Sturgeon (Environmental Commitment 12)

Impact AQUA-139: Effects of Localized Reduction of Predatory Fish on Green Sturgeon (Environmental Commitment 15)

Impact AQUA-140: Effects of Nonphysical Fish Barriers on Green Sturgeon (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on green sturgeon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

White Sturgeon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-145: Effects of Construction of Water Conveyance Facilities on White Sturgeon

The potential effects of construction of the water conveyance facilities on white sturgeon would be similar to those described for Alternative 4A (Impact AQUA-145) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to white sturgeon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-145, the effect would not be adverse for white sturgeon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-145, the impact of the construction of water conveyance facilities on white sturgeon would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-146: Effects of Maintenance of Water Conveyance Facilities on White Sturgeon

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-146, the effect would not be adverse for white sturgeon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-146 for white sturgeon, the impact of the maintenance of water conveyance facilities on white sturgeon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-147: Effects of Water Operations on Entrainment of White Sturgeon

Water Exports from SWP/CVP South Delta Facilities

Alternative 2D is expected to substantially reduce overall entrainment of juvenile white sturgeon at the south Delta export facilities, estimated as the salvage density method, by about 53–59% across all years as compared to Existing Conditions and NAA_ELT (Table 11-2D-68). As discussed for Alternative 2A (Impact AQUA-3), entrainment is highest in wet and above normal water years. Under Alternative 2D, entrainment in wet and above normal water years would be reduced 68–71% for juveniles, compared to baseline conditions. Therefore, Alternative 2D would not have adverse effects on juvenile white sturgeon.

Water Exports from SWP/CVP North Delta Intake Facilities

The potential entrainment effects of operating the new north Delta intakes under Alternative 2D would be the same as described for Impact AQUA-129 under Alternative 2A. The intakes would have screens to avoid or reduce entrainment; there would be no adverse effect.

Predation Associated with Entrainment

Juvenile white sturgeon predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Sturgeon develop bony scutes at a young age which reduces their predation vulnerability. Based on their early development of scutes and rapid growth rates, the number of juvenile white sturgeon lost to predation at the south Delta facilities would change negligibly between Alternative 2D and NAA_ELT. The impact and conclusion for predation risk associated with the north Delta intakes would be the same as described for Alternative 2A.

NEPA Effects: As concluded for Alternative 2A, the effect on entrainment and predation under Alternative 2D would not be adverse, because sturgeon grow rapidly and develop bony scutes early in their development which reduces predation risk; therefore the main effect would be reduced entrainment under Alternative 2D because of reduced south Delta exports.

CEQA Conclusion: As described above, operational activities associated with water exports from SWP/CVP south Delta facilities would result in an overall decrease in entrainment of white sturgeon under Alternative 2D compared to Existing Conditions (Table 11-2D-68; Existing Conditions vs. 2D_ELT). Impacts of Alternative 2D water operations on entrainment of white sturgeon would be less than significant due to an overall reduction in entrainment and no mitigation would be required.

Table 11-2D-68. Juvenile White Sturgeon Entrainment Index[a] at the SWP and CVP Salvage Facilities for Sacramento Valley Water Year-Types and Differences (Absolute and Percentage) between Model Scenarios

	Absolute Difference (Percent Difference)	
Water Year[b]	NAA_ELT vs. A2D_ELT	EXISTING CONDITIONS vs. A2D_ELT
Wet and Above Normal	-176 (-68%)	-205 (-71%)
Below Normal, Dry, and Critical	-10 (-28%)	-15 (-37%)
All Years	-84 (-53%)	-106 (-59%)

[a] Estimated annual number of fish lost.
[b] Sacramento Valley water year-types.

The impact of predation associated with entrainment would be the same as described immediately above because the rapid growth and development of bony scutes reduces the predation risk for juvenile white sturgeon. The impact would be less than significant.

Impact AQUA-148: Effects of Water Operations on Spawning and Egg Incubation Habitat for White Sturgeon

In general, Alternative 2D would not affect spawning and egg incubation habitat for white sturgeon relative to NAA_ELT.

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon. Mean flows under A2D_ELT would generally be similar to flows under NAA_ELT during February to April at both locations, and would be greater than flows under NAA_ELT during May in most water years (up to 16% greater) (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period.

The number of days on which temperature exceeded a 61°F optimal and 68°F lethal threshold by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above each threshold were further assigned a “level of concern” as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-69. For the 61°F threshold, there would be 11 fewer (44% fewer) “red” years under A2D_ELT than under NAA_ELT. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between NAA_ELT and A2D_ELT.

Table 11-2D-69. Differences between Baselines and Alternative 2D in the Number of Years in Which Water Temperature Exceedances above the 61°F and 68°F Thresholds Are within Each Level of Concern, Sacramento River at Hamilton City, March through June

Level of Concern	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
61°F threshold		
Red	17 (213%)	-11 (-44%)
Orange	10 (67%)	4 (16%)
Yellow	-11 (-35%)	3 (15%)
None	-16 (-57%)	4 (33%)
68°F threshold		
Red	0 (NA)	0 (NA)
Orange	0 (NA)	0 (NA)
Yellow	1 (NA)	-1 (-100%)
None	-1 (-1%)	1 (1%)

NA = could not be calculated because the denominator was 0.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-2D-70, Table 11-2D-71). Total degree-days (all water years combined) exceeding the 61°F threshold under Alternative 2D would be 2 degree-day (67%) greater than those under NAA_ELT during March, which would not be biologically meaningful. During April through June, total degree days above 61°F would be 3 to 480 (2% to 14%) lower under A2D_ELT than under NAA_ELT. These totals would not be biologically meaningful to white sturgeon considering that, since there are 2,542 and 2,460 total days during May and June, respectively, over the 82-year modeling period, the average daily reduction in temperature would be <0.2 degrees. Total degree-days exceeding the 68°F threshold would be similar between NAA_ELT and A2D_ELT, except during May, in which exceedances would be 12 degree-days (40%) fewer under A2D_ELT.

Table 11-2D-70. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	2 (NA)	2 (NA)
	Dry	3 (NA)	0 (0%)
	Critical	0 (NA)	0 (NA)
	All	5 (NA)	2 (67%)
April	Wet	18 (150%)	0 (0%)
	Above Normal	15 (150%)	0 (0%)
	Below Normal	15 (250%)	-5 (-19%)
	Dry	47 (92%)	4 (4%)
	Critical	2 (200%)	-2 (-40%)
	All	97 (121%)	-3 (-2%)
May	Wet	438 (132%)	-41 (-5%)
	Above Normal	103 (47%)	-133 (-29%)
	Below Normal	219 (119%)	-50 (-11%)
	Dry	221 (109%)	-93 (-18%)
	Critical	167 (83%)	-59 (-14%)
	All	1,148 (101%)	-376 (-14%)
June	Wet	369 (64%)	-121 (-11%)
	Above Normal	102 (33%)	-105 (-21%)
	Below Normal	172 (82%)	-75 (-16%)
	Dry	212 (63%)	-118 (-18%)
	Critical	175 (47%)	-61 (-10%)
	All	1,030 (57%)	-480 (-14%)

NA = could not be calculated because the denominator was 0.

Table 11-2D-71. Differences between Baseline and Alternative 2D Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
April	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
May	Wet	9 (129%)	0 (0%)
	Above Normal	1 (NA)	-12 (-92%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	11 (157%)	-12 (-40%)
June	Wet	1 (NA)	-1 (-50%)
	Above Normal	-1 (-100%)	-2 (-100%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	1 (100%)	-3 (-60%)

NA = could not be calculated because the denominator was 0.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows at Thermalito Afterbay under A2D_ELT would generally be similar to or greater by up to 35% than those under NAA_ELT, with minor exceptions. Mean flows at the confluence with the Sacramento River under A2D _ELT would be similar to or up to 14% greater than flows under NAA_ELT.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period. Mean water temperatures would not differ (<5%) between NAA_ELT and A2D_ELT at either location throughout the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis under A2D_ELT during February through May would be similar to flows under NAA_ELT (Appendix *B, Supplemental Modeling for New Alternatives)*.

Water temperature modeling was not conducted for the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat. Flows under Alternative 2D would generally be higher in the Feather River relative to the NAA_ELT and generally similar to flows under the NAA_ELT in the Sacramento and San Joaquin Rivers. Alternative 2D would not affect temperatures in any river during the white sturgeon spawning and egg incubation period.

CEQA Conclusion: Collectively, the results of the Impact AQUA-148 CEQA analysis show that the difference between the CEQA baseline and Alternative 2D could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 2D would not affect the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to the Existing Conditions.

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix *B, Supplemental Modeling for New Alternatives*). At Wilkins Slough, mean flows under A2D_ELT would generally be similar to those under Existing Conditions. At Verona, mean flow under A2D_ELT for most of the months and water year types would be slightly lower (less than 10% lower) than flows under Existing Conditions, with a maximum flow reduction of 15% in March of below normal years.

Mean water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

The number of days on which temperature exceeded a 61°F optimal and 68°F lethal threshold by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period (Table 11-2D-10). The combination of number of days and degrees above each threshold were further assigned a “level of concern” as defined in Table 11-2D-11. Differences between baselines and Alternative 2D in the highest level of concern across all months and all 82 modeled years are presented in Table 11-2D-69. For the 61°F threshold, there would be 17 more (213% increase) “red” years under A2D_ELT than under Existing Conditions. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between Existing Conditions and A2D_ELT.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-2D-70, Table 11-2D-71). Total degree-days (all water year types combined) exceeding the 61°F threshold under A2D_ELT would be 5 degree-days (percent change unable to be calculated due to division by 0) to 1,148 degree-days (101%) higher depending on month. Total degree-days exceeding the 68°F threshold would differ little between Existing Conditions and Alternative 2D during March, April and June. During May, total degree-days would be 11 (157%) degree-days higher under A2D_ELT, although this small absolute difference would not cause a biologically meaningful effect on white sturgeon.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix *B, Supplemental Modeling for New Alternatives*). Differences in mean flows between A2D_ELT and Existing Conditions at Thermalito Afterbay would vary greatly during the period. Mean flows during February and March of below normal and dry years would be up to 40% lower under A2D _ELT, and flows would be similar or moderately higher in other water year types. During April and May, flows would be up to 36% higher depending on water year type. Mean flows at the confluence with the Sacramento River under A2D _ELT would generally be similar to or greater than flows under Existing Conditions, except in below normal years during February and March (11% and 16% lower, respectively). These results indicate that there would be some reductions in flows in the Feather River under A2D _ELT relative to Existing Conditions.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would not differ between Existing Conditions and H4_ELT at either location throughout the period.

San Joaquin River

Flows under A2D_ELT were examined in the San Joaquin River at Vernalis during February through May. Mean flows under A2D _ELT during March and April would be up to 12% lower than those under Existing Conditions, whereas flows under A2D _ELT during February and May would be similar to or greater than those under Existing Conditions, with minor exceptions (Appendix *B, Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted for the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 2D, there would be small to moderate reductions in flows in the Sacramento, Feather, and San Joaquin Rivers that would cause biologically meaningful effects to white sturgeon spawning and egg incubation habitat. Further, there would be increases in exceedances of NMFS temperature thresholds in the Sacramento River that would cause a biologically meaningful effect to white sturgeon spawning and egg incubation.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce the quantity and quality of suitable spawning and egg incubation habitat.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the

CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows under Alternative 2D would generally be higher in the Feather River and generally similar in the Sacramento and San Joaquin Rivers. Alternative 2D would not affect temperatures in any river during the white sturgeon spawning and egg incubation period. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-149: Effects of Water Operations on Rearing Habitat for White Sturgeon

In general, Alternative 2D would not affect the quantity and quality of white sturgeon larval and juvenile rearing habitat relative to NAA_ELT.

Water temperature was used to determine the potential effects of Alternative 2D on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and A2D_ELT in any month or water year type throughout the period.

Mean water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT and Alternative 2D in any month or water year type throughout the period, except for 6% higher mean temperature in July of critical water years.

Water temperatures were not modeled in the San Joaquin River.

NEPA Effects: These modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable rearing habitat. There would be no differences in water temperatures between the NEPA baseline and Alternative 2D in the Sacramento River and little difference in the Feather River throughout the white sturgeon rearing period.

CEQA Conclusion: In general, Alternative 2D would not affect the quantity and quality of white sturgeon larval and juvenile rearing habitat relative to the Existing Conditions.

Water temperature was used to determine the potential effects of Alternative 2D on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing Conditions and A2D_ELT in any month or water year type throughout the period.

Mean monthly water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean monthly water temperatures would be similar between Existing Conditions during all months and water year types except July of critical water years and August of dry years, in which the means would be 7% and 6% higher, respectively, under A2D_ELT. These increases would not be large or frequent enough to affect white sturgeon.

Water temperatures were not modeled in the San Joaquin River.

Summary of CEQA Conclusion

These modeling results indicate that the effect is less than significant because it does not have the potential to substantially reduce the amount of suitable habitat and no mitigation is required. There would be few differences in water temperatures between Alternative 2D and the CEQA baseline that, when combined, would not amount to a substantial effect to the white sturgeon population.

Impact AQUA-150: Effects of Water Operations on Migration Conditions for White Sturgeon

In general, the effects of Alternative 2D on white sturgeon migration conditions relative to NAA_ELT are not adverse.

Upstream of the Delta

Analyses for white sturgeon focused on the Sacramento River (North Delta to RM 143 — i.e., Wilkins Slough and Verona CALSIM nodes). Larval transport flows were represented by the average number of months per year that exceeded thresholds of 17,700 cfs (Wilkins Slough) and 31,000 cfs (Verona) (Table 11-2D-72). Exceedances of the 17,700 cfs threshold for Wilkins Slough under A2D_ELT were similar to those under NAA_ELT. The number of months per year above 31,000 cfs at Verona would range from a reduction of 1.5 months (64% lower in wet years) to an increase of 0.8 months (350% higher in dry years) relative to NAA_ELT, depending on water year type. Overall, there is no consistent difference between Alternative 2D and NAA_ELT.

Table 11-2D-72. Difference and Percent Difference in Number of Months between February and May in Which Flow Rates Exceed 17,700 and 5,300 cfs in the Sacramento River at Wilkins Slough and 31,000 cfs at Verona

	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wilkins Slough, 17,700 cfs[a]		
Wet	-0.1 (-4%)	0 (0%)
Above Normal	0.1 (6%)	0 (0%)
Below Normal	-0.1 (-25%)	0 (0%)
Dry	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)
Wilkins Slough, 5,300 cfsb		
Wet	0 (-1%)	-0.1 (-1%)
Above Normal	-0.3 (-4%)	0 (0%)
Below Normal	-0.1 (-3%)	0.2 (4%)
Dry	0 (0%)	0.1 (1%)
Critical	0.2 (5%)	0.1 (2%)
Verona, 31,000 cfsa		
Wet	-1.7 (-67%)	-1.5 (-64%)
Above Normal	-0.5 (-30%)	-0.5 (-30%)
Below Normal	0.4 (86%)	0.5 (117%)
Dry	0.7 (260%)	0.8 (350%)
Critical	1.4 (NA)	1.4 (NA)

[a] Months analyzed: February through May.
[b] Months analyzed: November through May.

The effects of changes in flow for white sturgeon under Alternative 2D was also examined by utilizing the positive correlation between year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved transport (e.g., for white sturgeon larvae or other early life stages) that results in improved year class strength. An examination of monthly average Delta outflow exceedances above 15,000 cfs, 20,000 cfs, and 25,000 cfs during April and May of wet and above-normal years was used to provide context for differences in through-Delta migration conditions, per recommendations by the Anadromous Fish Restoration Program (USFWS 1995). The percentage of months exceeding flow thresholds under A2D_ELT would consistently be lower than those under NAA_ELT (up to 50% lower) (Table 11-2D-73). These results indicate that, using the positive correlation between Delta outflow and year class strength, year class strength could be consistently lower under A2D_ELT than NAA_ELT.

Table 11-2D-73. Difference and Percent Difference in Percentage of Months in Which Average Delta Outflow is Predicted to Exceed 15,000, 20,000, and 25,000 Cubic Feet per Second in April and May of Wet and Above-Normal Water Years

Flow	Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
April			
15,000 cfs	Wet	-4 (-4%)	-4 (-4%)
	Above Normal	-17 (-18%)	-17 (-18%)
20,000 cfs	Wet	-8 (-9%)	-8 (-9%)
	Above Normal	-33 (-44%)	-33 (-44%)
25,000 cfs	Wet	-19 (-24%)	-19 (-24%)
	Above Normal	-17 (-29%)	-17 (-29%)
May			
15,000 cfs	Wet	-8 (-9%)	-8 (-9%)
	Above Normal	-33 (-40%)	-25 (-33%)
20,000 cfs	Wet	-35 (-41%)	-23 (-32%)
	Above Normal	-17 (-40%)	-8 (-25%)
25,000 cfs	Wet	-19 (-28%)	-12 (-19%)
	Above Normal	-17 (-50%)	-17 (-50%)
April/May Average			
15,000 cfs	Wet	-8 (-8%)	-4 (-4%)
	Above Normal	-25 (-25%)	-25 (-25%)
20,000 cfs	Wet	-19 (-22%)	-19 (-22%)
	Above Normal	-17 (-25%)	-8 (-14%)
25,000 cfs	Wet	-19 (-24%)	-12 (-16%)
	Above Normal	-25 (-50%)	-25 (-50%)

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period (Appendix *B, Supplemental Modeling for New Alternatives*). Mean flows at Verona under A2D_ELT would be lower by up to 31% relative to NAA_ELT during January through April, July, August, October, and November, as well as in September of below normal, dry and critical water years. The flows would be up to 45% greater during June and in September of wet and above normal water years, and would generally be similar in May and December (Appendix *B, Supplemental Modeling for New Alternatives*).

For adults, the average number of months per year during the November through May adult migration period in which flows in the Sacramento River at Wilkins Slough exceed 5,300 cfs was determined (Table 11-2D-72). The average number of months exceeding 5,300 cfs under A2D_ELT would be similar to the number of months under NAA_ELT.

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows.

NEPA Effects: Upstream flows (above north Delta intakes) would generally be similar between Alternative 2D and NAA_ELT. The percentage of months exceeding the USFWS (1995) Delta outflow thresholds in April and May of wet and above normal years under Alternative 2D was appreciably lower than that under NAA_ELT. The exact mechanism for the correlation between white sturgeon year-class strength and Delta outflow is not known at this time and was found in the absence of north Delta intakes. One hypothesis suggests that the correlation is caused by high flows in the upper river resulting in improved migration, spawning, and rearing conditions in the upper river. In this case, there would be no causal link between Delta outflow and white sturgeon year-class strength. Another hypothesis suggests that the positive correlation is a result of higher flows through the Delta triggering more adult sturgeon to move up into the river to spawn. It is also possible that some combination of these factors are working together to produce the positive correlation between high flows and sturgeon year-class strength.

The scientific uncertainty regarding which mechanisms are responsible for the positive correlation between year class strength and river/Delta flow will be addressed through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations as described in the adaptive management and monitoring program in Section 4.1 to inform decisions regarding Delta outflow such that the effect on white sturgeon Delta flow conditions would not be adverse. This uncertainty and the associated adaptive management and monitoring program, combined with similarities in upstream flow conditions between Alternative 2D and NAA_ELT, indicate that Alternative 2D would not be adverse to migration conditions for white sturgeon

***CEQA Conclusion:* In general, Alternative 2D could reduce the quantity and quality of migration habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 2D would not affect the quantity and quality of migration habitat for white sturgeon.**

Upstream of the Delta

The number of months per year with exceedances above the 17,700 cfs threshold for Wilkins Slough under A2D_ELT would be similar to those under Existing Conditions on the relative scale (%), except in below normal years (25% lower) (Table 11-2D-72). The number of months per year above 31,000 cfs at Verona under A2D_ELT would range from a reduction of 1.7 months (67% reduction) in wet years to an increase of 0.7 months (260% higher) in dry years relative to Existing Conditions, depending on water year type. These changes would be small to moderate on the absolute scale (up to 1.7 fewer months per year).

For Delta outflow, the percent of months exceeding outflow thresholds under A2D_ELT would be consistently lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (Table 11-2D-73).

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period. In general, mean flows under A2D_ELT would be lower relative to Existing Conditions during January through April and July through November, depending on water year type and with some exceptions, and would be similar in May and December. The largest reductions in flow (up to 31% lower) would occur during July through September. Flows under A2D_ELT would be higher (up to 45%) during June of above normal, below normal, and dry water years and

September of wet and above normal water years (Appendix *B, Supplemental Modeling for New Alternatives*).

For adult migration, the average number of months exceeding 5,300 cfs under A2D_ELT would be similar to the number of months under Existing Conditions, except in critical water years (5% higher) (Table 11-2D-72).

Through-Delta

Given the improved OMR flows and the range of Delta outflows under Alternative 2D that could be refined to avoid negative impacts to green sturgeon (see NEPA Effects discussion above), the potential impact of Alternative 2D on in-Delta conditions for white sturgeon is considered less than significant, and no mitigation would be required.

Summary of CEQA Conclusion

Under Alternative 2D, exceedances of the 31,000 cfs flow threshold in the Sacramento River would be lower than under Existing Conditions in wet and above normal water years, but would be higher in below normal, dry and critical years. Differences for the 17,700 cfs threshold would be smaller and less tied to water year type. Exceedance of Delta outflow thresholds would be lower under Alternative 2D, but there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows are co-varying with another unknown factor. Juvenile migration flows in the Sacramento River at Verona would be up to 31% lower in nine of 12 months relative to Existing Conditions. These reduced flows could have a substantial effect on the ability to migrate downstream, delaying or slowing rates of successful migration downstream and increasing the risk of mortality. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce migration conditions for white sturgeon.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp, including those to mitigate upstream effects of climate change and ongoing operations. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on upstream flows. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under

Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-151: Effects of Construction of Restoration Measures on White Sturgeon

Impact AQUA-152: Effects of Contaminants Associated with Restoration Measures on White Sturgeon

Impact AQUA-153: Effects of Restored Habitat Conditions on White Sturgeon

Impact AQUA-154: Effects of Methylmercury Management on White Sturgeon (Environmental Commitment 12)

Impact AQUA-157: Effects of Localized Reduction of Predatory Fish on White Sturgeon (Environmental Commitment 15)

Impact AQUA-158: Effects of Nonphysical Fish Barriers on White Sturgeon (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on white sturgeon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Pacific Lamprey

Construction and Maintenance of Water Maintenance Facilities

Impact AQUA-163: Effects of Construction of Water Conveyance Facilities on Pacific Lamprey

The potential effects of construction of the water conveyance facilities on Pacific lamprey would be similar to those described for Alternative 4A (Impact AQUA-163) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to Pacific lamprey.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-163, the effect would not be adverse for Pacific lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-163, the impact of the construction of water conveyance facilities on Pacific lamprey would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-164: Effects of Maintenance of Water Conveyance Facilities on Pacific Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-164, the effect would not be adverse for Pacific lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-164 for Pacific lamprey, the impact of the maintenance of water conveyance facilities on Pacific lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-165: Effects of Water Operations on Entrainment of Pacific Lamprey

Water Exports

Alternative 2D is expected to substantially reduce average annual entrainment of Pacific lamprey, estimated by salvage density, by about 59% (Table 11-2D-74) averaged across all years compared to NAA_ELT.

The potential entrainment impacts of Alternative 2D on Pacific lamprey would be similar to Alternative 2A (Impact AQUA-165). These actions would avoid or reduce potential entrainment and the effect is not adverse.

The analysis of Pacific lamprey and river lamprey entrainment at the SWP/CVP south Delta facilities is combined because the salvage facilities do not distinguish between the two lamprey species. Similar to Alternative 2A (Impact AQUA-165), Alternative 2D is not expected to have an adverse effect on lamprey.

Predation Associated with Entrainment

Lamprey predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Lamprey entrainment to the south Delta would be reduced by 59% compared to NAA_ELT and predation losses would be expected to be reduced at a similar proportion.

NEPA Effects: Predation at the north Delta would be increased due to the construction of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta is unknown because of the lack of knowledge about their distribution and population abundances in the Delta. As described for Alternative 2A, the overall effect on entrainment and predation of lamprey is considered not adverse.

CEQA Conclusion: Annual entrainment losses of lamprey would be decreased under Alternative 2D by approximately 60% compared to Existing Conditions (Table 11-2D-74). At the north Delta facilities, the screened intakes as designed would exclude this species. Impacts of Alternative 2D water operations on entrainment on Pacific lamprey are anticipated to be less than significant and may be beneficial, due to reductions in entrainment at the Delta export facilities. No mitigation would be required.

Table 11-2D-74. Lamprey Annual Entrainment Index at the SWP and CVP Salvage Facilities for Alternative 2D[a]

	Absolute Difference (Percent Difference)	
Water Year	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
All Years	-2,019 (-60%)	-1,996 (-59%)

[a] Number of fish lost, based on non-normalized data, for all months.

The impact of predation associated with entrainment would be the same as described immediately above because the additional predation losses associated with the proposed north Delta intakes would be offset by the reduction in predation loss at the south Delta. The relative impact of predation loss on the lamprey population is unknown since there is little available knowledge on their distribution and abundance in the Delta. The impact is considered to be less than significant. No mitigation is required.

Impact AQUA-166: Effects of Water Operations on Spawning and Egg Incubation Habitat for Pacific Lamprey

In general, effects of Alternative 2D would not affect the quantity and quality of Pacific lamprey spawning habitat relative to NAA_ELT.

Flow-related impacts on Pacific lamprey spawning habitat were evaluated by estimating effects of flow alterations on egg exposure, called redd dewatering risk, and effects on water temperature. A redd is a gravel-covered nest of eggs; Pacific lamprey eggs take between 18 and 49 days to incubate and must remain covered by sufficient water for that time. Rapid reductions in flow can dewater redds leading to mortality. Locations for each river used in the dewatering risk analysis were based on available literature, personal conversations with agency experts, and spatial limitations of the CALSIM II model, and include the Sacramento River at Keswick, Sacramento River at Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and American River at Nimbus Dam and at the confluence with the Sacramento River. Pacific lamprey spawn in these rivers between January and August so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage). Water temperature results from the SRWQM and the Reclamation Temperature Model were used to assess the exceedances of water temperatures under all model scenarios in the upper Sacramento, Trinity, Feather, American, and Stanislaus rivers.

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, substrate) of Pacific lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, the change in month-over-month flows is used as a surrogate for a more formal analysis, and a month-over-month flow reduction of 50% was chosen as a best professional estimate of flow conditions in which redd dewatering is expected to occur, but does not estimate empirically derived redd dewatering events. As such, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, January to August.

Flows in all rivers evaluated indicate an increase in redd cohorts exposed to month-over-month flow reductions between January and August for Alternative 2Dcompared to NAA_ELT would only occur in the Feather River (12 cohorts or 11% greater) and Sacramento River at Red Bluff (6 cohorts or 9% greater) (Table 11-2D-75). However, because the total number of cohorts would be 648 in the Feather River and 19,928 in the Sacramento River, these effects would be negligible (<2%) to the Pacific lamprey populations in these rivers. Therefore, these results indicate that there would be no effect of Alternative 2D on the number of Pacific lamprey redd cohorts predicted to experience a month-over-month change in flow of greater than 50% in all rivers.

Table 11-2D-75. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts[a]

Location	Comparison[b]	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River at Keswick	Difference	13	1
	Percent Difference	24%	1%
Sacramento River at Red Bluff	Difference	16	6
	Percent Difference	30%	9%
Trinity River down-stream of Lewiston	Difference	-1	1
	Percent Difference	-1%	1%
Feather River at Thermalito Afterbay	Difference	-25	12
	Percent Difference	-17%	11%
American River at Nimbus Dam	Difference	28	6
	Percent Difference	33%	6%
American River at Sacramento River confluence	Difference	30	7
	Percent Difference	32%	6%

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.
[b] Positive values indicate a higher value in A2D_ELTthan in the baseline.

Significant reduction in survival of eggs and embryos of Pacific lamprey were observed at 22°C (71.6°F; Meeuwig et al. 2005). Therefore, in the Sacramento River, this analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive 2 month periods during which at least one month exceeds 22°C (71.6°F) using monthly averaged data from the Reclamation temperature model. Each individual day or month starts a new "egg cohort" such that there are 19,928 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from January 1 through August 31, and 648 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Exact spawning locations of Pacific lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In most locations, egg cohort exposure would not differ between NAA_ELT and Alternative 2D (Table 11-2D-76). However, the number of cohorts exposed to 22°C (71.6°F) under Alternative 2D would be 6% higher in the Sacramento River at Hamilton City, 100% higher in the Trinity River at North Fork and 140% higher in the Feather River at Thermalito Afterbay. The increase in the Sacramento River is negligible considering that it represents a difference of <0.1% of the total number of egg cohorts evaluated (19,928 cohorts). Additionally, the increase in the Trinity River is negligible considering that it represents a difference of <0.3% of the total number of egg cohorts evaluated (648 cohorts).

Table 11-2D-76. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. 2D_ELT	NAA_ELT vs. 2D_ELT
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	510 (NA)	27 (6%)
Trinity River at Lewiston	2 (NA)	0 (0%)
Trinity River at North Fork	-2 (NA)	2 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	72 (300%)	56 (140%)
American River at Nimbus	41 (373%)	1 (2%)
American River at Sacramento River Confluence	89 (159%)	-5 (-3%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	23 (1,150%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F during January to August on at least one day during a 49-Day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for each model scenario in other rivers. Positive values indicate a higher value in the proposed project than in EXISTING CONDITIONS or NAA_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because Alternative 2D does not have the potential to substantially reduce suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. Flows reductions that increase redd dewatering risk would be of similar or lower frequency under Alternative 2D relative to the NEPA baseline in all locations. There would be increased exposure risk of eggs to elevated temperatures in the Feather River, but this isolated result is not expected to cause a biologically meaningful effect to the Pacific lamprey population.

CEQA Conclusion: In general, Alternative 2D would not affect the quantity and quality of Pacific lamprey spawning habitat relative to the Existing Conditions.

Rapid reductions in flow can dewater redds leading to mortality. In the Sacramento American Rivers, Alternative 2D would increase in the number of redd cohorts predicted to experience a month-over-month change in flow of greater than 50% relative to Existing Conditions (Table 11-2D-75). The small values (13 and 16 cohorts) in the Sacramento River would not translate into biologically meaningful effects considering the total number of redd cohorts evaluated (up to 16 of 656 cohorts, or <3%). Changes would be most substantial for the American River (increased risk of dewatering exposure to 28 cohorts or 33% at Nimbus Dam, and 30 cohorts or 32% at the confluence). For the Feather River, there are 25 fewer redd cohorts (-17%) predicted to experience a month-over-month change in flow of greater than 50% for Alternative 2D relative to Existing Conditions. Minimal effects are predicted for the Trinity River (-1%).These results indicate that Alternative 2D would not have biologically meaningful effects on Pacific lamprey redd dewatering risk in the Sacramento, Feather, and Trinity Rivers; but would affect dewatering risk in the American River (maximum increases of 28 cohorts or 33% at Nimbus Dam and 30 cohorts or 32% at the Sacramento River confluence).

The number of egg cohorts exposed to 22°C (71.6°F) under Alternative 2D would be greater than that under Existing Conditions in all rivers, except the Trinity River (Table 11-2D-76).

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the results of the Impact AQUA-166 CEQA analysis indicate that the difference between the CEQA baseline and Alternative 2D could be significant because, under the CEQA baseline, the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. Redd dewatering risk under Alternative 2D would be higher relative to Existing Conditions in the American River, which would increase the risk of desiccation of eggs in this river. There would be increases in egg cohorts exposed to water temperatures above 71.6°F under Alternative 2D relative to Existing Conditions in at least one location in all rivers evaluated except the Trinity River. Increased exposure to elevated temperatures would reduce egg survival in these rivers.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on Pacific lamprey spawning and egg incubation habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-167: Effects of Water Operations on Rearing Habitat for Pacific Lamprey

In general, Alternative 2D would have negligible effects on Pacific lamprey rearing habitat conditions relative to NAA_ELT.

Flow-related impacts to Pacific lamprey rearing habitat were evaluated by estimating effects of flow alterations on ammocoete exposure, called ammocoete stranding risk. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of effects were made for ammocoete cohorts in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. An ammocoete is the filter-feeding larval stage of the lamprey that remains relatively immobile in the sediment in the same location for 5 to 7 years, after which it migrates downstream. During the upstream rearing period there is potential for ammocoete stranding from rapid reductions in flow.

The analysis of ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (January through August) and spend 7 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period.

Effects of Alternative 2D on Pacific lamprey ammocoete stranding were analyzed by calculating month-over-month flow reductions for the Sacramento River at Keswick for January through August (Table 11-2D-77). Results indicate either no effect (0%) or negligible effects (<5%) in the occurrence of flow reductions attributable solely to the project.

Table 11-2D-77. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	0	4
-65%	0	-2
-70%	4	-3
-75%	1	2
-80%	1	0
-85%	0	0
-90%	NA	NA

NA = all values were 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

Results of comparisons for the Sacramento River at Red Bluff provide similar conclusions, with slightly more variability in results (Table 11-2D-78). Results for Alternative 2D compared to NAA_ELT indicate no change (0%), negligible increases (<5%), and small decreases (-1 to -3%) attributable to the project that would not have biologically meaningful effects on stranding risk.

Table 11-2D-78. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	4	4
-60%	1	-1
-65%	-2	-3
-70%	3	0
-75%	10	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

Comparisons for the Trinity River indicate no effect (0%) or small increases (1 to 5%) attributable to the project (Table 11-2D-79).

Table 11-2D-79. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	21	0
-80%	20	1
-85%	20	1
-90%	34	5

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

In the Feather River, all comparisons resulted in no difference (0%), negligible increases (2%) or reductions in the occurrence of flow reductions between 50-90% (Table 11-2D-80).

Table 11-2D-80. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	-19	-30
-90%	-64	-64

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

Comparisons for the American River at Nimbus Dam (Table 11-2D-81) and at the confluence with the Sacramento River (Table 11-2D-82) indicate negligible increases (0 to 4%), small to moderate increases (12 to 32%) or negligible decreases (-3%) attributable to the project (Table 11-2D-81).

Table 11-2D-81. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	2	1
-70%	25	-3
-75%	85	12
-80%	236	22
-85%	104	0
-90%	-100	N/A

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

Table 11-2D-82. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	1
-70%	8	2
-75%	22	4
-80%	192	4
-85%	221	32
-90%	104	0

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 2D.

These results indicate that Alternative 2D would primarily have no effect (0%), negligible effects (<5%), or decreases in stranding risk that would be beneficial to on rearing success. Isolated occurrences of small increases in dewatering for some flow reduction categories would not have biologically meaningful effects. There would also be small to moderate beneficial effects in the Feather River (decreased occurrence of flow reductions to -64%) due to project-related effects of Alternative 2D.

To evaluate water temperature-related effects of Alternative 2D on Pacific lamprey ammocoetes, we examined the predicted number of ammocoete "cohorts" that experience water temperatures greater than 71.6°F for at least one day in the Sacramento River (because daily water temperature data are available) or for at least one month in the Feather, American, Stanislaus, and Trinity rivers over a 7 year period, the maximum likely duration of the ammocoete life stage (Moyle 2002). Each individual day or month starts a new "cohort" such that there are 18,244 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 593 cohorts for the other rivers using monthly data over the same period.

In general, there would be no differences in the number of ammocoete cohorts exposed to temperatures greater than 71.6°F in each river (Table 11-2D-83).There would be no difference in exposure between NAA_ELT and Alternative 2D in the Trinity River at Lewiston, but there would be 56 more cohorts (100% increase) exposed at North Fork. In addition, there would be 94 more cohorts (20% increase) exposed under Alternative 2D in the Feather River below Thermalito Afterbay, but there would be no change in cohorts exposed at Fish Barrier Dam. There would be 21 fewer cohorts (-4%) exposed under Alternative 2D in the American River at Nimbus Dam and 9 more cohorts (2%) exposed at the Sacramento River Confluence. Overall, the range of increases and decreases will balance out within rivers such that there would be no overall effect on Pacific lamprey ammocoetes.

Table 11-2D-83. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F in at Least One Day or Month

Location	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	5,299 (NA)	-1,946 (-27%)
Trinity River at Lewiston	56 (NA)	0 (0%)
Trinity River at North Fork	112 (NA)	56 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	188 (49%)	94 (20%)
American River at Nimbus	258 (133%)	-21 (-4%)
American River at Sacramento River Confluence	151 (35%)	9 (2%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	282 (504%)	-1 (0%)

NA = could not be calculated because the denominator was 0.
[a] Positive values indicate a higher value in Alternative 2D than in EXISTING CONDITIONS or NAA_ELT.
[b] Based on daily data; all other locations use monthly data; 1922–2003.

NEPA Effects: These modeling results indicate that the effect would not be adverse because it would not substantially reduce rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. There would be negligible effects on ammocoete cohort survival under Alternative 2D relative to the NEPA baseline for all locations. There would be increase and decreases in exposure risk of ammocoetes to elevated temperatures within each river evaluated that would balance out such that there would be no net effect on Pacific lamprey ammocoetes.

CEQA Conclusion: In general, under Alternative 2D water operations, the quantity and quality of Pacific lamprey rearing habitat would not be affected relative to the CEQA baseline.

Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of Alternative 2D to Existing Conditions for the Sacramento River at Keswick indicate negligible changes (<5%) in occurrence of flow reductions for all flow reduction categories (Table 11-2D-77). Comparisons for the Sacramento River at Red Bluff indicate no effect (0%) or negligible effects (<5%) for all flow reduction categories except for 75% and 80% flow reductions (increases of 10% and 23% [from 10 to 23], respectively) (Table 11-2D-78). Increases of 21-34% are predicted for flow reduction categories from 75% to 90% for the Trinity River (Table 11-2D-79) based on increases from approximately 83 to 116 ammocoete cohorts exposed to stranding risk. In the Feather River, all comparisons resulted in no difference (0%), moderate reductions (19% to 64%) in the occurrence of flow reductions between 85-90% (Table 11-2D-80). In the American River, there would be large increases in the occurrence of flows reductions in the 70% to 90% range, except the 90% flow reduction category at Nimbus Dam (100% reduction) (Table 11-2D-81, Table 11-2D-82).

The number of Pacific lamprey ammocoete cohorts exposed to 71.6°F temperatures under Alternative 2D would be substantially higher than those under Existing Conditions in at least one location in all rivers evaluated (Table 11-2D-83).

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the results of the Impact AQUA-167 CEQA analysis indicate that that the difference between the CEQA baseline and Alternative 2D could be significant because, under the CEQA baseline, the alternative could substantially reduce rearing habitat and substantially reduce the number of fish as a result of ammocoete mortality,. Increased water temperatures would increase stress and reduce survival of lamprey ammocoetes. In the Trinity and American Rivers, there would be increases in the number of cohorts exposed to stranding risk due to increased flow reductions. Increased stranding risk in these rivers would increase the risk of desiccation and reduce survival of ammocoete cohorts. Exposure of ammocoetes to elevated temperatures under Alternative 2D would be substantially higher than those under Existing Conditions in most locations evaluated.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on Pacific lamprey rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-168: Effects of Water Operations on Migration Conditions for Pacific Lamprey

In general, effects of Alternative 2D would be negligible relative to NAA_ELT based on a prevalence of negligible effects or beneficial increases in mean monthly flow for most of the locations analyzed, which would have a beneficial effect on migration conditions.

After 5–7 years, Pacific lamprey ammocoetes migrate downstream and become macropthalmia (juveniles) once they reach the Delta. Migration generally is associated with large flow pulses in winter months (December through March) (USFWS unpubl. data) meaning alterations in flow have the potential to affect downstream migration conditions. The effects of Alternative 2D on seasonal migration flows for Pacific lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the migration pathways of Pacific lamprey during the likely migration period (December through May) were examined for the Sacramento River at Rio Vista and Red Bluff, the Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

CALSIM flow data form the basis for the summary of changes in adult lamprey migration flows.

Sacramento River

Macropthalmia

The difference in mean monthly flow rate for the Sacramento River at Rio Vista for December to May for Alternative 2D compared to NAA_ELT indicates reductions in flow for most months/water year types in the migration period with persistent flow reductions of up to -30% depending on the specific month and water year (Appendix *B, Supplemental Modeling for New Alternatives)*. The project-related decreases in flow in the Sacramento River at Rio Vista could adversely affect outmigrating macropthalmia during these months if macropthalmia depend on flow to immigrate, but there is no scientific evidence of this.

For the Sacramento River at Red Bluff, the difference in mean monthly flow rate for Alternative 2D compared to NAA_ELT indicate negligible effects on flow attributable to the project for December through April and increases in flow attributable to the project during May of up to 12% (Appendix *B, Supplemental Modeling for New Alternatives)*. The project-related increases in flow in the Sacramento River at Red Bluff would have a beneficial effect on migration conditions.

These results indicate that project-related effects of Alternative 2D on flow consist of negligible effects (<5%), or small increases in flow that would have a beneficial effect on migration in the Sacramento River at Red Bluff, but that effects for Sacramento River at Rio Vista would consist primarily of reductions in flow, including during drier water years, for much of the macropthalmia migration period, although it is unknown whether these reductions would adversely affect outmigrating macropthalmia.

Adults

For the Sacramento River at Red Bluff for the time-frame January to June (Appendix *B, Supplemental Modeling for New Alternatives*), effects of Alternative 2D on mean monthly flow indicate effects would be negligible (<5%), except for one water year in January (6.2%), with small increases in flow (to 12%) during May and June for some water years. Increases in flow would have a beneficial effect on migration conditions.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) indicate negligible (<5%) project-related effects or small to moderate increases in flow (to 22%) for December through May,. Increases in mean monthly flow may be beneficial for migration conditions although there is no scientific evidence that this is true. The project would not have adverse effects on macropthalmia in the Feather River at the confluence.

Adults

For the Feather River at the confluence with the Sacramento River, January to June (Appendix *B, Supplemental Modeling for New Alternatives*), mean monthly flows under Alternative 2D are variable, with primarily negligible changes (<5%) for most months and water year types, with the exception of fairly substantial increases for most water year types for May (8–13%) and June (21–88%) that would have beneficial effects on migration conditions.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) indicate negligible effects (<5%) or small to moderate increases in flows in most months, with the exception of a moderate decrease during May in a critical (-24%) year and small decreases during January in below normal (-11.5%) and dry (-5.6%) years that would not have biologically meaningful effects on migration conditions.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River for January to June (Appendix *B, Supplemental Modeling for New Alternatives*) indicate predominantly negligible effects (<5%) attributable to the project with the exception of increased flows in May (6–11%) and June (6–36%) which would enhance migration especially during drier water year types, and small decreases in flow (to -11.5%) during January in below normal and dry years and during May in a critical (-23.9%) year. that would not have biologically meaningful effects on migration conditions.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish. Flows in the Sacramento River at Rio Vista under Alternative 2D would be reduced relative to NAA_ELT, with persistent flow reductions to -30% throughout the migration period that could affect conditions for outmigrating macropthalmia at that location. The degree to which this reduction would affect lamprey is unknown, but given the predominance of negligible effects in other locations, it is not likely that reduced flows at this location would affect the Pacific lamprey population. Effects of Alternative 2D in the other locations analyzed would consist primarily of negligible effects (<5%), infrequent, small decreases in flow (to -7%) that would not have biologically meaningful effects, and small to substantial (to 73%) increases in flow that would have beneficial effects on migration conditions.

CEQA Conclusion: In general, the effect of Alternative 2D on Pacific lamprey migration conditions would be negligible relative to the Existing Conditions.

Sacramento River

Macropthalmia

Comparisons of mean monthly flow rates in the Sacramento River at Rio Vista (Appendix *B, Supplemental Modeling for New Alternatives*) for December to May for Alternative 2D relative to Existing Conditions indicate reductions in flow ranging from -5% to -38% in most water years for each of these months. These results indicate that effects of Alternative 2D on flow could have negative effects on outmigrating macropthalmia in the Sacramento River. Comparisons for the Sacramento River at Red Bluff (Appendix *B, Supplemental Modeling for New Alternatives*) indicate negligible (<5%) effects or small increases or decreases in flow (± 10%) that would not have biologically meaningful effects on migration conditions. Therefore, Alternative 2D would not have biologically meaningful negative effects on outmigrating macropthalmia at this location.

Adults

Comparisons of mean monthly flow for the Sacramento River at Red Bluff (Appendix *B, Supplemental Modeling for New Alternatives*) during the Pacific lamprey adult migration period from January through June indicate that for most months and water year types, flows under Alternative 2D would be similar to (<5% difference) flows under Existing Conditions, with infrequent occurrences of small-scale (to 10%) increases or decreases in flow that would not have biologically meaningful effects on migration conditions. Therefore, effects of Alternative 2D consist of negligible effects or increases in flow that would have beneficial effects, and small reductions in flow that would not have biologically meaningful effects.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence (Appendix *B, Supplemental Modeling for New Alternatives*) for December to May indicate variable effects by month and water year type, with increases in flow during December in above normal and below normal years (to 18%) and decreases in wet and critical years (to -12%), generally increases in flow during January through March in wetter years (to 11%) and decreases during some drier water year types (to -17%), and negligible effects or increases in flow (to 9%) during April and May except for a decrease (-10%) during May in wet years. Increases in flow would have beneficial effects on migration conditions, and decreases in wetter water years would not have significant effects on migration. Based on this limited occurrence of flow decreases at times that would be most critical for migration, and the prevalence of negligible effects or flow increases for most of the migration period, effects of Alternative 2D on flows would not have biologically meaningful effects on macropthalmia migration in the Feather River.

Adults

Comparisons of mean monthly flow for the Feather River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) for January to June indicate variable effects of Alternative 2D depending on the month and water year type, with primarily negligible effects (<5%) and small increases or decreases in flow (to about 13%) that would not have biologically meaningful effects on migration conditions, with the exception of more substantial increases in flow during June in above normal (51%), below normal (58%), and critical (19%) years. These flow increases would have a beneficial effect on migration conditions. There would be more substantial decreases in flow during January in below normal years (-17%) and March in below normal years (-16%). These flow reductions are isolated occurrences of relatively small magnitude and would therefore not have biologically meaningful effects on migration conditions. Therefore, effects of Alternative 2D on flow would not affect migration conditions in the Feather River.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) for December to May indicate negligible effects (<5%) or decreases in flow during December and April, increases in flow during January through March for some wetter water year types (to 16%) and decreases for some drier water year types (to -13%), and decreases to -16% during May in all water year types.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River (Appendix *B, Supplemental Modeling for New Alternatives*) for January to June indicate variable effects of Alternative 2D depending on the month and water year type, with meaningful changes in flow (±>5%) consisting of increases up to 16% (February, above normal years) that would have beneficial effects on migration conditions, and decreases to -7% in drier years. There would be primarily negligible effects (<5%) or small decreases (to -7%) and an increase of 9% (critical years) during April. There would be increases (to 8%) in all but critical years (decrease of -11%) during May, and decreases during June in wet (-21%) and critical (-36%) years with increases (to 23%) in the remaining water years.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact is not significant because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish, and no mitigation is necessary. Effects of Alternative 2D compared to Existing Conditions during the January to June adult Pacific lamprey migration period consist predominantly of negligible effects (<5%), increases in flow, or small, isolated occurrences of decreases in flow for some water year types that would not have biologically meaningful effects on migration conditions. Flows at Rio Vista would decrease for much of the period. However, the degree to which this reduction would affect lamprey is unknown, but given the predominance of negligible effects in other locations, it is not likely that reduced flows at this location would affect the Pacific lamprey population.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-169: Effects of Construction of Restoration Measures on Pacific Lamprey

Impact AQUA-170: Effects of Contaminants Associated with Restoration Measures on Pacific Lamprey

Impact AQUA-171: Effects of Restored Habitat Conditions on Pacific Lamprey

Impact AQUA-172: Effects of Methylmercury Management on Pacific Lamprey (Environmental Commitment 12)

Impact AQUA-175: Effects of Localized Reduction of Predatory Fish on Pacific Lamprey (Environmental Commitment 15)

Impact AQUA-176: Effects of Nonphysical Fish Barriers on Pacific Lamprey (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on Pacific lamprey for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

River Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-181: Effects of Construction of Water Conveyance Facilities on River Lamprey

The potential effects of construction of the water conveyance facilities on river lamprey would be similar to those described for Alternative 4A (Impact AQUA-181) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to river lamprey.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-181, the effect would not be adverse for river lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-181, the impact of the construction of water conveyance facilities on river lamprey would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-182: Effects of Maintenance of Water Conveyance Facilities on River Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-182, the effect would not be adverse for river lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-182 for river lamprey, the impact of the maintenance of water conveyance facilities on river lamprey would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-183: Effects of Water Operations on Entrainment of River Lamprey

The potential entrainment impacts of Alternative 2D on river lamprey would be the same as described above for Pacific lamprey (Impact AQUA-163).

NEPA Effects: The analysis of river lamprey entrainment at the SWP/CVP south Delta facilities is combined with the analysis of Pacific lamprey because the salvage facilities do not distinguish between the two lamprey species. Alternative 2D is expected to substantially reduce average annual entrainment of lamprey, estimated by salvage density, by about 59% (Table 11-2D-74) averaged across all years compared to NAA_ELT. Overall, Alternative 2D would not have adverse effects on lamprey.

CEQA Conclusion: Annual entrainment losses of juvenile green sturgeon would be decreased under Alternative 2D by approximately 60% compared to Existing Conditions (Table 11-2D-74). The screened north Delta intakes would exclude this species. Impacts of water operations on entrainment of river lamprey are considered less than significant and may be beneficial; no mitigation is required.

Impact AQUA-184: Effects of Water Operations on Spawning and Egg Incubation Habitat for River Lamprey

In general, Alternative 2D would not affect the quantity and quality of river lamprey spawning habitat relative to NAA_ELT.

Flow-related impacts to river lamprey spawning habitat were evaluated by estimating effects of flow alterations on redd dewatering risk as described for Pacific lamprey with appropriate time-frames for river lamprey incorporated into the analysis. Lower flows can reduce the instream area available for spawning and rapid reductions in flow can dewater redds leading to mortality. The same locations were analyzed as for Pacific lamprey: the Sacramento River at Keswick and Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and American River at Nimbus Dam and at the confluence with the Sacramento River. River lamprey spawn in these rivers between February and June so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage).

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, as described for Pacific lamprey, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, February to June.

Flows in all rivers evaluated indicated no change (0%) or negligible change (<5%) in redd cohorts exposed (Table 11-2D-85). There would be no biologically meaningful effects on spawning success attributable to the project.

Table 11-2D-85. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	Comparison[b]	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Sacramento River at Keswick	Difference	2	-1
	Percent Difference	6%	-3%
Sacramento River at Red Bluff	Difference	3	0
	Percent Difference	8%	0%
Trinity River downstream of Lewiston	Difference	-2	0
	Percent Difference	-3%	0%
Feather River Below Thermalito Afterbay	Difference	-3	-3
	Percent Difference	-4%	-4%
American River at Nimbus	Difference	6	-3
	Percent Difference	11%	-5%
American River at Sacramento River confluence	Difference	13	1
	Percent Difference	22%	1%

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.
[b] Positive values indicate a higher value in A2D_ELT than in EXISTING CONDITIONS or NAA_ELT).

River lamprey generally spawn between February and June (Beamish 1980, Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey "adults need…

temperatures [that] do not exceed 25°C," although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from USRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau's temperature model. Each individual day or month starts a new "egg cohort" such that there are 12,320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

For both thresholds, there would be few differences in egg cohort exposure between NAA_ELT and A2D_ELT among all sites (Table 11-2D-86). Differences of 7 cohorts in the Sacramento River at Hamilton City are negligible to the population considering the total number of cohorts is 12,320. In the Feather River below Thermalito Afterbay, there would be 16 more cohorts (123% increase) exposed to the 71.6°F threshold under Alternative 2D relative to NAA_ELT, although differences at the 77°F threshold would be negligible. In addition, there would be no differences between NAA_ELT and Alternative 2D in egg exposure at the Fish Barrier Dam in the Feather River. Overall, except at one location in the Feather River for the more conservative threshold temperature (71.6°F), these results indicate that there would be no differences in egg exposure to elevated temperatures under Alternative 2D.

Table 11-2D-86. Differences (Percent Differences) between Model Scenarios in River Lamprey Egg Cohort Temperature Exposure

Location	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
71.6°F Threshold		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	108 (NA)	7 (7%)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	2 (NA)	1 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	20 (222%)	16 (123%)
American River at Nimbus	13 (260%)	-1 (-5%)
American River at Sacramento River Confluence	14 (50%)	-15 (-26%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	11 (1,100%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	0 (NA)	0 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	2 (NA)	2 (NA)
American River at Nimbus	2 (NA)	1 (100%)
American River at Sacramento River Confluence	3 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F and 77°F during February to June on at least one day during a 49-Day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for each model scenario in other rivers. Positive values indicate a higher value in the proposed project than in EXISTING CONDITIONS or NAA_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially reduce rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. Alternative 2D would cause minor effects to river lamprey redd dewatering and exposure to elevated water temperatures that would not be substantial.

CEQA Conclusion: In general, Alternative 2D would not affect the quantity and quality of river lamprey spawning habitat relative to the Existing Conditions.

Lower flows can reduce the instream area available for spawning and rapid reductions in flow can dewater redds leading to mortality. Effects of Alternative 2D on flow reductions during the river lamprey spawning period from February to June in the Sacramento River and American River consist of increases in river lamprey redd cohort dewatering risk relative to Existing Conditions

(Table 11-2D-85). Changes would be most substantial for the American River (increased risk of dewatering exposure to 6 cohorts or 11% at Nimbus Dam, and 13 cohorts or 22% at the confluence). For the Trinity River there are 2 fewer redd cohorts (-3%), and for the Feather River there are 3 fewer redd cohorts (-4%), predicted to experience a month-over-month change in flow of greater than 50% for Alternative 2D relative to Existing Conditions.

In most locations, the number of ammocoete cohorts exposed to each threshold under Alternative 2D would be similar to or lower than those under NAA_ELT (Table 11-2D-86). Biologically meaningful exceptions include the Feather River below Thermalito Afterbay for the 71.6°F threshold. In this case, there would be another location within the river that would have similar or lower exceedances under Alternative 2D.

Summary of CEQA Conclusion

Collectively, the results of the Impact AQUA-184 CEQA analysis indicate that there would be less than significant effects to river lamprey spawning conditions because there would be minor effects of the alternative on redd dewatering risk and temperature exposure in all rivers. No mitigation is necessary.

Impact AQUA-185: Effects of Water Operations on Rearing Habitat for River Lamprey

In general, Alternative 2D would not affect the quantity and quality of river lamprey rearing habitat relative to NAA_ELT.

Flow-related effects on river lamprey rearing habitat were evaluated by estimating effects of flow alterations on ammocoete exposure, or stranding risk, as described for Pacific lamprey. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Effects of Alternative 2D on flow were evaluated in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. As for Pacific lamprey, the analysis of river lamprey ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (February through June) and spend 5 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period. Comparisons of flow reductions for A2D_ELT relative to NAA_ELT for the Sacramento River at Keswick (Table 11-2D-87) predicted either no effect (0%) or negligible effects (±5%) in the occurrence of flow reductions attributable solely to the project, which would have beneficial effects on rearing success.

Table 11-2D-87. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	2	0
-60%	6	5
-65%	1	-4
-70%	0	-5
-75%	4	3
-80%	7	0
-85%	111	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

Results of comparisons for the Sacramento River at Red Bluff (Table 11-2D-88) provided similar conclusions, with slightly more variability in results. A2D_ELT compared to NAA_ELT indicated no change (0%), negligible effects (±5%), and small increases (to 6%) attributable to the project for different flow reduction categories. Based on the general decrease in frequency of most of the flow reduction categories, the small increases (to 6%) predicted for the 50% and 55% flow reduction event would not have biologically meaningful effects on rearing success.

Table 11-2D-88. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Differencea	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	2
-55%	6	6
-60%	4	-2
-65%	-3	-4
-70%	2	0
-75%	19	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

Comparisons for the Trinity River indicate small increases in occurrence of 80 through 90% flow reductions under Alternative 2D relative to NAA_ELT (Table 11-2D-89). Occurrences of 50 to 75% flow reductions indicates no effect (0%) or (negligible changes ±5%) attributable to the project.

Table 11-2D-89. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	27	0
-80%	30	5
-85%	33	6
-90%	49	11

[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

In the Feather River, there would be no difference (0%) or negligible decreases (<-5%) in the occurrence of flow reductions between 50-80% and moderate decreases (up to -64%) in the occurrence of flow reductions between 85-90% (Table 11-2D-90).

Table 11-2D-90. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT_	NAA_ELT vs. A2D_ELT_
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	-2	-2
-80%	-4	-2
-85%	-27	-32
-90%	-61	-64

[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

Flow reduction comparisons for the American River at Nimbus Dam (Table 11-2D-91) and at the confluence with the Sacramento River (Table 11-2D-92) indicated no effect (0%), negligible increases (<5%), small increases (<13%) or substantial decreases (to -55%) attributable to the project, with increases of 19 to 32% for 75 to 80%, flow reduction categories, at Nimbus Dam and the confluence. Based on the general decrease in frequency of most of the flow reduction categories, the 19 to 32% increases predicted for a three flow reduction categories (75%, 80, and 85%) would not have biologically meaningful effects.

Table 11-2D-91. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT_	NAA_ELT vs. A2D_ELT_
-50%	0	0
-55%	0	0
-60%	3	1
-65%	8	4
-70%	35	-4
-75%	119	19
-80%	292	22
-85%	100	0
-90%	-100	N/A

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

Table 11-2D-92. Relative Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A2D_ELT_	NAA_ELT vs. A2D_ELT_
-50%	0	0
-55%	0	0
-60%	3	1
-65%	5	3
-70%	24	8
-75%	33	2
-80%	235	9
-85%	270	32
-90%	100	0

[a] Negative values indicate reduced cohort exposure, a benefit of A2D_ELT.

River lamprey generally spawn between February and June (Beamish 1980, Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey "adults need… temperatures [that] do not exceed 25°C," although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau's temperature model. Each individual day or month starts a new "egg cohort" such that there are 12.320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In the Sacramento River at Hamilton City, there would be 1,460 fewer cohorts (-25%) exposed to the 71.6°F threshold under Alternative 2D relative to NAA_ELT, although there would be 4,647 more exposed to the 77°F threshold (Table 11-2D-93) There would be 25 more (100% increase) and 95 more (37% increase) cohorts exposed to the 71.6°F threshold in the Trinity River at North Fork and in the Feather River below Thermalito Afterbay, respectively. There would also be increase in exposure to the 77°F threshold in the Feather and American Rivers. However, none of these increases is expected to be biologically meaningful due to the relatively small magnitude relative to the total number of cohorts and the lack of effect in the majority of locations.

Table 11-2D-93. Differences (Percent Differences) between Model Scenarios in River Lamprey Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F and 77°F in at Least One Month

Location	EXISTING CONDITIONS vs. A2D_ELT_	NAA_ELT vs. A2D_ELT_
71.6°F Threshold		
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	4326 (NA)	-1460 (-25%)
Trinity River at Lewiston	25 (NA)	0 (0%)
Trinity River at North Fork	50 (NA)	25 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	165 (87%)	95 (37%)
American River at Nimbus	175 (194%)	-5 (-2%)
American River at Sacramento River Confluence	120 (49%)	5 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	155 (620%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick[b]	0 (0%)	0 (NA)
Sacramento River at Hamilton City[b]	0 (0%)	4647 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	50 (NA)	25 (100%)
American River at Nimbus	90 (NA)	40 (80%)
American River at Sacramento River Confluence	130 (NA)	25 (24%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Positive values indicate a higher value in the preliminary proposal than in EXISTING CONDITIONS or NAA_ELT.

[b] Based on daily data; all other locations use monthly data; 1922–2003.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially reduce rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. Alternative 2D would not affect river lamprey ammocoete stranding relative to the NEPA baseline. Further, increases in exposure to water temperatures under Alternative 2D would not be biologically meaningful.

CEQA Conclusion: In general, Alternative 2D would not affect the quantity and quality of river lamprey rearing habitat relative to the Existing Conditions.

Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of Alternative 2D to Existing Conditions for the Sacramento River at Keswick indicate small increases (to 7%), negligible increases (<5%) in the occurrence of flow reductions for all flow reduction categories (Table 11-2D-87) with the exception of a substantial increase (11%) in month-over-month flow reductions of 85%. Comparisons for the Sacramento River at Red Bluff indicate slightly more variable results with no effect (0%) or negligible effects (<5%) for all flow reduction categories except for increases (19% and 23%) in the 75% and 80% flow reduction categories, respectively (Table 11-2D-88).

Comparisons for the Trinity River indicated no effect (0%) for flow reduction categories from 50% to 70%, and increases ranging from 27% to 49% for the higher flow reduction categories (Table 11-2D-89).

Comparisons for the Feather River indicated no effect or reductions in frequency of occurrence for all flow reduction categories (Table 11-2D-90).

Comparisons for the American River at Nimbus Dam (Table 11-2D-91) and at the confluence with the Sacramento River (Table 11-2D-92) indicated increased chance of occurrence of flow reductions between 70 and 90% for Alternative 2D compared to Existing Conditions, with the exception of predicted 100% decrease of occurrence for 90% flow reduction at the confluence; meaningful (>5%) predicted increases are from 35 to 292% for Nimbus Dam and from 24 to 270% for the confluence.

The number of ammocoete cohorts exposed to 71.6°F under Alternative 2D would be substantially higher than those under Existing Conditions in most locations examined (Table 112D-93). The number of ammocoete cohorts exposed to 77°F under Alternative 2D would be similar at all locations except the Feather River below Thermalito Afterbay and at both locations in the American River, at which exposure would increase by 50 to 130 cohorts.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the results of the Impact AQUA-185 CEQA analysis indicate that that the difference between the CEQA baseline and Alternative 2D could be significant because, under the CEQA baseline, the alternative could substantially reduce rearing habitat and substantially reduce the number of fish as a result of ammocoete mortality. There would be substantial increases in stranding risk in the Trinity and American Rivers under Alternative 2D relative to the Existing Conditions. Increased stranding risk in these rivers would increase the risk of desiccation and reduce survival of ammocoete cohorts. Additionally, the risk of exposure to elevated water temperatures in the Feather and American Rivers would increase under Alternative 2D relative to the Existing Conditions. Increased water temperatures would increase stress and reduce survival of lamprey ammocoetes.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on river lamprey rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-186: Effects of Water Operations on Migration Conditions for River Lamprey

In general, Alternative 2D would have negligible effects on river lamprey migration conditions relative to NAA_ELT due to negligible effects on mean monthly flows. There would be beneficial effects due to moderate increases in mean monthly flow for some months and water year types but these generally would be offset by flow reductions in other months.

Macropthalmia

After 3 to 5 years river lamprey ammocoetes migrate downstream and become macropthalmia once they reach the Delta. River lamprey migration generally occurs September through November (USFWS unpubl. data). The effects of water operations on seasonal migration flows for river lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of river lamprey during the likely migration period (September through November) were examined to predict how Alternative 2D may affect migration flows for outmigrating macropthalmia.

Analyses were conducted for the Sacramento River at Red Bluff, Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

Sacramento River

Comparisons for the Sacramento River at Red Bluff for September through November indicate variable effects of Alternative 2D depending on the month and the water year type. Alternative 2D indicates variable effects, with project-related decreases (-5% and -17%) for September in all water year types except critical years indicate negligible effects, negligible effects (with <5% difference) in all water year types in October, and decreases in flows for all year types (-6% to -18%) in November. Decreases in wetter years in September would less detrimental because flows are higher; the decreases in drier water years would be more detrimental for outmigration. Decreases (to 18%) in November would affect migration conditions during that month, which is the last month in the relatively short migration period.

Feather River

Comparisons for the Feather River at the confluence with the Sacramento River for September through November indicate decreases in flow during most water year types in September (-16, -18, -32, and -7% for wet, above normal, below normal, dry respectively) and increases in flow during critical years (14%). The increases in flow during critical years for September would have a positive effect on migration when flow conditions are most critical. There would also be project-related increases in flow during October in all water years, ranging from 5 to 15% depending on water year type. Project-related effects during November would be negligible (<5%) in all water year types. These results indicate Alternative 2D would not affect migration in the Feather River.

American River

Comparisons for the American River at the confluence with the Sacramento River for September through November indicate decreased flows for September in generally all water year types (-9% to -27% depending on year type) except dry years indicate negligible effects, decreased flows during October in wetter water years (to -7%) and dry years (-8%) and increased flows (19% and 27%, below normal and critical years, respectively), and negligible project-related changes during dry and critical years during November and decreased flows (to 15%) for wetter years. These results indicate Alternative 2D would not affect migration conditions in the American River.

Overall conclusions are that, with some variation in results by location, month, and water year type, Alternative 2D would generally not have biologically meaningful effects on macropthalmia migration based on negligible effects (<5%), decreases in flow during wetter water year types that would not have biologically meaningful effects, and increases in flow during drier water years that would have a beneficial effect on migration.

Adults

Effects of Alternative 2D on flow during the adult migration period, September through November, would be the same as described for the macropthalmia migration period, September through November, above.

NEPA Effects: Collectively, these results indicate that is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. Flows under Alternative 2D would not be reduced from NAA_ELT in any waterway analyzed that would affect river lamprey macropthalmia or adults in a biologically meaningful way. There would be small to moderate increases in mean monthly flow for some months and water year types that would have beneficial effects on migration conditions.

CEQA Conclusion: In general, under Alternative 2D water operations, the quantity and quality of suitable migration habitat for river lamprey would not be affected relative to the CEQA baseline.

Macropthalmia

Sacramento River

Comparisons for the Sacramento River at Red Bluff for September through November indicate variable effects of Alternative 2D during September, with increases in mean monthly flow for wetter water year types (21 to 28%) that would have beneficial effects on migration conditions, and decreases for drier water year types (-6 to -24% for below normal, dry, and critical years). Alternative 2D would result in decreases (-5% to -18%) for October in all water year types. Alternative 2D would result in small to moderate decreases in mean monthly flows compared to Existing Conditions for all water year types in November (-8 to -18%). Persistent small to moderate reductions in flow in drier water years for two of the three months in the migration period could affect migration conditions in the Sacramento River.

Feather River

Comparisons for the Feather River at the confluence with the Sacramento River for September through November indicate variable results by month and water year type, with increases for wetter years and decreases in drier years in September except critical years indicates increases (14%), increases in dry years (19%)) in October that would have a small beneficial effect on migration, and negligible effects for water year types in November except for small decreases (-5%) in wet years. Decreased mean monthly flows in September and November during drier water years could affect migration conditions; increases in these water year types in September would have a beneficial effect.

American River

Comparisons for the American River at the confluence with the Sacramento River for September through November indicate reductions in flow for most months and most water year types, ranging from -8 to -43%, with the exception of a 10% and 17% increases in mean monthly flow for below normal and critical water years during October. The predominance of decreased flows for Alternative 2D compared to Existing Conditions would affect migration conditions, with substantial decreases for dry and critical years in September (-30 and -47%, respectively) and November (-23 and -17%, respectively).

Overall, these results indicate that Alternative 2D would cause decreases in mean monthly flow during all or portions of the river lamprey macropthalmia migration period in the Sacramento River (to -22% in dry years), Feather River (to -28%), and American River (to -43%).

Adults

Effects of Alternative 2D on flow during the adult migration period, September through November, would be the same as described for the macropthalmia migration period, September through November, above.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the results of the Impact AQUA-186 CEQA analysis indicate that the difference between the CEQA baseline and Alternative 2D could be significant because, under the CEQA baseline, the alternative could substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish. Reductions in flows during the macropthalmia and adult migration periods would reduce migration ability of both life stages. For macropthalmia, reduced migration ability could increase straying risk and delay initiation of the oceanic life stage. For adults, reduced flows could reduce the ability to sense olfactory cues if adults use such cues to return to natal spawning grounds.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the

2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 2D on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 2D on river lamprey migration habitat conditions would be less than significant and no mitigation is necessary.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-187: Effects of Construction of Restoration Measures on River Lamprey

Impact AQUA-188: Effects of Contaminants Associated with Restoration Measures on River Lamprey

Impact AQUA-189: Effects of Restored Habitat Conditions on River Lamprey

Impact AQUA-190: Effects of Methylmercury Management on River Lamprey (Environmental Commitment 12)

Impact AQUA-193: Effects of Localized Reduction of Predatory Fish on River Lamprey (Environmental Commitment 15)

Impact AQUA-194: Effects of Nonphysical Fish Barriers on River Lamprey (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on river lamprey for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Non-Covered Aquatic Species of Primary Management Concern

Construction and Maintenance of Water Conveyance Facilities

The effects of construction and maintenance of CM1 under Alternative 2D would be similar for all non-covered species; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-199: Effects of Construction of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

The potential effects of the construction of water conveyance facilities on non-covered species of primary management concern would be similar to those described for Alternative 4A (Impact AQUA-199) except that Alternative 2D would include two additional north Delta intakes (i.e., five intakes instead of three), with the result that the effects (e.g., pile driving; see Table 11-mult-1 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS) would be proportionally greater. The same measures applied to Alternative 4A would be applied to Alternative 2D in order to avoid and minimize the effects to non-covered species of primary management concern.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-199, the effect would not be adverse for non-covered species of primary management concern.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-199, the impact of the construction of the water conveyance facilities on non-covered aquatic species of primary management concern would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-200: Effects of Maintenance of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 2D would be the same as those described for Alternative 4A. As concluded in Alternative 4A, Impact AQUA-200, the effect would not be adverse for non-covered aquatic species of primary management concern.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-200 for non-covered aquatic species of primary management concern, the impact of the maintenance of water conveyance facilities on non-covered aquatic species of primary management concern would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

The effects of water operations of water conveyance facilities under Alternative 2D include a detailed analysis of the following species:

- Striped Bass
- American Shad
- Threadfin Shad
- Largemouth Bass
- Sacramento tule perch
- Sacramento-San Joaquin roach – California species of special concern
- Hardhead – California species of special concern
- California bay shrimp

Impact AQUA-201: Effects of Water Operations on Entrainment of Non-Covered Aquatic Species of Primary Management Concern

A revised analysis of Impact AQUA-201 for all alternatives, including Alternative 2D, is provided in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The analysis below for Alternative 2D draws on that analysis.

Striped Bass

NEPA Effects: Under Existing Conditions, striped bass are observed in salvage operations of the south Delta facilities throughout the year, with the majority of juvenile striped bass entrainment occurring during the summer (May through July). As described in Chapter 11, Section 11.3.5 of this RDEIR/SDEIS, in Appendix A, operation of the north Delta intakes under Alternative 2D would be expected to reduce overall entrainment of screenable life stages (i.e., early juveniles and older, around 20 mm long) because of the reduction in use of the south Delta facilities, which do not have the state of the art fish screens proposed for the north Delta intakes. Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile striped bass. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval striped bass are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of striped bass originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 2D, the mean entrainment was increased from 6.5% of particles to 23% of particles, a 256% increase. Note that entrainment of the early life stages of striped bass at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 2D during the spring to benefit covered fishes such as spring-run Chinook salmon. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, density-dependence during the juvenile stages of the striped bass life cycle means that losses of early life stages do not necessarily translate into proportional reductions in abundance of older individuals, and entrainment has not recently been identified as a significant driver of juvenile abundance (Mac Nally et al. 2010; Thomson et al. 2010). Therefore it is concluded with some uncertainty that there would be an adverse effect on striped bass.

CEQA Conclusion: The impact of water operations on entrainment of striped bass would be the same as described immediately above. Relative to Existing Conditions, particle tracking modeling for Alternative 2D showed mean entrainment was increased by around 192% (from 8% to 23%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, increased losses of striped bass eggs and larvae need not necessarily translate into reductions in abundance of later life stages. Nevertheless it is concluded that the impact is significant and unavoidable.

American Shad

American shad eggs and larvae would be vulnerable to entrainment at the proposed north SWP/CVP Delta intakes as these life stages are passively transported downstream to the north Delta. Most American shad spawning though takes place well upstream of the Delta and juveniles may rear to sufficiently large size to avoid entrainment as state-of-the-art fish screens on the proposed north Delta intakes would exclude juvenile and adult American shad.

NEPA Effects: Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile American shad. As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, eggs and larval American shad are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of American shad originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT(see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 2D, scenario NAA_ELT, and as discussed above for striped bass, the mean entrainment was increased from 6.5% of particles to 23% of particles, a 256% increase. As noted for striped bass, entrainment of the early life stages of American shad at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 2D during the spring to benefit covered fishes such as spring-run Chinook salmon. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, although American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment, they could also be entrained in appreciably greater magnitude than currently occurs and therefore it is also concluded that the effects of entrainment on American shad would be adverse.

CEQA Conclusion: The impact of water operations on entrainment of American shad would be the same as described immediately above. Relative to Existing Conditions and as described above for striped bass, particle tracking modeling for Alternative 2D scenario NAA_ELT showed mean entrainment was increased by around 192% (from 8% to 23%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above, American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment. Nevertheless it is concluded that the impact is significant and unavoidable.

Threadfin Shad

NEPA Effects: The impact and conclusion would be the same as discussed for Alternative 1A (Impact AQUA-201 for Threadfin Shad). Entrainment at the south delta would be reduced due to overall decreased exports from the SWP/CVP south Delta facilities. There would be potential entrainment of threadfin shad eggs and larvae to the north Delta intakes, although this risk is minimal because threadfin shad are most abundant in the south Delta (Baxter et al. 2010; see also discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). Overall, threadfin shad entrainment would be reduced because they are most abundant in the southern Delta and would particularly benefit from reduced south Delta exports. The effect would not be adverse.

CEQA Conclusion: The impact of water operations on entrainment of threadfin shad would be the same as described immediately above in the NEPA Effects section. The impact would be less than significant and no mitigation would be required.

Largemouth Bass

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The impact would be less than significant and no mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The impact would be less than significant and no mitigation would be required

Sacramento-San Joaquin Roach

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The impact would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The impact would be less than significant and no mitigation would be required

California Bay Shrimp

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The impact would be less than significant and no mitigation would be required.

Impact AQUA-202: Effects of Water Operations on Spawning and Egg Incubation Habitat for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-202 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

In general, the effects of Alternative 2D on the quality and quantity of spawning, egg incubation, and initial rearing habitat conditions for striped bass would not be adverse relative to NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or slightly greater than flows under NAA_ELT during April through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during April through June regardless of water year type (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in critical years during May (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be moderately greater than flows under NAA_ELT during April through June, except in critical years during May (20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-2D-138).

Table 11-2D-138. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay are outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (0%)	-5 (-11%)
Above Normal	-6 (-13%)	-15 (-28%)
Below Normal	-12 (-28%)	-14 (-32%)
Dry	2 (4%)	-7 (-13%)
Critical	8 (21%)	-3 (-6%)
All	-1 (-3%)	-8 (-16%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in striped bass spawning, incubation, or initial rearing habitat. Flows in all rivers examined during the April through June spawning, incubation, and initial rearing period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 2D in any river examined.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for striped bass relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be up to 13% lower under Existing Conditions during May but similar during April and June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be up to 14% lower than those under Existing Conditions during April through June.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June would be the same as or lower than the percentage under Existing Conditions in all water years except critical years (21% higher on a relative scale; 8% higher on an absolute scale) (Table 11-2D-138). This is a relatively small effect that would not have biologically meaningful negative effects on the striped bass population because it only occurs in one water year type.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would not be significant because Alternative 2D would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of striped bass relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 2D would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to striped bass. There would be no substantial temperature effects under Alternative 2D on striped bass.

American Shad

In general, the effects of Alternative 2D on the quality and quantity of spawning and egg incubation habitat conditions for American shad would not be adverse relative to NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during April through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during April through June, regardless of water year type (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in critical years during May (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be moderately greater than flows under NAA_ELT during April through June, except in critical years during May (20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside the 60°F to 70°F water temperature range would be lower than the percentage under NAA_ELT regardless of water year type (Table 11-2D-140).

Table 11-2D-140. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-6 (-14%)	-3 (-6%)
Above Normal	-3 (-8%)	-15 (-31%)
Below Normal	-2 (-8%)	-7 (-20%)
Dry	-2 (-5%)	-4 (-9%)
Critical	-3 (-8%)	-6 (-14%)
All	-4 (-9%)	-6 (-14%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in American shad spawning or adult migration. Flows in all rivers examined during the April through June adult migration and spawning period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 2D in any river examined.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for American shad relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) and wet years during May (15% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be up to 13% lower under Existing Conditions during May, but similar during April and June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June. In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be up to 14% lower than those under Existing Conditions during April through June.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside of the 60°F to 70°F water temperature range would be lower than the percentage under Existing Conditions in all water year types (Table 11-2D-140).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 2D would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of American shad relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 2D would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to American shad. There would be no substantial temperature effects under Alternative 2D on American shad.

Threadfin Shad

In general, the effects of Alternative 2D on the quality and quantity of spawning habitat conditions for threadfin shad would not be adverse relative to NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August threadfin shad spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during April through August, except in dry years during August (11% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to flows under NAA_ELT during April through August, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during April through August, except in critical years during July (14% lower) and in critical years during August (11% greater) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be moderately to substantially greater than flows under NAA_ELT during April through June (to 121% greater), except during critical years in May (7% lower), and moderately to substantially lower than flows under NAA_ELT during July and August (to 45% lower), except during critical years in August (14% greater) (Appendix *B, Supplemental Modeling for New Alternatives*). Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

In the American River below Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during April through July, except in May during critical years (20%) and lower flows under NAA_ELT during August (to 20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). These flow reductions are small to moderate in magnitude and limited to late in the spawning period and, therefore, would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT below 68°F would be greater than those under NAA_ELT (2% to 20% greater) in all but dry and critical years (Table 11-2D-142). On an absolute scale, there are small increases (≤4%) in wet and above normal water years that would not have biologically meaningful effects, and a small increase that is isolated to below normal water years (11% increase).

Table 11-2D-142. Difference and Percent Difference in the Percentage of Months during April–August in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (0%)	2 (2%)
Above Normal	-9 (-12%)	4 (6%)
Below Normal	-1 (-2%)	11 (20%)
Dry	-29 (-39%)	-6 (-11%)
Critical	-22 (-33%)	-2 (-4%)
All	-11 (-16%)	1 (3%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in threadfin shad spawning habitat. Flows in all rivers examined during the April through August spawning period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. Some flow reductions would occur late in the spawning season in the Feather and American Rivers and would be too small in magnitude or frequency to have a biologically meaningful effect on threadfin shad. The percentage of years below the spawning temperature threshold would be similar or lower under Alternative 2D relative to the NAA_ELT, except in below normal years, but this increase is not expected to have a biologically meaningful effect on the threadfin shad population because it occurs in only one water year type and is isolated to the Feather River.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for threadfin shad relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in wet years during May (10% lower) and in dry and critical years during August (12% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). These are relatively small-magnitude and infrequent flow reductions and would not have biologically meaningful effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in critical years during May and August (6% and 8% lower, respectively) and in wet years during July (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during April through August (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years during April (6% lower) and in wet years during May (15% lower), and would be lower than flows under Existing Conditions in dry and critical years during July (28% and 50% lower, respectively) and in below normal and dry years during August (10% and 45% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to flows under Existing Conditions during April and July and lower flows under Existing Conditions during May, June and August (up to 46% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months below the 68°F water temperature threshold for threadfin shad spawning under A2D_ELT would be similar to or 2% to 29% lower than the percentage under Existing Conditions, depending on water year type (Table 11-2D-142).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 2D during the threadfin shad spawning period relative to Existing Conditions. Flows would be moderately to substantially lower in the Feather, American, Stanislaus, and San Joaquin rivers during substantial portions of the spawning period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable spawning habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the

alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Largemouth Bass

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for largemouth bass relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during March through June, except in May during critically dry years (20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that in the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside the 59°F to 75°F water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-2D-144).

Table 11-2D-144. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-2 (-4%)	0 (0%)
Above Normal	-2 (-5%)	0 (0%)
Below Normal	0 (0%)	0 (0%)
Dry	-6 (-12%)	0 (0%)
Critical	-8 (-19%)	-2 (-6%)
All	-3 (-7%)	0 (-1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in largemouth bass spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 2D in any river examined.

CEQA Conclusion: In general, Alternative 2D would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (7% lower) and in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (40% and 14% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (7% lower), above normal years during April (5% lower), and in wet and critical years during June (20% and 30% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be lower than flows under Existing Conditions during May (to 13% lower) except in critical years (11% greater). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or lower (up to 16%) than those under Existing Conditions during March through June, except in wet years during March to May, when flows under A2D ELT would range from 2% to 9% greater.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under A2D_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside of the 59°F to 75°F water temperature range for largemouth bass spawning would be the same or lower than the percentage under Existing Conditions in all water year types (Table 11-2D-144).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 2D would not cause a substantial reduction in largemouth bass spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 2D would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to largemouth bass. There would be no substantial temperature effects under Alternative 2D on largemouth bass.

Sacramento Tule Perch

NEPA Effects: The effects of water operations on spawning habitat for Sacramento tule perch under Alternative 2D would be similar to that described for Alternative 1A due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: As described under Alternative 1A, Impact AQUA-202 the impacts on Sacramento tule perch spawning would be not be significant and no mitigation is required.

Sacramento-San Joaquin Roach – California species of special concern

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (13% lower) and in critical years during May 7% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during March through June, except in May during critically dry years (20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix *B, Supplemental Modeling for New Alternatives*).

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation under A2D_ELT would be similar to the percentage under NAA_ELT in all water year types (Table 11-2D-146).

Table 11-2D-146. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Fall below the 60.8°F Water Temperature Threshold for the Initiation of Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	-8 (-12%)	0 (0%)
Above Normal	-5 (-8%)	0 (0%)
Below Normal	-2 (-4%)	0 (0%)
Dry	-6 (-10%)	0 (0%)
Critical	-8 (-15%)	0 (0%)
All	-6 (-10%)	0 (0%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. The occurrence of flow reductions would not be of sufficient magnitude or frequency to have a biologically meaningful effect on roach. There would be no substantial temperature effects under Alternative 2D in any river examined.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (7% lower) and in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (6% lower) and in critical years during May (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet years during May (15% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (7% lower), above normal years during April (5% lower), and in wet and critical years during June (20% and 30% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be lower than flows under Existing Conditions during May (to 13% lower), except in critical years (11% greater) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under A2D_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 11% lower, respectively.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or lower (up to 16%) than those under Existing Conditions during March through June, except during March to May in wet years, when flows under A2D ELT would range from 2% to 9% greater.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June, except during these four months in wet years, in which flows under A2D_ELT would range from 0.3% lower to 11% greater.

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation would be lower than the percentage under Existing Conditions in all water year types (Table 11-2D-146).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 2D would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 2D would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to Sacramento-San Joaquin roach. There would be no substantial temperature effects under Alternative 2D on Sacramento-San Joaquin roach.

Hardhead – California species of special concern

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during April and May) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to flows under NAA_ELT during April and May, except in above normal years during April (17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during April and May (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be similar to moderately greater than flows under NAA_ELT during April and May, except in critical years in May (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during April and May, except in critically dry years during May (20% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

Water Temperature

The percentage of years outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature-related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of years under A2D_ELT outside the 59°F to 64°F suitable water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-2D-148).

Table 11-2D-148. Difference and Percent Difference in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	2 (3%)	0 (0%)
Above Normal	0 (0%)	-9 (-13%)
Below Normal	18 (42%)	4 (6%)
Dry	6 (10%)	-6 (-8%)
Critical	-8 (-15%)	-8 (-15%)
All	4 (7%)	-3 (-5%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in hardhead spawning habitat. Flows in all rivers examined during the April through May spawning period under Alternative 2D would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 2D in any river examined.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to flows under Existing Conditions during April through May, except in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through May, except in critical years during May (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under Existing Conditions during April through May, except in critical years during April and May (7% and 6% higher, respectively)(Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during April through May, except in below normal years during April (6% lower) and in wet years during May (15% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower). Flows under A2D_ELT would generally be lower than flows under Existing Conditions during May (to 13% lower). (Appendix *B, Supplemental Modeling for New Alternatives*). These few flow reductions are relatively small in magnitude and, therefore would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower (up to 8%) than those under Existing Conditions during April and May.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be lower (up to 12%) than to those under Existing Conditions during April and May.

Water Temperature

The percentage of months outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside of the 59°F to 64°F water temperature range for hardhead spawning would be greater than the percentage under Existing Conditions in all water years types, except critical years (15% lower) (Table 11-2D-148).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in hardhead spawning habitat, and no mitigation is necessary. Flows in most rivers examined during the April through May spawning period under Alternative 2D would generally be similar to or greater than flows under Existing Conditions. Flows in the San Joaquin and Stanislaus Rivers would be lower under Alternative 2D, although these reductions would not have population-level effects on hardhead. There would be no substantial temperature effects under Alternative 2D on hardhead.

California Bay Shrimp

NEPA Effects: The effect of water operations on spawning habitat of California bay shrimp under Alternative 2D would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-202) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: The impact of water operations on spawning habitat of California bay shrimp would be the same as described immediately above. The impacts would be less than significant and no mitigation would be required.

Impact AQUA-203: Effects of Water Operations on Rearing Habitat for Non-Covered Aquatic Species of Primary Management Concern

Also, see Alternative 1A, Impact AQUA-203 for additional background information relevant to non-covered species of primary management concern. The analysis for striped bass, American shad, and bay shrimp includes new analysis across all alternatives that is described in detail in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS. The analysis below for Alternative 2D draws on that analysis.

Striped Bass

NEPA Effects: The discussion under Alternative 2D, Impact AQUA-202 for striped bass also addressed the embryo incubation and initial rearing period. That analysis indicates that there is no adverse effect on striped bass rearing during that period. As discussed further in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, water operations have the potential to affect striped bass juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Several X2-abundance index or X2-survival index relationships from Kimmerer et al. (2009) were applied to striped bass in order to assess the potential effects on abundance or survival through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there generally would be 5-10% reductions in mean abundance index as a result of change in rearing habitat under Alternative 2D scenarios A2D_ELT (See Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). The exception was the mean bay midwater trawl abundance index (11% reduction; Table 11-mult-9). This result- indicates that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for striped bass.

CEQA Conclusion: The analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions (see Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult 10 in Chapter 11, Section 11.3.5, in Appendix A of this

RDEIR/SDEIS), there could be significant impacts of Alternative 2D on survival or abundance of striped bass, in contrast to the conclusion presented above in the NEPA Effects section. As described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both Alternative 2D and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in the ELT, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands. Because Alternative 2D modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for striped bass, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would be necessary.

American Shad

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, water operations have the potential to affect American shad juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Two X2-abundance index relationships from Kimmerer et al. (2009) were applied to American shad in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 2D scenario A2D_ELT (See Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for American shad.

CEQA Conclusion: Similar to striped bass, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 2D on abundance of American shad (Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Threadfin Shad

NEPA Effects: The effects of water operations on rearing habitat for threadfin shad under Alternative 2D would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-203) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A, Impact AQUA-203. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on threadfin shad rearing habitat would be less than significant and no mitigation would be required.

Largemouth Bass

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during April through October with some exceptions (to 17% lower), and would be lower in all water year types during November (to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to flows under NAA_ELT with isolated exceptions, including flow reduction in above normal years during April (to 17% lower) and small flow reductions in above normal years during October (8% lower) and in wet years during November (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT during April through November, except in critical years during August (11% greater) and in critical years during July, September, and October (to 14% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be moderately to substantially greater than flows under NAA_ELT during April through June (to 121% greater), except in critical years during May (to 7% lower); moderately to substantially lower flows under NAA_ELT during July through September (to 49% lower), except in critical years during August and September (to 23% greater); and similar to or greater than flows under NAA_ELT during October and November (to 17% greater) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions during July through September would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during April through July and October, except in above normal and dry years during October (7% and 8% lower, respectively), and would be lower than flows under NAA_ELT during August, September, and November (to 24% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 88°F under NAA_ELT or A2D_ELT. As a result, there would be no difference between NAA_ELT and A2D_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-2D-150).

Table 11-2D-150. Difference and Percent Difference in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 12% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be lower than flows under NAA_ELT during July through September, except in critical years in August and September (17% and 23% greater, respectively); would generally be similar to or greater than flows under NAA_ELT during January through June and October, except for below normal years during March (13% lower) and in critical years during May (7% lower); and would generally be similar to or greater than flows under NAA_ELT during November and December (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would be more persistently lower under A2D_ELT relative to NAA_ELT (up to 49% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 24% lower) during August through November, except in below normal and critical years during October (17% and 24% greater, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT and A2D_ELT (Table 11-2D-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and A2D_ELT.

Table 11-2D-151. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in juvenile largemouth bass rearing and adult residency habitat. Flows in all rivers examined during the year under Alternative 2D are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Regardless of these small changes to flows, water temperatures under Alternative 2D would not increase above the 86°F threshold at a higher frequency than would occur under NAA_ELT. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the largemouth bass population.

CEQA Conclusion: In general, Alternative 2D would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in wet years during May (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (to 27% greater) (Appendix *B, Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in critical years during May (6% lower) and in wet years during July (10% lower), and similar to or lower than flows under Existing Conditions during August through November (to 17% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). The persistent, small to moderate flow reductions years during August through November would have a localized effect on rearing conditions.

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions during April through November, except in critical years during September (19% lower) and in below normal years during October (6% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). This flow reduction is a relatively small, isolated effect limited to a single water year type and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during April through June, September, and October, with a few isolated exceptions (to 47% lower)(Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be moderately to substantially lower than flows under Existing Conditions during July, August, and November (to 50% lower), except in wet and above normal years during July and August (to 42% greater) and in above normal years during November (5% greater).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during April, except in above normal years (5% lower), but generally lower, by up to 46%, during May through November (Appendix *B, Supplemental Modeling for New Alternatives*). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May and September through November, and would be similar to or up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be similar to or up to 14% lower than to those under Existing Conditions during April through July, except for 11% greater flow during June of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through November.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 88°F water temperature threshold for juvenile largemouth bass during the April through November rearing period under Existing Conditions or A2D_ELT (Table 11-2D-150). As a result, there would be no difference in the percentage of months in which the 88°F water temperature threshold is exceeded between A2D_ELT and Existing Conditions.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March (to 7% lower), and in wet years during May (10% lower), (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (20% and 27% greater, respectively). (Appendix *B, Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively). Flows under A2D_ELT would generally be similar to or lower (up to 16%) than flows under Existing Conditions during October and November (Appendix *B, Supplemental Modeling for New Alternatives*). These small flow reductions in some water year types during October and November would not be persistent enough or of a magnitude that would have biologically meaningful negative effects

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, September, and October, except in below normal and dry years during March (40% and 14% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and dry years during September (35% and 47% lower, respectively), and in wet and below normal years during October (6% and 5% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, July, August, November, and December, except in wet and above normal years during July (6% and 7% greater, respectively), in wet years during August (42%

greater), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (5% lower), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, in below normal and dry years during June (18% and 23% greater, respectively), and in below normal and critical years during October (10% and 17% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through September (up to 23% lower), and would be similar or slightly higher than flows under Existing Conditions during January, February, and October through November (up to 11% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat for adults and increased stress and mortality of adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for adult largemouth bass under Existing Conditions or A2D_ELT (Table 11-2D-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between A2D_ELT and Existing Conditions.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 2D during the adult largemouth bass residency period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce the quantity and quality of habitat for adults as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento Tule Perch

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for rearing.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 12% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be lower than flows under NAA_ELT during July through September, except in critical years in August and September (17% and 23% greater, respectively), and would generally be similar to or greater than flows under NAA_ELT during January through June and October, except for below normal years during March (13% lower) and in critical years during May (7% lower); and would generally be similar to or greater than flows under NAA_ELT during November and December (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would be more persistently lower under A2D_ELT relative to NAA_ELT (up to 49% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal and critical years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 24% lower) during August through November, except in below normal and critical years during October (17% and 24% greater, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 2D indicates that there would be no biologically meaningful differences in flows between A2D and NAA because flows would not be reduced enough or frequently enough to affect habitat conditions.

Water Temperature

The percentage of months exceeding water temperature thresholds of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced rearing habitat quantity and quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of years under A2D_ELT exceeding the 72°F threshold would be higher than the percentage under NAA_ELT by up to 267% depending on water year type (Table 11-2D-154). Although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤2%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

The percentage of months under A2D_ELT exceeding the 75°F threshold would be similar to or up to 14% lower than the percentage under NAA_ELT (Table 11-2D-154). As with the 72°F threshold, although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤1%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

Table 11-2D-154. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
72°F Threshold		
Wet	2 (86%)	2 (117%)
Above Normal	1 (NA)	1 (NA)
Below Normal	3 (NA)	3 (NA)
Dry	5 (NA)	4 (267%)
Critical	6 (133%)	2 (27%)
All	3 (238%)	2 (120%)
75°F Threshold		
Wet	0 (NA)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	3 (500%)	-1 (-14%)
All	1 (600%)	0 (-13%)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in the quantity or quality of Sacramento tule perch habitat. Flows in all rivers examined during the year under Alternative 2D are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento tule perch population. There would be no substantial differences in water temperature between Alternative 2D and NAA_ELT in any river examined that would cause a biologically meaningful effect to Sacramento tule perch.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for tule perch.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March (to 7% lower), and in wet years during May (10% lower), (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (20% and 27% greater, respectively). (Appendix *B, Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively) but would generally be similar to or lower than flows under Existing Conditions during October and November (Appendix *B, Supplemental Modeling for New Alternatives*). These small to moderate flow reductions in October and November would not cause a biologically meaningful effect on Sacramento tule perch.

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, September, and October, except in below normal and dry years during March (40% and 14% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and dry years during September (35% and 47% lower, respectively), and in wet and below normal years during October (6% and 5% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, July, August, November, and December, except in wet and above normal years during July (6% and 7% greater, respectively), in wet years during August (42% greater), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (5% lower), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, in below normal and dry years during June (18% and 23% greater, respectively), and in below normal and critical years during October (10% and 17% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through September (up to 23% lower), and would be similar or slightly above flows under Existing Conditions during January, February, and October through November (up to 11% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months exceeding water temperatures of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced habitat quality and increased stress and mortality. Water temperatures were not modeled in Clear Creek or the San Joaquin River.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT exceeding 72°F relative to the percentage under Existing Conditions would be similar to or greater, by up to 133% (Table 11-2D-154). However, these relative increases correspond to small absolute increases (≤5%) that are not expected to have biologically meaningful effects.

The percentage of years under A2D_ELT exceeding 75°F would be similar to the percentage under Existing Conditions in all water years except critical years (500% higher) (Table 11-2D-154). As with the 72°F threshold, this increase corresponds to a small absolute increase (3%) that is not expected to have biologically meaningful negative effects.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 2D during the juvenile and adult Sacramento tule perch occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento-San Joaquin Roach

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 12% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower)(Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT throughout the year, except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be lower than flows under NAA_ELT during July through September, except in critical years in August and September (17% and 23% greater, respectively), and would generally be similar to or greater than flows under NAA_ELT during January through June and October, except for below normal years during March (13% lower) and in critical years during May (7% lower); and would generally be similar to or greater than flows under NAA_ELT during November and December (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would be more persistently lower under A2D_ELT relative to NAA_ELT (up to 49% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 24% lower) during August through November, except in below normal and critical years during October (17% and 24% greater, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced rearing habitat quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D _ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D _ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT or A2D_ELT (Table 11-2D-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and A2D_ELT.

Table 11-2D-156. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in quantity and quality of habitat for juvenile and adult Sacramento-San Joaquin roach. Flows in all rivers examined during the year under Alternative 2D are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento-San Joaquin roach population.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March (to 7% lower), and in wet years during May (10% lower), (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (20% and 27% greater, respectively). (Appendix *B, Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively) but would generally be similar to or lower than flows under Existing Conditions during October through November (Appendix *B, Supplemental Modeling for New Alternatives*). The small flow reductions during these months not be large or frequent enough to cause a biologically meaningful effects to roach.

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during September and in below normal years during October (19% and 6% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, September, and October, except in below normal and dry years during March (40% and 14% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and dry years during September (35% and 47% lower, respectively), and in wet and below normal years during October (6% and 5% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be moderately to substantially lower than flows under

Existing Conditions in January, February, July, August, November, and December, except in wet and above normal years during July (6% and 7% greater, respectively), in wet years during August (42% greater), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (5% lower), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, in below normal and dry years during June (18% and 23% greater, respectively), and in below normal and critical years during October (10% and 17% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through September (up to 23% lower), and would be similar or slightly above flows under Existing Conditions during January, February, and October through November (up to 11% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for juvenile and adult Sacramento-San Joaquin roach. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for Sacramento-San Joaquin roach under Existing Conditions or A2D_ELT (Table 11-2D-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between A2D_ELT and Existing Conditions.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 2D during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Hardhead

In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT throughout the year with some exceptions (up to 12% lower), and would be lower in all water year types during November (up to 18% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April and October (17% and 8% lower, respectively), and in wet years during November (10% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A2D_ELT would be similar to flows under NAA_ELT throughout the year except in critical years during July (14% lower), August (11% greater), September (10% lower), and October (7% lower) (Appendix *B, Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would generally be lower than flows under NAA_ELT during July through September, except in critical years in August and September (17% and 23% greater, respectively), and would generally be similar to or greater than flows under NAA_ELT during January through June and October, except for below normal years during March (13% lower) and in critical years during May (7% lower); and would generally be similar to or greater than flows under NAA_ELT during November and December (Appendix *B, Supplemental Modeling for New Alternatives*). Flows would be more persistently lower under A2D_ELT relative to NAA_ELT (up to 49% lower) during July, August, and in all water year types except critical years during September. Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A2D_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 24% lower) during August through November, except in below normal and critical years during October (17% and 24% greater, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A2D_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year except below normal years (7% greater) (Table 11-2D-158).

Table 11-2D-158. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. A2D_ELT	NAA_ELT vs. A2D_ELT
Wet	1 (1%)	2 (3%)
Above Normal	-1 (-1%)	-1 (-1%)
Below Normal	1 (1%)	5 (7%)
Dry	-1 (-2%)	-1 (-1%)
Critical	-3 (-5%)	-1 (-1%)
All	-1 (-1%)	1 (1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 2D would not cause a substantial reduction in the quantity or quality of habitat for juvenile and adult hardhead. Flows in all rivers examined during the year under Alternative 2D are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on hardhead. There are no temperature-related effects in any other rivers examined.

CEQA Conclusion: In general, Alternative 2D would not affect the quality and quantity of upstream habitat conditions for juvenile and adult hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March (to 7% lower), and in wet years during May (10% lower), (Appendix *B, Supplemental Modeling for New Alternatives*)*.* Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (20% and 27% greater, respectively). (Appendix *B, Supplemental Modeling for New Alternatives*)*.* There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively) but would generally be similar to or lower than flows under Existing

Conditions during October through November (Appendix *B, Supplemental Modeling for New Alternatives*). The small flow reductions during these months not be large or frequent enough to cause a biologically meaningful effects to hardhead.

In the Feather River at Thermalito Afterbay, flows under A2D_ELT would be greater than flows under Existing Conditions during March through June, September, and October, except in below normal and dry years during March (40% and 14% lower, respectively), in below normal years during April (6% lower), in wet years during May (15% lower), in below normal and dry years during September (35% and 47% lower, respectively), and in wet and below normal years during October (6% and 5% lower, respectively) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, July, August, November, and December, except in wet and above normal years during July (6% and 7% greater, respectively), in wet years during August (42% greater), in above normal years during November (5% greater), and in above normal years during December (18% greater).

In the American River at Nimbus Dam, flows under A2D_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through April, except in dry and critical years during February (5% lower), in critical years during March (7% lower), and in above normal years during April (5% lower) (Appendix *B, Supplemental Modeling for New Alternatives*). Flows under A2D_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, in below normal and dry years during June (18% and 23% greater, respectively), and in below normal and critical years during October (10% and 17% greater, respectively). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A2D_ELT would generally be similar to or slightly lower than those under Existing Conditions during March through September (up to 23% lower) and would be similar to or slightly above flows under Existing Conditions during January, February and October through November (up to 11% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A2D_ELT would generally be similar to or up to 29% lower than to those under Existing Conditions during January through July, except for 17% and 11% greater flow in wet years during February and June, respectively, and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months in which year-round in-stream temperatures would be outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A2D_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A2D_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under A2D_ELT outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead would be similar to or lower than the percentage under Existing Conditions in all water years (Table 11-2D-158).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 2D during the juvenile and adult hardhead occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 2D could be significant because the alternative could substantially reduce habitat for juvenile and adult hardhead as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 2D. These modeling results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, water operations have the potential to affect California bay shrimp juvenile abundance through an increase in residual circulation in the estuary with increasing outflow (as indexed by X2) that could translate to more rapid or more complete entrainment into the estuary, or more rapid transport to rearing grounds, both of which presumably could increase survival from hatching to settlement (Kimmerer et al. 2009). An X2-abundance index relationship from Kimmerer et al. (2009) was applied to bay shrimp in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be a 6% decrease in mean abundance index as a result of change in rearing habitat under Alternative 2D scenario A2D_ELT (See Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). This result indicates that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for California bay shrimp.

CEQA Conclusion: Similar to striped bass and American shad, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 2D on abundance of California bay shrimp (Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted for striped bass and American shad, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for California bay shrimp and as noted for striped bass and American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Impact AQUA-204: Effects of Water Operations on Migration Conditions for Non-Covered Aquatic Species of Primary Management Concern

See Alternative 1A, Impact AQUA-204 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

NEPA Effects: Under Alternative 2D, average spring (March–May) monthly flows in the Sacramento River downstream of the north Delta intake would be reduced 4–33% during the adult striped bass migration compared to the NEPA baseline (NAA_ELT). Sacramento River flows are highly variable inter-annually, but striped bass are still able to migrate upstream the Sacramento River during years of lower flows. The effect of reduced Sacramento flows under Alternative 2D would not be adverse.

CEQA Conclusion: Impacts would be less than significant because the changes in spring flow under Scenarios A2D_ELT (4–36% lower compared to Existing Conditions) would not interfere substantially with movement of pre-spawning striped bass through the Delta. No mitigation would be required.

American Shad

NEPA Effects: Flows in the Sacramento River below the north Delta diversion facilities under Scenario A2D_ELT would be reduced 4–33% relative to NAA_ELT during March–May, as described above for striped bass. River flows are highly variable inter-annually, and American shad are still able to migrate upstream the Sacramento River during lower flow years. Overall, the impact to American shad migration habitat conditions would not be adverse under Alternative 2D.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because, as described above for striped bass, the changes in flow under Scenario A2D_ELT (4-36% lower compared to Existing Conditions) would not interfere substantially with movement of American shad from the Delta to upstream spawning habitat. No mitigation would be required.

Threadfin Shad

NEPA Effects: Threadfin shad are semi-anadromous, moving between freshwater and brackish water habitats. Threadfin shad found in the Delta do not actively migrate upstream to spawn. Therefore there is no effect on migration habitat conditions.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because flow changes in the Delta under Alternative 2D would not alter movement patterns for threadfin shad. No mitigation would be required.

Largemouth Bass

NEPA Effects: Largemouth bass are non-migratory fish within the Delta. Therefore they do not use the Delta as a migration habitat corridor. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes under Alternative 2D would not affect largemouth movements within the Delta. No mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Similar with largemouth bass, Sacramento tule perch are a non-migratory species and do not use the Delta as a migration corridor as they are a resident Delta species. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes would not affect Sacramento tule perch movements within the Delta. No mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: For Sacramento-San Joaquin roach, the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 2D, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to the NEPA baseline. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for Sacramento-San Joaquin roach would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: For hardhead the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 2D, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to NAA_ELT. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for hardhead would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: The effect of water operations on migration conditions of California bay shrimp under Alternative 2D would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-204). For a detailed discussion, please see Alternative 1A, Impact AQUA-204. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on California bay shrimp migration conditions would be less than significant and no mitigation would be required.

Restoration Measures and Environmental Commitments

Alternative 2D has the same restoration and environmental commitments as Alternative 4A, although with a proportionally greater extent of restoration because there are five north Delta intakes included under Alternative 2D compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 2D.

Impact AQUA-205: Effects of Construction of Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-206: Effects of Contaminants Associated with Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-207: Effects of Restored Habitat Conditions on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-208: Effects of Methylmercury Management on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 12)

Impact AQUA-211: Effects of Localized Reduction of Predatory Fish on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 15)

Impact AQUA-212: Effects of Nonphysical Fish Barriers on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on non-covered aquatic species of primary management concern for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Upstream Reservoirs

Impact AQUA-217: Effects of Water Operations on Reservoir Coldwater Fish Habitat

NEPA Effects: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, this effect would not be adverse because coldwater fish habitat in the CVP and SWP upstream reservoirs under Alternative 2D would not be substantially reduced when compared to the No Action Alternative. Carryover storage thresholds for all CVP and SWP reservoirs would be similar between the No Action Alternative and Alternative 2D.

CEQA Conclusion: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, Alternative 2D would reduce the quantity of coldwater fish habitat in the CVP and SWP relative to Existing Conditions. There would be 6 fewer years (7% lower) that exceed the 250 TAF carryover storage threshold in Folsom Reservoir under Alternative 2D relative to Existing Conditions, which could result in a significant impact.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, there would be negligible effects on reservoir storage. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in reservoir storage under Alternative 2D and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

4.4.8 Terrestrial Biological Resources

Alternative 2D is generally similar to Alternative 4A except that it includes two additional intakes (Intakes 1 and 4) along the Sacramento River and operates under a different operational scenario. Like Alternative 4A, this alternative would not serve as an NCCP/HCP and thus the analysis below only considers the conveyance facilities and operations and only includes the environmental commitments necessary to fully mitigate the projects impacts under CEQA and NEPA. Other than the increased impacts from the intakes and associated restoration actions, the effects from Alternative 2D are relatively the same as those under Alternative 4A and therefore Alternative 2D is considered here in a summary fashion. The reader is referred to the discussion of Alternative 4A for a detailed analysis of impacts that would be associated with implementing Alternative 2D. The impacts associated with Alternatives 2D and 4A were derived by comparing the alternative with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Operations under Alternative 2D would be similar, but not identical, to those described under Operational Scenario B (see Chapter 3, Section 3.6.4.2, *North Delta and South Delta Water Conveyance Operational Criteria*, of the Draft EIR/EIS). These operations would include both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Operations included in this alternative for south Delta export facilities would replace the south Delta operations currently implemented in compliance with the FWS (2008) and NMFS (2009) BiOps. The north Delta intakes and the head of Old River barrier would be new facilities for the SWP and CVP and would be operated as described in Chapter 3, Section 3.6.4.2 of the Draft EIR/EIS. Alternative 2D operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times. The operational scenario under Alternative 2D would have a greater operational capacity compared to Alternative 4A (15,000 cfs compared to 9,000 cfs).

Comparative Differences in Effects for Alternatives 2D and 4A

The principal differences in effects between these two alternatives would be related to the differing construction footprints of the water conveyance facilities and the differences in proposed restoration efforts. The Alternative 2D water conveyance facilities would entail construction of two additional north Delta intakes (Intakes 1 and 4). Intake 1 is located northeast of Clarksburg on the east side of the river and Intake 4 is located just south of Hood, also on the east side of the river. There is also a large RTM disposal area and a new permanent transmission line between Intakes 1 and 2. The operational scenario for Alternative 2D (Scenario B) is also different from Alternative 4A (Scenario H3–H4), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area.

As a result of the greater impacts from Alternative 2D additional restoration and protection acreages would be required under the environmental commitments to achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b). The restoration actions would themselves result in effects on natural communities where they are likely to occur. Specific locations for implementing many of the restoration commitments have not been identified at this time. Therefore, the analysis considers typical activities that would be undertaken for implementation of the habitat restoration and provides an estimate of what acreages of natural communities would be lost or converted by these activities. These activities under Alternative 2D would generally be the same as those under Alternative 4A but would result in additional impacts on valley foothill riparian and cultivated lands. The effects from these activities are summarized below in Table 4.4.8-1.

Due to the addition of the two intakes and their associated pumps and pipelines, the additional RTM disposal area, and the additional restoration under the environmental commitments, Alternative 2D would create differences in the permanent and temporary loss of natural communities and cultivated lands when compared with Alternative 4A (Table 4.4.8-1). Alternative 2D would permanently remove 11 more acres of valley/foothill riparian habitat along the Sacramento River, 10 acres more of grassland, 75 acres more of managed wetlands, 6 more acres of tidal perennial aquatic, and 867 acres more of cultivated land when compared to Alternative 4A.

During the water conveyance facilities construction process, Alternative 2D would involve more temporary loss of natural communities when compared with Alternative 4A mostly because of the temporary work areas associated with the two additional intakes and the additional pipelines from the intakes. The differences would include greater impacts on cultivated lands east of the river (76 acres more), grassland along the river levee (8 acres more), tidal perennial aquatic within the river channel (25 acres more), tidal freshwater emergent wetland (1 acre more), and valley/foothill riparian along the river levee (3 acres more). No temporary impacts from restoration actions are anticipated because all restoration activities will take place within in the footprint of the proposed restoration site.

These differences in permanent loss of habitat associated with water conveyance construction and restoration would create some differences in effects on wildlife, primarily birds that utilize croplands for foraging and some species that utilize managed wetlands in the north Delta. The increase in permanent loss of cultivated land (primarily irrigated pasture and other hay crops) associated with Alternative 2D would result in a larger loss of foraging habitat for species such as tricolored blackbird, greater sandhill crane, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark. The increase in impacts on managed wetland would result in increased impacts on white-tailed kite, northern harrier, yellow-head blackbird, and short-eared owl but the particular area of managed wetland that would be affected is not identified as suitable for greater sandhill crane (i.e., is not included as part of the species' modeled habitat). Alternative 2D would also result in an increase in the loss of riparian habitat along the Sacramento River, which would affect nesting habitat for Swainson's hawk, white-tailed kite, cormorants, herons, egrets, and migratory habitat for birds moving along the Sacramento River corridor.

The slightly larger temporary losses of cultivated land, grassland and valley/foothill riparian natural communities associated with Alternative 2D would also increase the effects on special-status species that use these communities. There would be more foraging habitat temporarily lost under Alternative 2D for greater sandhill crane when compared to Alternative 4A because of the cultivated land loss.

Alternative 2D would also affect 51 more acres of jurisdictional wetlands and waters as regulated by Section 404 of the CWA, when compared to Alternative 4 (Table 4.4.8-2). Refer to Table 12-4A-68 for a summary of Alternative 4A jurisdictional waters and wetlands impacts. The majority of this difference is due to impacts on tidal channel and scrub-shrub wetlands (as mapped for the wetland delineation) by the construction of the intakes along the Sacramento River.

The environmental commitments described in Section 4.1.3.3 and the acreages of these commitments presented in Table 4.1-5 would provide for protection, enhancement, and restoration of habitats affected under Alternative 2D. In addition, the Resource Restoration and Performance Principles in Table 4.1-8 would further guide the environmental commitments in mitigating the effects on terrestrial biological resources, the AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37–39 described in part in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and in Appendix D*, Substantive BDCP Revisions,* of this RDEIR/SEIS would be available to further avoid and minimize impacts, and preparation of an adaptive management and monitoring program as would likely be required during the ESA Section 7 and CESA Section 2081(b) process would further avoid, minimize, and mitigate the effects of Alternative 2D.

Table 4.4.8-1 Alternative 2D Effects on Natural Communities Relative to Alternative 4A (acres)

	Permanent Impacts from Alt. 2D								
Natural Community	Water Conveyance	EC 4 – Tidal Restoration	EC 7 – Riparian Restoration	EC8 – Grassland Restoration	EC 10 – Nontidal Restoration	*Permanent Impact Total*	Permanent Impact Difference from Alternative 4A	Temporary Impacts Alt. 2D	Temporary Impact Difference from Alternative 4A
Tidal perennial aquatic	213	0	0	0	0	*213*	6	*2,123*	25
Tidal brackish emergent wetland	0	0	0	0	0	*0*	0	*0*	0
Tidal freshwater emergent wetland	3	0	0	0	0	*3*	0	*15*	1
Valley/foothill riparian	53	5	0	0	0	*58*	11	*34*	3
Nontidal perennial aquatic	59	0	0	0	0	*59*	0	*9*	0
Nontidal freshwater perennial emergent wetland	2	0	0	0	0	*2*	0	*6*	0
Alkali seasonal wetland complex	2	0	0	0	0	*2*	0	*0*	0
Vernal pool complex	28	0	0	0	0	*28*	0	*3*	0
Managed wetland	96	0	0	0	0	*96*	75	*29*	0
Other natural seasonal wetland	0	0	0	0	0	*0*	0	*0*	0
Grassland	516	0	0	0	0	*516*	10	*159*	8
Inland dune scrub	0	0	0	0	0	*0*	0	*0*	0
Cultivated lands	4,079	60	297	1,009	1,307	*6,842*	867	*1,415*	76

Table 4.4.8-2 Alternative 2D Effects on Jurisdictional Wetlands and Waters Relative to Alternative 4A (acres)

	Alternative 2D Impacts on Jurisdictional Wetlands and Waters				
Wetland/Water Type	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]	Difference from 4A[d]
Agricultural Ditch	48.6	18.6	0	67.2	4.3
Alkaline Wetland	20.3	0.1	0	20.4	0
Clifton Court Forebay	258.0	0	1,931.0	258.0	0
Conveyance Channel	8.0	2.9	0	10.8	0
Depression	29.3	8.5	0	37.8	1.4
Emergent Wetland	57.3	32.3	0	89.6	0.9
Forest	9.0	9.1	0	18.0	1.2
Lake	23.2		0	23.2	0
Scrub-Shrub	25.3	6.1	0	31.4	13.3
Seasonal Wetland	114.6	25.1	0	139.7	0
Tidal Channel	25.3	104.9	0	130.2	30.3
Vernal Pool	0.3	18.6	0	0.3	0
Total	619	207	1,931	827	51.3

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.
[b] Temporary impacts would result from dredging Clifton Court Forebay.
[c] Total does not include temporary impacts on Clifton Court Forebay because these would be temporary disturbance to open water, which typically does not require compensatory mitigation.
[d] Difference in total impacts between 5A and 4A.

NEPA Effects: Alternative 2D would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. As with Alternative 4A, this alternative also would not substantially disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, Alternative 2D would result in existing habitat converted by water conveyance construction and restoration actions but to a slightly larger degree. The temporarily affected habitat would be restored to its pre-project condition and the restoration under the environmental commitments (Environmental Commitments 3, 4, 6–10) would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The environmental commitments would result in the protection of 14,958 acres and restoration of 2,802 acres of natural communities to offset effects. Where environmental commitments would not fully offset effects, AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37-39, and in some cases specific mitigation measures have been developed to avoid and minimize adverse effects. Alternative 2D would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

CEQA Conclusion: Alternative 2D would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species, and common species that occupy the study area. As with Alternative 4A, this alternative also would not significantly disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, existing habitat would be converted during construction of water conveyance facilities and the associated restoration to offset these impacts. The temporarily affected habitat would be restored to its pre-project condition and the restoration conservation measures (Environmental Commitments 3, 4, 6–10) would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The environmental commitments would result in the protection of 14,958 acres and restoration of 2,802 acres of natural communities and, together with AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37–39, and in some cases specific mitigation measures would mitigate the projects impacts to a less-than significant-level. Alternative 2D would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

As with Alternative 4A, Alternative 2D would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the Environmental Commitments provided and AMMs provided by Alternative 2D. The relevant mitigation measures, which are included in detail in the analysis of Alternative 4A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries
- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the U.S.

4.4.9 Land Use

Impact LU-1: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The nature of impacts related to incompatibility with land use regulations stemming from the construction of water conveyance structures under Alternative 2D would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because the alignments are the same. However, whereas Alternative 4 includes Intakes 2, 3, and 5, Alternative 2D includes Intakes 1 through 5. Because Alternative 2D would include the same physical/structural components as Alternative 4 and two additional intakes, impacts would be of a slightly greater magnitude.

Like Alternative 4, Alternative 2D would place temporary and permanent structures on lands designated for other uses by the general plans of Sacramento, San Joaquin, Contra Costa, and Alameda Counties. However, because Alternative 2D includes five intakes, it is anticipated that more acres would be impacted than under Alternative 4. The construction of the water conveyance facilities would require land use activities that would be incompatible with land use designations, goals and policies ascribed to the study area and for the purposes of reducing environmental impacts. To the extent that constructing Alternative 2D would result in incompatibilities with land use designations, goals and policies designed to avoid or reduce environmental effects, these potential incompatibilities are described in Alternative 4 of Chapter 13, *Land Use*, Section 13.3.3.9, Impact LU-1 in Appendix A of this RDEIR/SDEIS. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, to the extent that alternatives are incompatible with such land use designations, goals, and policies, any related environmental effects are discussed in other chapters.

CEQA Conclusion: These incompatibilities indicate the potential for a physical consequence to the environment. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, the physical effects they suggest are discussed in other chapters throughout this document. The relationship between plans, policies, and regulations and impacts on the physical environment is discussed in Section 13.3.1, *Methods for Analysis*, of the Draft EIR/EIS.

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The nature of effects related to conflicts with existing land uses under Alternative 2D would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because the alignments are the same. However, whereas Alternative 4 includes Intakes 2, 3, and 5, Alternative 2D includes Intakes 1 through 5. Because Alternative 2D would include the same physical/structural components as Alternative 4 and two additional intakes, there would be a greater impact related to construction two additional intakes. As for Alternative 4, construction and operation of physical facilities for water conveyance would create temporary or permanent conflicts with existing land uses (including displacement of existing structures and residences) because of the construction of permanent features of the facility. Because Alternative 2D includes five intakes, it is anticipated that more structures would be impacted than under Alternative 4. Indirect impacts would primarily happen as a result of incompatibility with adjacent land uses or the loss or increased difficultly of access to parcels. Table 13-12 in Appendix A of this RDEIR/SDEIS, summarizes the estimated number of structures affected across structure type and alternative and

Mapbook Figure M13-4 in the Mapbook Volume of the Draft EIR/EIS shows the distribution of these effects across the Modified Pipeline/Tunnel conveyance alignment.

The removal of a substantial number of existing permanent structures as a result of constructing the water conveyance facility would be considered a direct, adverse socioeconomic effect of this alternative under NEPA. When required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative, which would reduce the severity of economic effects related to this physical impact, but would not reduce the severity of the physical impact itself. Project conflicts with existing public structures under Alternative 4 are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential adverse effects on the environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential adverse effects on traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS.

CEQA Conclusion: Construction of the proposed water conveyance facility would necessitate the removal of a substantial number of existing permanent structures. The removal of existing structures is not, in itself, considered an environmental impact, though removal might entail economic impacts. Significant environmental impacts would only result if the structures qualified as "historical resources" or the removal of structures led to physical effects on certain other resources. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, such effects are discussed in other sections throughout the document. Project conflicts with existing public structures under Alternative 2D are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential impacts on the public and environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in Section 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential impacts on "historical resources" (including qualifying structures) and traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS. Where applicable, project proponents will provide compensation to property owners for losses due to implementation of Alternative 2D. This compensation would not constitute mitigation for any related physical impact; however, it would reduce the severity of economic effects.

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: Effects related to any potential division of an existing community as a result of the construction of water conveyance facilities under Alternative 2D would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but with greater magnitude due to construction of additional intakes. Construction of permanent facilities and associated work areas would be located in and around the community of Hood, in some cases displacing structures in the community and creating linear construction zones between structures within the community. Intake 4 would be constructed along the southern border of the community over a period of approximately four years, altering a point of access to the community. Work areas associated with construction of the conveyance pipeline carrying water from Intakes 1 through 4 to the intermediate forebay would run north to south in the eastern section of the community. Additionally, a temporary work area associated with construction of the conveyance facilities would be built adjacent to Hood on the southern side of the community, and would serve as a staging area during the construction phase. It would consist of facilities such as parking areas, offices, and construction equipment storage. A tunnel carrying water south from Intakes 1 through 3 to the intermediate forebay would be placed under the community. The tunnel would be constructed below the surface and would not interfere with the existing community; therefore, the alignment would not create a physical structure adjacent to or through the existing community. A temporary power line would be constructed around the northern, eastern, and southern sections of the community, which would provide power to the intake work areas during construction. Proposed permanent transmission lines would be constructed to the east of the community to provide power to the intake facilities. Construction and the long-term placement of Intakes 3, 4, and 5, would be built about one-quarter mile north, immediately south, and one-half mile south of Hood, respectively, and would substantially alter the lands to the north and south of the community. While permanent physical structures adjacent to or through Hood are not anticipated to result from this alternative, activities associated with their construction could make it difficult to travel within and around Hood in certain areas for a limited period of time. Additionally, the lasting placement of the intake facilities and intermediate forebay would represent physical structures that would substantially alter the setting of the community and its immediate surroundings, constituting an adverse effect. Mitigation Measures TRANS-1a and TRANS-1b are available to address this effect.

CEQA Conclusion: During the construction of the tunnels between Intakes 1 and 5 and the intermediate forebay, construction activities would occur to the north and south of the community of Hood, and proposed temporary and proposed permanent power lines would cross through portions of the community. Even though access to and from the community would be maintained over the long-term, the nearby construction of the temporary work area would substantially alter the setting of the community in the near term. Similarly, the nearby construction of Intakes 3, 4 and 5, would create permanent physical structures approximately one-quarter mile north, immediately south, and one-half mile south of Hood that would substantially alter the community's surroundings. These structures would therefore result in a significant and unavoidable impact. Implementation of Mitigation Measures TRANS-1a and TRANS-1b would reduce the severity of this impact by supporting continued access to and from the community on transportation routes; however, permanent structures in the community's vicinity would remain, and the impact would be significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact LU-4: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 2D related to incompatibility with applicable land use designations, goals, and policies resulting from implementation of Environmental Commitments3, 4, 6–12, 15, and 16 would be similar in mechanism to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, if this RDEIR/SDEIS, Alternative 2D would protect and restore up to 17,766 acres of habitat under Environmental Commitment 3, 4, and 6–10 as compared with 83,800 acres under Alternative 4. Up to 5.5 miles of channel margin habitat would be enhanced under Alternative 2D with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 2D would likely be substantially smaller than those associated with Alternative 4. Because Alternative 2D does not include those Conservation Measures, the BDCP will be treated as a covered activity under the Delta Plan. The consistency between this alternative and the Delta Plan is discussed in detail in Appendix G of this RDEIR/SDEIS.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land use designations, goals, and policies. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, local designations, goals, and policies related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations for the implementation of many of these land-intensive actions are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-5: Conflicts with Existing Land Uses as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects related to conflicts with existing land uses under Alternative 2D would be similar in mechanism to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 2D (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS, and under Impact LU-4, above). While the location of each restoration and/or enhancement action is not known at this time, it is possible that implementing these measures may result in temporary (e.g., construction activities that may conflict with land designated as open space) or permanent (e.g., displacement of existing residents and removal of existing structures) physical conflicts with existing land uses in or immediately adjacent to the study area.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with land uses within and adjacent to the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, land uses related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations and types of restoration to be implemented are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would conflict with existing land uses or result in the permanent conversion of land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapters 13, *Agricultural Resources*, and 11, *Terrestrial Resources*. Therefore, implementation of this alternative is not anticipated to conflict with existing land uses. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-6: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects related to the physical division of an existing community under Alternative 2D would be similar in mechanism to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 2D (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS, and under Impact LU-4, above). Because the locations for the implementation of these habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is not anticipated to be adverse.

CEQA Conclusion: Because the locations for the implementation of habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is anticipated to be less than significant.

4.4.10 Agricultural Resources

Impact AG-1: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The temporary and short-term conversion and permanent conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses would be similar to those described under Alternative 4 (as described in Chapter 14, *Agricultural Resources*, Section 14.3.3.9 in Appendix A of this RDEIR/SDEIS) and would constitute an adverse effect on the physical environment. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher agricultural conversion effects when compared to Alternative 4. Disposal and reuse of RTM (described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS), along with Mitigation Measure AG-1, would be available to reduce these effects.

CEQA Conclusion: Construction of physical structures associated with the water conveyance facility proposed under this alternative would occupy Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones, directly precluding agricultural use for the duration of construction. As described above and in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, it is anticipated that the RTM and dredged material would be removed from RTM storage areas (which represent a substantial portion of the permanent impact areas) and reused, as appropriate, as bulking material for levee maintenance, as fill material for habitat restoration projects, or other beneficial means of reuse identified for the material. Because these activities would convert a substantial amount of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses, however, they are considered significant impacts on the environment. Implementation of Mitigation Measure AG-1 would reduce these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4. For further discussion of potential incompatibilities with land use designations, see Section 4.4.9, *Land Use*, in this RDEIR/SDEIS.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in the Draft EIR/EIS.

Impact AG-2: Other Effects on Agriculture as a Result of Constructing and Operating the Proposed Water Conveyance Facility

Effects associated with construction and operation of the water conveyance facility under this alternative would be similar to those described under Alternative 4 in terms of effects related to seepage from the operation of forebays and from disruption of drainage and irrigation facilities during construction of water conveyance facilities. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher effects related to disruption of agricultural infrastructure when compared to Alternative 4. These activities could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas adjacent to forebays and through disruption of drainage and irrigation facilities.

Under Alternative 2D, Operational Scenario B, the operation of new physical facilities combined with hydrodynamic effects of habitat restoration activities could indirectly affect agriculture by causing changes to the quality of irrigation water in parts of the study area. Relative to Existing Conditions, Alternative 2D would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and in the San Joaquin River at San Andreas Landing (Table EC-9 in Appendix B of this RDEIR/SDEIS). The percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions to 16% and the percent of days out of compliance would increase from 11% under Existing Conditions to 25%. The percent of days the San Andreas Landing EC objective would be exceeded would remain at 1% under Alternative 2D, but the percent of days out of compliance with the EC objective for San Andreas Landing would increase from 1% to 2%. San Andreas Landing average EC would decrease 6% for the entire period modeled, but would increase 2% during the drought period modeled, relative to Existing Conditions (Table EC-16 in Appendix B of this RDEIR/SDEIS). Alternative 2D is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions.

As discussed in Section 4.4.4, *Water Quality*, of this RDEIR/SDEIS, sensitivity analyses suggest that many of these modeled exceedances are a result of modeling artifacts or a result of operating rules used by the CALSIM II model under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements. In these cases, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions, as suggested by modeling results. In the case of San Andreas Landing, the small number of modeled exceedances not attributable to modeling artifacts would be small in magnitude, last only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, *Water Quality,* Section 8.3.1.1, in Appendix A of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). However, the results at Emmaton indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects on agricultural beneficial uses.

In general, the changes in frequency of exceedances of EC objectives relative to the No Action Alternative (ELT) would be similar to those discussed above relative to Existing Conditions, and thus the conclusions of the sensitivity analyses discussed above extend to the comparison to the No Action Alternative (ELT). Long-term monthly average EC levels at Emmaton would increase 1–12% for the entire period modeled (1976–1991) and 4–33% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Table EC-16 in Appendix B of this RDEIR/SDEIS). The largest increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. During these periods, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for

May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative (ELT). Alternative 2D is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing relative to the No Action Alternative.

NEPA Effects: Considered together, construction and operation of the water conveyance facility under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Water quality modeling results indicate that there could be increased long-term and drought period average EC levels during the summer months that would occur in the western Delta (i.e., in the Sacramento River at Emmaton) under this alternative relative to the No Action Alternative (ELT), that could contribute to adverse effects on the agricultural beneficial uses. Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 will reduce the severity of these adverse effects.

CEQA Conclusion: Water conveyance facility construction and operation could create a significant adverse impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Modeling results indicate that relative to Existing Conditions, average EC levels at Emmaton would increase during the drought period with the largest increase occurring during the summer months of the drought period, and more generally in dry and critical water year types. These increases would potentially impact agricultural beneficial uses in the western Delta. As discussed in Section 4.4.4, *Water* Quality, the comparison to Existing Conditions reflects changes in EC due to both Alternative 2D operations and climate change/sea level rise. The EC effects expected to occur at Emmaton would be due in part to the effects of climate change/sea level rise, and in part due to Alternative 2D operations.

Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 will reduce the severity of these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; monitoring changes in groundwater levels during construction; offsetting water supply losses attributable to construction dewatering activities; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. Implementation of Mitigation Measure WQ-11 would be expected to reduce the EC effects to a less than significant level. However, the impacts related to conversion of Important Farmland would remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure WQ-11: Avoid, Minimize, or Offset, as Feasible, Reduced Water Quality Conditions

Please see Mitigation Measure WQ-11 under Impact WQ-11 in the discussion of Alternative 1A in Chapter 8, *Water Quality*, of the Draft EIR/EIS.

Impact AG-3: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 2D related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4A in Section 4.3.10 of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 2D would protect and restore up to 17,766 acres of habitat under Environmental Commitment 3, 4, and 6-10 as compared with 83,800 acres under Alternative 4. Up to 5.5 miles of channel margin habitat would be enhanced under Alternative 2D with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 2D would likely be substantially smaller than those associated with Alternative 4.

NEPA Effects: Because locations have not been selected for many of these habitat restoration and enhancement activities, the precise extent of this effect is unknown. However, based on the large proportion of land in the Conservation Zones designated as Important Farmland and/or subject to Williamson Act contracts or in Farmland Security Zones, it is anticipated that a substantial area of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones would be directly converted to habitat purposes under this alternative, resulting in an adverse effect on the environment. While conflicts with or cancellation of Williamson Act contracts would not—by itself—constitute an adverse effect on the quality of the human environment, the related conversion of the underlying agricultural resource would result in such an effect. Mitigation Measure AG-1 would be available to lessen the severity of these potential effects. Also, under the provisions of Government Code §51223, it may be feasible to rescind Williamson Act contracts for agricultural use, and enter into open space contracts under the Williamson Act, or open space easements pursuant to the Open Space Easement Act. To the extent this mechanism is used, it would eliminate the Williamson Act conflicts otherwise resulting from changes from agriculture to restoration and mitigation uses. For further discussion of potential incompatibilities with land use policies, see Section 4.4.9, *Land Use*, of this RDEIR/SDEIS.

CEQA Conclusion: Implementation of Environmental Commitments could result in conversion of a substantial amount of Important Farmland and conflict with land subject to Williamson Act contracts or in Farmland Security Zones, resulting in a significant impact on agricultural resources in the study area. Implementation of Mitigation Measure AG-1 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Impact AG-4: Other Effects on Agriculture as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 2D related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4A. However, the acreages associated with some of these commitments would be somewhat higher than those proposed under Alternative 4A, as described in Impact AG-3 above.

NEPA Effects: Implementation of conservation actions under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. However, implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these adverse effects.

CEQA Conclusion: Implementation of Environmental Commitments under this alternative could create a significant impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. Implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

4.4.11 Recreation

Impact REC-1: Permanent Displacement of Existing Well-Established Public Use or Private Commercial Recreation Facility Available for Public Access as a Result of the Location of Proposed Water Conveyance Facilities

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4 in Appendix A of this RDEIR/SDEIS, except that it would include two additional intakes compared to Alternative 4. The extent of the permanent displacement of public use or private commercial recreation areas located within the Delta occurring under Alternative 2D as a result of the location of the intakes would be the same as described for Alternative 2, as described in Chapter 15, *Recreation* of the Draft EIR/EIS. The proposed location of the Alternative 2A five intake facilities, tunnels, and associated water conveyance facilities would not lie within the designated boundaries of an existing public use recreation site. The post-construction location of the water conveyance facilities would not result in long-term disruption or reduction of any well-established recreation activity or site, including parks, marinas, or other designated areas. Therefore, there would be no adverse effects. The extent of the permanent displacement of public use or private commercial recreation areas under Alternative 2D as a result of the conveyance facilities located along the rest of the alignment past the intakes, would be the same as described for Alternative 4, as described in Chapter 15, *Recreation*, Section 15.3.3.9 in Appendix A of this RDEIR/SDEIS.

CEQA Conclusion: The extent of permanent displacement of public use or private commercial recreation areas as a result of the location of the intakes under Alternative 2D would be the same as discussed for Alternative 2 because the location of proposed intakes are similar between the two alternatives. The alternative would not locate alternative facilities that would result in the permanent displacement of any well-established public use or private commercial recreation facility available for public access. The extent of permanent displacement of public use or private commercial recreation areas as a result of the location of the rest of the alignment past the intakes under Alternative 2D would be the same as discussed for Alternative 4 because the location of proposed alignments are similar between the two alternatives. Therefore, impacts are considered less than significant. No mitigation is required.

Impact REC-2: Result in Long-Term Reduction of Recreation Opportunities and Experiences as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction of recreation experiences within the Delta as a result of construction the water conveyance facilities under Alternative 2D would be the same as described for Alternative 2A in relation to construction of Intakes 1, 2, 3, and 4, and the same as Alternative 4 in relation to construction of Intakes 3 and 5 as well as the rest of the alignment past the intakes. Clarksburg Boat Launch and Stone Lakes National Wildlife would be affected by long-term noise and visual disturbances from the construction of the intakes, as described under Alternative 2. Two recreation sites, Clifton Court Forebay and Cosumnes River Preserve, are within the potential construction footprint and six recreation sites or areas (Stone Lakes National Wildlife Refuge, Clarksburg Boat Launch, Wimpy's Marina, Delta Meadows, Bullfrog Landing Marina, and Lazy M Marina) are within the 1,200- to 1,400-foot indirect impact area, as described in Alternative 4. Potential indirect effects on recreation include loss of access, construction noise, and changes in the visual character of the area surrounding the recreation sites.

As discussed in detail under Alternative 1A (Alternative 2 refers to Alternative 1A for detailed discussion of impacts), Stone Lakes National Wildlife Refuge would be affected by noise and visual disturbances as a result of construction of and associated work areas related to Intakes 1 through 4.

As discussed in detail under Alternative 4, impacts on recreation occurring within the Stone Lakes NWR would be attributable to noise and changes in visual character as a result of temporary work areas, RTM storage, geotechnical exploration, construction of Intakes 2 and 3, and construction of the temporary transmission lines. Recreation activities that could be adversely affected include wildlife and environmental education.

The Clarksburg Boat Launch is on the west bank of the Sacramento River across the river from the site of Intake 3. Although access to the boat launch would be maintained during the construction period, noise generated during construction and geotechnical testing could adversely affect use of the public access areas near the boat launch for fishing or other activities.

As discussed under Alternative 4, impacts on recreation opportunities occurring within the Cosumnes River Preserve would include disruption of wildlife viewing and docent-guided tours. Although no recreation opportunities would be permanently displaced, recreation opportunities occurring within portions of the preserve could be adversely affected during construction as result of the introduction of noise, light, and temporary facilities such as access roads, safe haven work sites, and tunnel shaft with temporary work areas.

Wimpy's Marina is a private boating facility located on the south fork of the Mokelumne River southeast of Walnut Grove. Geotechnical exploration would occur along the tunnel corridor for approximately 2.5 years and would introduce noise that would adversely affect recreation occurring at the marina.

As discussed in detail under Alternative 4, recreation occurring at Delta Meadows could be affected by geotechnical testing and construction and operation of the intermediate forebay and spillway. These features would generate noise and introduce visual disturbances to the recreation site.

Recreation occurring at the Bullfrog Landing Marina on Middle River could be affected by noise and visual disturbance as a result of constructing the water conveyance across Bacon Island. This would include impacts from constructing a temporary access road on the island as well as a temporary safe haven work area. Anglers on the river between the marina and the construction area would also experience noise and visual disturbances during construction.

On-water recreation opportunities not associated with formal recreation sites could be affected by the introduction of noise and light during the construction period. The quality of recreation opportunities in the vicinity of construction sites may be adversely affected by noise and changes in visual character.

As discussed in detail under Alternative 4, recreation opportunities, including fishing and hunting, could be adversely affected by expanding Clifton Court Forebay. Recreation would be adversely affected because access to the forebay would not be allowed during construction.

Construction of Alternative 2D intakes and water conveyance facilities would result in disruption to recreational opportunities. Indirect effects on recreation experiences may occur as a result of impaired access, construction noise, or negative visual effects. Overall, construction and geotechnical exploration may occur year-round and last from 2.5 to 13.5 years at individual construction sites near recreation sites or areas and in-river construction would be primarily limited to June 1 through October 31 each year, which would result in a long-term reduction of recreational opportunities or experiences. Mitigation measures (REC-2, BIO-75, AES-1a, AES-1b, AES-1c, AES-1d, AES-1e, AES-1f, AES-1g, AES-2D, AES-4b, AES-4c, TRANS-1a, TRANS-1b, TRANS-1c, NOI-1a, and NOI-1b) are available to address adverse effects on recreation resulting from introduction of noise and light and the loss of access. However, due to the length of time that construction would occur and the dispersed effects across the Delta, the direct and indirect effects related to temporary disruption of existing recreational activities at facilities within the impact area would be adverse.

CEQA Conclusion: Construction of the Alternative 2D intakes and related water conveyance facilities would result in permanent and long-term (i.e., lasting over 2 years) impacts on well-established recreational opportunities and experiences in the study area because of access, noise, and visual setting disruptions that could result in loss of public use. These impacts would occur year-round. The mitigation measures described below, in combination with environmental commitments, would reduce some construction-related impacts by compensating for effects on wildlife habitat and species; minimizing the extent of changes to the visual setting, including nighttime light sources; manage construction-related traffic; and implementing noise reduction and complaint tracking measures. However, the level of impact would not be reduced to a less-than-significant level because it is not certain the mitigation would reduce the level of these impacts to less than significant in all the instances occurring within the entire study area. Therefore, these impacts are considered significant and unavoidable.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation*, of the Draft EIR/EIS.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

Please see Mitigation Measure BIO-75 under Impact BIO-75 in the discussion of Alternative 4 in Chapter 12, *Biological Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see to Mitigation Measure AES-1c under Impact AES-1in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-2D: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Please see Mitigation Measure AES-2D under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please see Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please see Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please see Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please see Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact REC-3: Result in Long-Term Reduction of Recreational Navigation Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction in recreational navigation opportunities as a result of constructing the proposed water conveyance facilities under Alternative 2D would be similar to Alternative 2A in relation to construction of Intakes 1, 2, 3, and 4, and Alternative 4 in relation to Intakes 2, 3, and 5 as well as the rest of the alignment. Construction activities associated with constructing five intakes on the Sacramento River, siphons near Clifton Court Forebay, Head of Old River barrier and operating barges and constructing temporary barge unloading facilities at Snodgrass Slough, Potato Slough, San Joaquin River, Middle River, Connection Slough, Old River, and the West Canal would disrupt boat passage and navigation at and near these sites. Although implementing Mitigation Measure TRANS-1a and helping to fund measures to reduce aquatic weeds would reduce impacts on recreational navigation, these effects would remain adverse because of the long duration of construction which would continually reduce recreation opportunities and distract from experiences occurring near construction activity.

CEQA Conclusion: Impacts on recreational navigation during construction of the water conveyance facilities under Alternative 2D would be similar to those described under Alternatives 2A and 4. Impeding boat passage and navigation and resulting impacts on recreation would occur during construction of the intakes, temporary barge unloading facilities, and siphons. Although Mitigation Measure TRANS-1a would reduce impacts on navigation associated with barge unloading facilities and participating in the aquatic weed reduction program would help address impacts on navigation, the impact of constructing the water conveyance facilities would be considered significant and unavoidable.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact REC-4: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of changes in sport fishing opportunities occurring within the study area under Alternative 2D would be similar to Alternative 2A in relation to construction of Intakes 1, 2, 3, and 4, and Alternative 4 in relation to Intakes 2, 3, and 5 as well as the rest of the alignment. Constructing water intakes, siphons, and operable barrier and placement and use of barge unloading facilities during tunnel/pipeline construction would result in temporary water quality effects (e.g., turbidity, accidental spills, disturbance of contaminated sediments); elevated underwater noise (associated with pile driving and other construction activities); fish exposure to stranding and direct physical injury; and temporary exclusion or degradation of spawning and rearing habitats. Expanding Clifton Court Forebay would restrict access to bank fishing sites during the construction period. Although fish populations likely would not be affected to the degree that the abundance of sport fish would be substantially reduced, construction conditions would introduce noise and visual disturbances that would affect the recreation experience for anglers.

Although construction would occur for more than 2 years and cause a long-term reduction in fishing opportunities at one recreational site, construction of the proposed water conveyance facilities would not affect most fishing opportunities throughout the Delta. Additionally, mitigation measures are available to enhance and ensure access to nearby fishing sites and to address noise and visual disturbances.

Construction of the water conveyance facilities would not result in a long-term adverse effect on fishing opportunities because the effects would be limited to construction sites and would not limit fishing opportunities occurring in other parts of the Delta. Mitigation Measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would help reduce or avoid impacts on recreational fishing occurring at construction sites.

CEQA Conclusion: The impact on recreational fishing opportunities as a result of constructing the water conveyance facilities under Alternative 2D would be similar to Alternative 2A in relation to construction of Intakes 1, 2, 3, and 4, and Alternative 4 in relation to Intakes 2, 3, and 5 as well as the rest of the alignment. The combined impact on recreational fishing opportunities would be considered significant. Implementing mitigation measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would reduce the impact on recreational fishing to a less-than-significant level by providing alternate fishing sites, reducing noise generated during construction activities, and limiting changes in the visual character of recreational fishing sites.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under, Alternative 1A in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact REC-5: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of the Operation of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of operating the water conveyance facilities on recreational fishing opportunities under Alternative 2D would be similar to Alternative 2A in relation to the location of Intakes 1, 2, 3, and 4, and Alternative 4 in relation to Intakes 2, 3, and 5 as well as the rest of the alignment. Operation of Alternative 2D may result in changes in entrainment, spawning, rearing, and migration. However, effects on fish species that are popular for recreational fishing are not of a nature/level that will adversely affect recreational fishing. While there are some significant impacts on specific non-listed species, as discussed in Section 4.3.7, *Fish and Aquatic Resources*, of this RDEIR/SDEIS, they are typically limited to specific rivers and not the population of that species as a whole. The effect is not adverse because it would not result in a substantial long-term reduction in recreational fishing opportunities.

CEQA Conclusion: The potential impact on covered and non-covered sport fish species from operation of Alternative 2D would be considered less than significant because any impacts on fish and, as a result, impacts on recreational fishing, are anticipated to be isolated to certain areas and would not affect the abundance of popular sport fish.

Impact REC-6: Cause a Change in Reservoir or Lake Elevations Resulting in Substantial Reductions in Water-Based Recreation Opportunities and Experiences at North- and South-of-Delta Reservoirs

NEPA Effects: The methodology for assessing effects on recreation at major upstream storage reservoirs for Alternative 2D is the same as applied to Alternative 2A. However, Alternative 2A only analyzes Operational Scenario B Late Long Term compared to No Action Alternative Late Long Term (2060). Alternative 2D analyzes Operational Scenario B Early Long Term compared to No Action Alternative Early Long Term (2025). The results of this assessment are shown in Tables 4.3.11-1 and 4.3.11-2 below.

Existing Conditions (CEQA Baseline) Compared to Alternative 2D ELT (2025)

Under Alternative 2D Operational Scenario B recreation thresholds would be exceeded more frequently at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs relative to Existing Conditions. These changes represent a greater than 10% increase in the frequency the recreation thresholds are exceeded under Operational Scenario B Early Long Term at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs compared to Existing Conditions. However, as discussed in Section 15.3.1, *Methods for Analysis*, of the Draft EIR/EIS these changes in SWP/CVP reservoir elevations are primarily attributable to change in demand and other external factors such as sea level rise and climate change. It is not possible to specifically define the exact extent of the changes due to implementation of the action alternative using these model simulation results. Thus, the precise contributions of the external factors to the total differences between Existing Conditions and Alternative 2D Operational Scenario B Early Long Term cannot be isolated in this comparison. Please refer to the comparison of the No Action Alternative (ELT) to Alternative 2D for a discussion of the potential effects on end-of-September reservoir and lake elevations attributable to operation of Alternative 2D.

Existing Conditions (CEQA Baseline) Compared to Alternative 2D LLT (2060)

Existing Conditions compared to Alternative 2D LLT (2060) results are the same as described under Alternative 2A.

No Action Alternative (ELT) Compared to Alternative 2D

The comparison of Alternative 2D to the No Action Alternative (ELT) condition most closely represents changes in reservoir elevations that may occur as a result of operation of Alternative 2D because both conditions external factors such as change in demand and sea level rise and climate change (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS). As shown in Table 4.3.11-1 and Table 4.3.11-2, below, Alternative 2D Operational Scenario B Early Long Term would result in changes in the frequency with which the end-of-September reservoir levels at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs would fall below levels identified as important water-dependent recreation thresholds. The CALSIM II modeling results indicate that reservoir levels under Alternative 2D ELT operations would either not change or would fall below the individual reservoir recreation thresholds less frequently than under No Action Alternative (ELT) conditions at Trinity, Shasta, and Oroville Reservoirs. Operation of Alternative 2D would not adversely affect water-dependent or water-enhanced recreation at these reservoirs. Overall, these conditions represent improved recreation conditions for ELT results under operation of Alternative 2D because there would be slightly fewer years in which end-of-September reservoir levels would fall below the recreation thresholds thus indicating better boating opportunities, when compared to No Action Alternative (ELT) conditions.

The ELT modeling result for Folsom Reservoir indicates there could be 4 additional years under Alternative 2D, during which the reservoir level would fall below the reservoir's boating threshold at the end of September. The change would not exceed the 10% increase in the frequency threshold that would indicate an adverse impact on recreation occurring at the reservoir.

The ELT modeling result for New Melones Reservoir indicates there could be 1 additional year under Alternative 2D, during which the reservoir level would fall below the reservoir's boating threshold at the end of September. The change would not exceed the 10% increase in the frequency threshold that would indicate an adverse impact on recreation occurring at the reservoir.

The ELT modeling results for San Luis Reservoir indicate there could be 26 additional years under Alternative 2D, during which the reservoir level would fall below the reservoir boating threshold at the end of September relative to the No Action Alternative (ELT) condition. This is a greater than 10% change and would be considered a substantial reduction in recreational boating opportunities at San Luis Reservoir. Shoreline fishing would still be possible, and other recreation activities at the reservoir—picnicking, biking, hiking, and fishing—would be available. The reduction in surface elevations at San Luis Reservoir under Operational Scenarios H3 and H4 would result in an adverse impact on recreation occurring at the reservoir by restricting access by boaters. Mitigation Measure REC-6 would be available to address this effect.

CEQA Conclusion: This impact on water-dependent and water-enhanced recreation opportunities at north- and south-of-Delta reservoirs would be less than significant because, with the exception of San Luis Reservoir, the CALSIM II modeling results indicate that reservoir levels attributable to

Alternative 2D operations would either slightly decrease (Folsom and New Melones Reservoirs) or would fall below the individual reservoir thresholds less frequently than under No Action Alternative (ELT). These changes in reservoir and lake elevations would result in a less-than-significant impact on recreation opportunities and experiences at Trinity, Shasta, Oroville, Folsom, and New Melones Reservoirs. At Trinity and Oroville Reservoirs, because there would be fewer years in which the reservoir or lake levels fall below the recreation threshold relative to No Action Alternative (ELT) conditions, these effects would be considered beneficial to recreation opportunities and experiences. Operation of Alternative 2D would not substantially affect water-dependent or water-enhanced recreation at these reservoirs. At San Luis Reservoir at ELT, the reduction in reservoir access by boaters would be significant because it is a greater than 10% change and could result in a significant impact on recreation. Mitigation Measure REC-6 would reduce this impact to less than significant.

Mitigation Measure REC-6: Provide a Temporary Alternative Boat Launch to Ensure Access to San Luis Reservoir

Consistent with applicable recreation management plans, DWR and Reclamation will work with DPR to establish a boat ramp extension at or near the Basalt boat launch or other alternative boat ramp site at San Luis Reservoir to maintain reservoir access in years when access becomes unavailable.

Table 4.3.11-1. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 2D

	Recreation Threshold[a]								
	Trinity Lake			Shasta Lake			Lake Oroville		
	<2,270 ft Elevation			<967 ft Elevation			<700 ft Elevation		
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative (ELT) (CEQA/ NEPA)
Existing Condition (CEQA)	21			17			17		
No Action Alternative (ELT)	32	11		22	5		26	9	
Alternative 2D (ELT)									
Operational Scenario B	31	10	-1	22	5	0	20	3	-6
Alternative 2D (LLT)									
Operational Scenario B	43	22		29	12		29	12	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action Alternative ELT). A positive change would indicate more years with reduced recreation opportunities.

Table 4.3.11-2. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 2D

	Recreation Threshold[a]								
	Folsom Lake <405 ft Elevation			New Melones Lake <900 ft Elevation			San Luis Reservoir <360 ft Elevation		
Scenario	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative ELT (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative ELT (CEQA/ NEPA)	Years[b]	Change Relative to Existing Condition (CEQA)[c]	Change Relative to No Action Alternative ELT (CEQA/ NEPA)
Existing Condition (CEQA)	22			9			3		
No Action (ELT)	33	11		8	-1		9	6	
Alternative 2D (ELT)									
Operational Scenario B	37	15	4	9	0	1	35	32	26
Alternative 2D (LLT)									
Operational Scenario B	44	22		12	3		34	31	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.
[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).
[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action ELT). A positive change indicates more years with reduced recreation opportunities relative to the comparison condition. A negative change indicates fewer years with reduced recreation opportunities relative to the comparison condition.

Impact REC-7: Result in Long-Term Reduction in Water-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on water-based recreation under Alternative 2D would be the same as described under Alternative 4. These potential effects would occur as a result of regular maintenance activities of the intakes. The effect on boating is not considered adverse because the boat passage around the intakes would be maintained and disruption of boat access in the immediate vicinity of the intakes would be short-term.

CEQA Conclusion: Effects on recreation resulting from the maintenance of intake facilities would be short-term and intermittent and would not result in significant impacts on boat passage, navigation, or water-based recreation within the vicinity of the intakes.

Impact REC-8: Result in Long-Term Reduction in Land-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on land-based recreation under Alternative 2D would be the same as described under Alternative 4. Maintenance activities would be short-term and intermittent, occur within the immediate vicinity of water conveyance facility, and are not expected to generate noise that would distract from adjacent recreation opportunities. Therefore, there would be no effects on recreation opportunities as a result of maintenance of the proposed water conveyance facilities.

CEQA Conclusion: Maintenance of conveyance facilities would be short-term and intermittent and would not result in any changes to land-based recreational opportunities. Therefore, there would be no impact and no mitigation would be required.

Impact REC-9: Result in Long-Term Reduction in Fishing Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 2D would result in effects on fishing opportunities similar to those described for Alternative 4. The magnitude of the effects occurring under Alternative 2D would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions (Environmental Commitments 3, 4, 6–12, 15, and 16) occurring in the Plan Area would be much less than the conservation measures proposed under Alternative 4. Construction, operation, and maintenance of the conservation and stressor reduction components could have affects that would be similar in nature to those discussed above for construction, operation, and maintenance of proposed water conveyance facilities. Although similar in nature, the potential intensity of any effects would likely be substantially lower because the nature of the activities associated with implementing the conservation and stressor reduction components would be much less when compared to Alternative 4. In addition, the conservation and stressor reduction components would be expected to result in long-term benefits to aquatic species.

During the implementation stage, construction activity associated with the conservation and stressor reduction components could result in adverse effects on recreation by temporarily or permanently limiting access to fishing sites and disturbing fish habitat. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would not be considered adverse because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance.

CEQA Conclusion: Conservation and stressor reduction components would be expected to improve fishing opportunities within the Plan Area. The adverse and beneficial impacts would be similar to those described under Alternative 4, however the extent of those impacts would be much less because the restoration actions occurring under Alternative 2D would include much less acreage and a smaller geographic scope than the conservation measures described under Alternative 4. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would be considered less than significant because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance.

Impact REC-10: Result in Long-Term Reduction in Boating-Related Recreation Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 2D would result in effects on boating-related recreation similar to the effects discussed under Alternative 4 for implementing conservation measures. However, the extent of the effects on boating under Alternative 2D would be much less because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less when compared to Alternative 4. Restoration of channel margin enhancement, riparian natural community, and nontidal marsh could provide increased boating opportunities within the study area.

CEQA Conclusion: Channel modification and other activities associated with implementation of some of the conservation and stressor reduction components may limit some opportunities for boating and boating-related recreation by reducing the extent of navigable water available to boaters. However, overall the conservation and stressor reduction components would also lead to an enhanced boating experience by expanding the extent of waterways available to boaters. Overall, these measures would not be anticipated to result in a long-term reduction in boating-related recreation activities; therefore, this impact is considered less than significant.

Impact REC-11: Result in Long-Term Reduction in Upland Recreational Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 2D would result in effects on upland recreational opportunities similar to Alternative 4. However, the extent of these effects occurring under Alternative 2D would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less. The actions could benefit the same types of recreation opportunities (e.g., hunting, hiking, walking, wildlife viewing, botanical viewing, nature photography, picnicking, and sightseeing) as described for Alternative 4, however the recreational benefits accruing from these actions would be much less because of the smaller acreage that would be restored. Conversely, the conservation and stressor reduction actions could adversely affected established recreation activities that would no longer be possible or compatible with restoration. These potential adverse effects would be would be similar to those described under Alternative 4, however the effects are expected to be much less because of the smaller total acreage that would be restored.

Implementing the conservation and stressor reduction components could result in an adverse effect on recreation opportunities by reducing the extent of upland recreation sites and activities available to hiking, nature photography, or other similar activity. However, implementation of the measures would also restore or enhance new potential sites for upland recreation thereby potentially improving the quality of recreational opportunities.

CEQA Conclusion: Similar to Alternative 4, site preparation and earthwork activities occurring under Alternative 2D required to implement the conservation and stressor reduction components could temporarily limit or disrupt opportunities for upland recreational. These impacts on upland recreational opportunities would be considered less than significant because—similar to Alternative 4—environmental commitments incorporated into the project would require the project proponents to consult with CDFW to expand wildlife viewing, angling, and hunting opportunities as an element of the conservation and stressor reduction components. These components would not be anticipated to result in a substantial long-term disruption of upland recreational activities; thus, this impact is considered less than significant.

Impact REC-12: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Recreation Resources

NEPA Effects: Similar to Alternative 4, constructing the water conveyance facilities and implementing the conservation and stressor reduction components under Alternative 2D could result in incompatibilities with plans and policies that address recreation. A number of plans and policies that coincide with the study area provide guidance for recreation resource issues are overviewed in Chapter 15, *Recreation*, Section 15.2, *Regulatory Setting*, of the Draft EIR/EIS. This overview of plan and policy compatibility evaluates whether Alternative 2D is compatible or incompatible with such enactments, rather than whether impacts are adverse or not adverse or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or regulation adopted to avoid or mitigate recreation effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 2D on recreation resources are addressed in Impacts REC-1 through REC-11, and in other sections, such as Section 4.3.19, *Noise*, and Section 4.3.13, *Aesthetics and Visual Resources*, of this RDEIR/SDEIS. A summary of the compatibility evaluations related to recreation resources for plans and policies is contained in the analysis of Alternative 4 and is applicable to Alternative 2D. Generally the evaluation found that implementing Alternative 2D would not be compatible with some provisions of The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992 and some policies of the Sacramento, San Joaquin, Contra Costa, and Alameda Counties general plans that address recreation.

CEQA Conclusion: The incompatibilities identified in the analysis indicate the potential for a physical consequence to the environment. The physical effects are discussed in Alternative 2D, impacts REC-1 through REC-11, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices.

4.4.12 Socioeconomics

Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities

The regional economic effects on employment and income in the Delta region during construction of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher project-related employment effects when compared to Alternative 4. Conversely, adverse effects associated with agricultural employment would also be somewhat higher due to the additional acreages of agricultural land that would be affected by construction of five intake facilities.

NEPA Effects: Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would temporarily increase total employment and income in the Delta region. The change would result from expenditures on construction, increasing employment, and from changes in agricultural production, decreasing employment. Changes in recreational expenditures and natural gas well operations could also affect regional employment and income, but these have not been quantified. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other sections throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources*, Impacts AG-1 and AG-2; changes in recreation related activities are addressed in Section 4.4.11, *Recreation,* Impacts REC-1 through REC-4; abandonment of natural gas wells is addressed in Section 4.4.22, *Minerals*, Impact MIN-1. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-2: Effects on Population and Housing in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on population and housing in the Delta region during construction of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher project-related changes in population and housing demand when compared to Alternative 4. Construction of five intakes under this alternative would also be anticipated to result in slightly higher effects associated with displacement of residential structures, which could create additional demand for housing in localized areas.

The construction workforce would most likely commute daily to the work sites from within the five-county region; however, if needed, there are about 53,000 housing units available to accommodate workers who may choose to commute on a workweek basis or who may choose to temporarily relocate to the region for the duration of the construction period. In addition to the available housing units, there are recreational vehicle parks and hotels and motels within the five-county region to accommodate any construction workers. As a result, and as discussed in more detail in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS, construction of the proposed conveyance facilities is not expected to substantially increase the demand for housing within the five-county region.

NEPA Effects: Within specific local communities, there could be localized effects on housing. However, given the availability of housing within the five-county region, predicting where this impact might fall would be speculative. In addition, new residents would likely be dispersed across the region, thereby not creating a burden on any one community. Because these activities would not result in permanent concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population. Therefore, the minor increase in demand for housing is not anticipated to lead to a reasonably foreseeable adverse physical changes constituting a significant impact on the environment.

Impact ECON-3: Changes in Community Character as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in community character in the Delta region during construction of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 2D two additional intake facilities would be constructed, which would result in additional localized effects on community character when compared to Alternative 4, particularly in and around the communities of Clarksburg, Hood, and Courtland.

Under Alternative 2D, additional regional employment and income could create net positive effects on the character of Delta communities. In addition to potential demographic effects associated with changes in employment, however, property values may decline in areas that become less desirable in which to live, work, shop, or participate in recreational activities. For instance, negative visual- or noise-related effects on residential property could lead to localized abandonment of buildings. While water conveyance construction could result in beneficial effects relating to the economic welfare of a community, adverse social effects could also arise as a result of declining economic stability in communities closest to construction effects and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce adverse effects (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

CEQA Conclusion: Construction of water conveyance facilities under Alternative 2D could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to physical impacts involving population growth, such impacts are described under Impact ECON-2 and in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-4: Changes in Local Government Fiscal Conditions as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in local government fiscal conditions during construction of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives would be similar. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in higher project-related effects on property tax and assessment revenue when compared to Alternative 4. However, California Water Code Section 85089 subdivision (b) specifies that the entities constructing and operating a new Delta conveyance facility will fully mitigate for the loss of property tax revenues or assessments levied by local governments or special districts. The Water Code requirement will ensure that forgone tax revenues as a result of transferring land from private to public ownership will be fully offset In addition, as discussed under Impact ECON-1, construction of the water conveyance facilities would be anticipated to result in a net temporary increase of income and employment in the Delta region. This would also create an indirect beneficial effect through increased sales tax revenue for local government entities that rely on sales taxes.

CEQA Conclusion: Under Alternative 2D, construction of water conveyance facilities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. The potential losses would be offset by the provisions in the California Water Code that require entities constructing and operating new Delta water conveyance facilities to fully mitigate for the loss of property tax or assessment levied by local governments or special districts. It is anticipated that the Water Code requirement will ensure that forgone tax revenues will be fully offset. In addition, CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. The potential for a physical change to the environment as a result of changes in tax revenues would be avoided by offsetting the potential losses in tax revenues.

Impact ECON-5: Effects on Recreational Economics as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: As described and defined in Section 4.4.11, *Recreation*, Impacts REC-1 through REC-4, construction of water conveyance facilities under Alternative 2D would be similar to those under Alternative 4, and would include elements that would be permanently located in two existing recreation areas. Additionally, substantial disruption of other recreational activities considered temporary and permanent would occur in certain areas during the construction period. Were it to occur, a decline in visits to Delta recreational sites as a result of facility construction would be expected to reduce recreation-related spending, creating an adverse effect throughout the Delta region. Additionally, if construction activities shift the relative popularity of different recreational sites, implementation of Alternative 2D may carry localized beneficial or adverse effects.

Access would be maintained to all existing recreational facilities, including marinas, throughout construction. As part of Mitigation Measure REC-2, project proponents would enhance nearby fishing access sites and would incorporate public recreational access into design of the intakes along the Sacramento River. Implementation of this measure along with separate, non-environmental commitments as set forth in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS relating to the enhancement of recreational access and control of aquatic weeds in the Delta would reduce these effects. Environmental commitments would also be implemented to reduce some of the effects of construction activities on the recreational experience. Similarly, mitigation measures proposed throughout other sections of this document, and listed under Impact REC-2 in Section 4.4.11, *Recreation*, of this RDEIR/SDEIS would also contribute to reducing construction effects on recreational experiences in the study area. Overall, however, the multi-year schedule and geographic scale of construction activities and the anticipated decline in recreational spending would be considered an adverse effect. The commitments and mitigation measures cited above would contribute to the reduction of this effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities under Alternative 2D could affect recreational revenue in the Delta region if construction activities result in fewer visits to the area. Fewer visits would be anticipated to result in decreased economic activity related to recreational activities. This section considers only the economic effects of recreational changes brought about by construction of the proposed water conveyance facilities. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.4.11, *Recreation,* Impacts REC-1 through REC-4, in this RDEIR/SDEIS.

Impact ECON-6: Effects on Agricultural Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on agricultural economics related to construction of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher effects on agricultural economics when compared to Alternative 4.

NEPA Effects: Because construction of the proposed water conveyance facilities would lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural*

Resources, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would reduce the total value of agricultural production in the Delta region. The removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources,* Impacts AG-1 and AG-2, in this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-7: Permanent Regional Economic and Employment Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Permanent effects on regional economics during operation and maintenance of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar and, in the context of the regional economy, operational outcomes related to water supply, water quality, recreation, or fisheries would be similar between the two alternatives. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher effects on employment effects when compared to Alternative 4. Increased expenditures related to operation and maintenance of water conveyance facilities would be expected to result in a permanent increase in regional employment and income, while the permanent removal of agricultural land following construction would have lasting negative effects on agricultural employment and income.

NEPA Effects: Because continued operation and maintenance of water conveyance facilities would result in an increase in operations-related employment and labor income, this would be considered a beneficial effect. However, the long-term footprint of facilities would lead to a continued decline in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would increase total employment and income in the Delta region. The net change would result from expenditures on operation and maintenance and from changes in agricultural production. The total change in income and employment is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources*, Impacts AG-1 and AG-2; and changes in recreation related activities are addressed in Section 4.4.11, *Recreation,* Impacts REC-5 through REC-8 in this RDEIR/SDEIS. When required, DWR would provide compensation to landowners as a result of acquiring lands for the proposed conveyance facilities. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-8: Permanent Effects on Population and Housing in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Permanent effects on population and housing during operation and maintenance of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar. It is anticipated that non-local workers would relocate to the five-county region, thus adding to the local population. However, this additional population would constitute a minor increase in the total 2025 projected regional population of 4.6 million and be distributed throughout the region. It is anticipated that most of the operational workforce would be drawn from within the five-county region. Consequently, operation of the conveyance facilities would not result in impacts on housing.

NEPA Effects: Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population and therefore significant impacts on the physical environment are not anticipated.

Impact ECON-9: Changes in Community Character during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Under Alternative 2D, effects on community character would be similar in nature, location, and magnitude to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar. However, under Alternative 2D two additional intake facilities would be constructed, which would result in additional localized effects on community character when compared to Alternative 4, particularly in and around the communities of Clarksburg, Hood, and Courtland.

While water conveyance operation and maintenance could result in beneficial effects relating to the economic welfare of a community, lasting adverse social effects, including effects on community cohesion, could also arise in communities closest to physical features and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation would reduce adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS).

CEQA Conclusion: Operation and maintenance of water conveyance facilities under Alternative 2D could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to physical impacts involving population growth, such impacts are described under Impact ECON-8 and in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-10: Changes in Local Government Fiscal Conditions during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in local government fiscal conditions during operation and maintenance of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives would be similar. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in higher project-related effects on property tax and assessment revenue when compared to Alternative 4. For the reasons discussed under ECON-4 above, adverse effects on property tax and assessment revenues would be offset by the requirement of the California Water. In addition, as discussed under Impact ECON-1, continued operation and maintenance of the water conveyance facilities would be anticipated to result in a net increase of income and employment in the Delta region. This would also create an indirect beneficial effect through increased sales tax revenue for local government entities that rely on sales taxes.

CEQA Conclusion: Under Alternative 2D, the ongoing operation and maintenance of water conveyance facilities would restrict property tax revenue levels for various local government entities in the Delta region. Some losses could be offset, at least in part, by an anticipated increase in sales tax revenue. For the reasons discussed under ECON-4 above, adverse effects on property tax and assessment revenues would be offset by the requirement of the California Water.

Impact ECON-11: Effects on Recreational Economics during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: As discussed in Section 4.4.11, *Recreation,* Impacts REC-5 through REC-8, in this RDEIR/SDEIS, operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 2D are anticipated to create minor effects on recreational resources. Maintenance of conveyance facilities, including intakes, would result in periodic temporary but not substantial adverse effects on boat passage and water-based recreational activities. Because effects of facility maintenance would be short-term and intermittent, substantial economic effects are not anticipated to result from operation and maintenance of the facilities.

CEQA Conclusion: Operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 2D are anticipated to create minor effects on recreational resources and therefore, are not expected to substantially reduce economic activity related to recreational activities. This section considers only the economic effects of recreational changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.4.11, *Recreation,* Impacts REC-5 through REC-8, in this RDEIR/SDEIS.

Impact ECON-12: Permanent Effects on Agricultural Economics in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Effects on agricultural economics during operation and maintenance of Alternative 2D would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives would be similar and, in the context of the regional agricultural economy, outcomes related to water quality would be similar between the two alternatives. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher effects on agricultural economics when compared to Alternative 4.

NEPA Effects: The footprint of water conveyance facilities would result in lasting reductions in crop acreage and in the value of agricultural production in the Delta region; therefore, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: During operation and maintenance of the proposed water conveyance facilities the value of agricultural production in the Delta region would be reduced. The permanent removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources,* Impacts AG-1 and AG-2 of this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably foreseeable physical impacts. Such physical effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical effect. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-13: Effects on the Delta Region's Economy and Employment Due to the Implementation of Environmental Commitments 3, 4, 6–12, 15, and16

The effects on the economy of the Delta region associated with implementation of these Environmental Commitments would be similar to those described for Alternative 4A in Section 4.3.12, *Socioeconomics*, of this RDEIR/SDEIS. However, the acreages associated with some of these commitments would be somewhat higher than those proposed under Alternative 4A.

NEPA Effects: Because implementation of these Environmental Commitments would be anticipated to result in an increase in construction and operation and maintenance-related employment and labor income, this would be considered a beneficial effect. However, implementation of these components would also be anticipated to result in a decrease in agricultural-related and natural gas production-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite. Additionally, measures to reduce impacts on natural gas wells are discussed in Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

CEQA Conclusion: Implementation of the proposed Environmental Commitments would affect total employment and income in the Delta region. The change in total employment and income in the Delta region is based on expenditures resulting from implementation of the habitat enhancement and restoration activities and any resulting changes in agricultural production, recreation, and natural gas production. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. Removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources*, Impacts AG-3 and AG-4; changes in recreation-related activities are addressed in Section 4.4.11, *Recreation,* Impacts REC-9 through REC-11; and abandonment of natural gas wells is addressed in Section 4.4.22, *Minerals*, Impact MIN-5. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative*.* While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts and impacts on natural gas wells are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, and Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

Impact ECON-14: Effects on Population and Housing in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: In the Delta region, implementation of habitat enhancement and restoration activities could increase employment and convert land from existing uses, including possible displacement of residential housing and business establishments. The effects on population and housing in the Delta region would be similar to those described for Alternative 4A. However, the acreages associated with some of these commitments would be somewhat higher than those proposed under Alternative 4A. In general, the changes in population and housing would include increases in population from the construction and operation and maintenance-related activity and declines in residential housing and business establishments as a result of lands converted or impaired. Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Implementation of the proposed habitat enhancement and restoration activities could affect total population and housing in the Delta region. The change in total population and housing in the Delta region is based on employment resulting from implementation of the proposed conservation activities. The change in population and housing is expected to be minor relative to the five-county Delta region, and dispersed throughout the region. Therefore, significant impacts on the physical environment are not anticipated to result.

Impact ECON-15: Changes in Community Character as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: As noted under Impacts ECON-13 and ECON-14, conservation activities designed to restore, conserve, or enhance natural habitat would be anticipated to create economic effects similar to, but slightly higher than those described for Alternative 4A, including increases to employment and changes in land use that could trigger the disruption of agricultural and recreational economies.

They could also affect the possible displacement of residences and businesses. The effects these activities would create with regard to community character would depend on the nature of each measure along with its specific location, size, and other factors that are not yet defined.

Under Alternative 2D, temporary construction associated with implementation of these measures could lead to demographic changes and resulting effects on the composition and size of Delta communities. Earthwork and site preparation associated with environmental commitments could also detract from the rural qualities of the Delta region; however, their implementation would take place in phases over time, which would limit the extent of effects taking place at any one point in time.

Implementation of these measures could also alter community character over the long term. Conversion of agricultural land to restored habitat would result in the erosion of some economic and social contributions stemming from agriculture in Delta communities. However, in the context of the Delta region, a substantial proportion of land would not be converted. Additionally, restored habitat could support some rural qualities, particularly in terms of visual resources and recreational opportunities. These effects could attract more residents to some areas of the Delta, and could replace some agricultural economic activities with those related to recreation and tourism. To the extent that agricultural facilities and supportive businesses were affected and led to vacancy, alteration of community character could result from these activities. However, protection of cultivated lands would ensure the continuation of agricultural production on a substantial area of land in the Delta. If necessary, implementation of mitigation measures and environmental commitments related to transportation, agriculture, and recreation would be anticipated to reduce these adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities under Alternative 2D could affect community character within the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character are related to physical impacts involving population growth, these impacts are described in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS*.* Furthermore, notable decreases in population or employment, even if limited to certain areas, sectors, or the vacancy of individual buildings, could result in decay and blight stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-16: Changes in Local Government Fiscal Conditions as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

As discussed in relation to construction of water conveyance facilities, habitat restoration and enhancement activities under Alternative 2D would also take place, in part, on land held by private owners and from which local governments derive revenue through property taxes and assessments. In particular, environmental commitments related to protection and restoration of natural communities would require the acquisition of multiple parcels of land.

The loss of a substantial portion of an entity's tax base would represent an adverse effect on an agency, resulting in a decrease in local government's ability to provide public goods and services. Under Alternative 2D, property tax and assessment revenue forgone as a result of Environmental Commitment implementation would be similar to that described under Alternative 4A in Section 4.3.12, *Socioeconomics*, of this RDEIR/SDEIS. As described for Alternative 4A, impacts on tax revenues would be avoided as a result of the requirements stipulated in California Water Code that requires entities constructing or operating new Delta conveyance facilities to fully mitigate for the loss of property tax or assessments levied by local governments or special districts.

NEPA Effects: Overall, habitat enhancement and restoration activities would remove many acres of private land from local property tax and assessment rolls. This economic effect would be considered adverse; however, project proponents would offset forgone property tax and assessments levied by local governments and special districts on private lands converted to habitat. As described under Impact ECON-13, regional economic effects from the implementation of these activities would be mixed. While activities associated with construction and establishment of habitat areas could boost regional expenditures and sales tax revenue, reduced agricultural activities may offset these gains. Changes in recreation spending and related sales tax revenue could be positive or negative, depending on the implementation of the measures.

CEQA Conclusion: Under Alternative 2D, implementation of habitat enhancement and restoration activities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. As discussed in Alternative 4A, these losses would be offset by the requirements stipulated in the California Water Code. CEQA does not require a discussion of socioeconomic effects except where they would result in physical changes. The potential for a physical change in the environment would be avoided by offsetting the potential losses in tax revenues

Impact ECON-17: Effects on Recreational Economics as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Implementation of habitat enhancement and restoration activities under this alternative would be anticipated to create an adverse effect on recreational resources by limiting access to facilities, restricting boat navigation, and disturbing fish habitat while restoration activities are taking place. These measures may also permanently reduce the extent of upland recreation sites. However, these components could also create beneficial effects by enhancing aquatic habitat and fish abundance, expanding the extent of navigable waterways available to boaters, and improving the quality of existing upland recreation opportunities. Therefore, the potential exists for the creation of adverse and beneficial effects related to recreational economics. Adverse effects would be anticipated to be primarily limited to areas close to restoration areas and during site preparation and earthwork phases. These effects could result in a decline in visits to the Delta and reduction in recreation-related spending, creating an adverse economic effect throughout the Delta. Beneficial recreational effects would generally result during later stages of restoration implementation as environmental conditions supporting recreational activities are enhanced. These effects could improve the quality of recreational experiences, leading to increased economic activities related to recreation, particularly in areas where habitat enhancement or restoration could create new recreational opportunities.

CEQA Conclusion: Site preparation and earthwork activities associated with a number of environmental commitments would limit opportunities for recreational activities where they occur in or near existing recreational areas. Noise, odors, and visual effects of construction activities would also temporarily compromise the quality of recreation in and around these areas, leading to potential economic impacts. However, over time, implementation could improve the quality of existing recreational opportunities, leading to increased economic activity. This section considers only the economic effects of recreational changes brought about by implementation of habitat enhancement and restoration activities. CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.4.11, *Recreation,* Impacts REC-9 through REC-11 in this RDEIR/SDEIS.

Impact ECON-18: Effects on Agricultural Economics in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Habitat enhancement and restoration activities would convert land from existing agricultural uses. These direct effects on agricultural land are described qualitatively in Section 4.4.10, *Agricultural Resources,* Impacts AG-3 and AG-4 in this RDEIR/SDEIS. Effects on agricultural economics would include effects on crop production and agricultural investments resulting from restoration actions on agricultural lands. The effects would be similar in kind to those described for lands converted due to construction and operation of the conveyance features and facilities. The total acreage and crop mix of agricultural land potentially affected is not specified at this time, but when required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative. Because implementation of habitat enhancement and restoration activities would be anticipated to lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities would reduce the total value of agricultural production in the Delta region. The permanent removal of agricultural land from production is addressed in Section 4.4.10, *Agricultural Resources,* Impacts AG-3 and AG-4 of this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative*.* While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-19: Socioeconomic Effects in the South-of-Delta Hydrologic Regions

As described in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS, the operational components of water conveyance facilities under Alternative 2D could result in a number of effects in areas receiving SWP and CVP water deliveries outside of the Delta. Generally, these effects would be similar to those described for Alternative 2A (Operational Scenario B) in Chapter 16, *Socioeconomics*, Section 16.3.3.5, of the Draft EIR/EIS, because the incremental change in Delta exports is similar, when compared to the relevant No Action condition.

Under Operational Scenario B as considered for Alternative 2D (at the ELT), Delta exports would increase by 14%when compared to the No Action Alternative (ELT), as shown in Table B.1-6 in Appendix B of this RDEIR/SDEIS. Under Operational Scenario B as considered for Alternative 2A (LLT), Delta exports would also increase by 14% when compared to the No Action Alternative (LLT), as shown in Table 5-6 in Appendix A of this RDEIR/SDEIS.

Changes in the amount, cost, or reliability of water deliveries could create socioeconomic effects in the hydrologic regions. To the extent that unreliable or insufficient water supplies currently represent obstacles to agricultural production, Alternative 2D may support more stable agricultural activities by enabling broader crop selection or by reducing risk associated with uncertain water deliveries. As a result of an increase in water supply and supply reliability, farmers may choose to leave fewer acres fallow and/or plant higher-value crops. While the locations and extent of any increases in production would depend on local factors and individual economic decisions, a general increase in production would be anticipated to support growth in seasonal and permanent on-farm employment, along with the potential expansion of employment in industries closely associated with agricultural production. These include food processing, agricultural inputs, and transportation. Generally, these effects would be most concentrated in hydrologic regions where agriculture is a primary industry and where agricultural operations depend most heavily on SWP and CVP deliveries.

NEPA Effects: Changes in water deliveries associated with operation of Alternative 2D could result in beneficial socioeconomic effects in areas receiving water from the SWP and CVP. In hydrologic regions where water deliveries are predicted to increase when compared with the No Action Alternative, more stable agricultural activities could support employment and economic production associated with agriculture. Where M&I deliveries increase, population growth could lead to general economic growth and support water-intensive industries. Such changes could also lead to shifts in the character of communities in the hydrologic regions with resultant beneficial or adverse effects. Likewise, growth associated with deliveries could require additional expenditures for local governments while also supporting increases in revenue.

CEQA Conclusion: As described above, the operational components of the proposed water conveyance facilities could result in a number of socioeconomic effects in areas receiving SWP and CVP water deliveries outside of the Delta. However, because these impacts are social and economic in nature, rather than physical, they are not considered environmental impacts under CEQA. To the extent that changes in socioeconomic conditions in the hydrologic regions would lead to physical impacts, such impacts are described in Section 4.4.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS.

4.4.13 Aesthetics and Visual Resources

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4 in Appendix A of this RDEIR/SDEIS, except that it would include two additional intakes compared to Alternative 4. The potential under Alternative 2D to create substantial alteration in visual quality or character during construction of conveyance facilities would be greater than those impacts described under Alternative 4 and would constitute an adverse effect on existing visual character because of the long-term nature of construction, combined with the proximity to sensitive receptors, effects on residences and agricultural buildings, removal of vegetation, and changes to topography through grading. The primary features that would affect the existing visual quality and character under Alternative 2D, once the facility has been constructed, would be Intakes 1, 2, 3, 4, and 5, the intermediate forebay and expanded Clifton Court Forebay, resulting landscape effects left behind from spoil/borrow and RTM areas, the operable barrier and transmission lines. These changes would be most evident in the northern portion of the study area, which would undergo extensive changes from the permanent establishment of large industrial facilities and the supporting infrastructure along and surrounding the segment of the Sacramento River from Clarksburg to north of Courtland where the intakes would be situated. Mitigation Measures AES-1a through AES-1g are available to address visual effects resulting from construction of Alternative 2D water conveyance facilities.

CEQA Conclusion: Construction of Alternative 2D would substantially alter the existing visual quality and character present in the study area in a similar manner as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The long-term nature of construction of the five intakes, operable barrier, pipeline/tunnel, work areas, spoil/borrow and RTM areas, shaft sites, barge unloading facilities, and operable barrier; presence and visibility of heavy construction equipment; proximity to sensitive receptors; relocation of residences and agricultural buildings; removal of riparian vegetation and other mature vegetation or landscape plantings; earthmoving and grading that result in changes to topography in areas that are predominantly flat; addition of large-scale industrial structures (intakes and related facilities); remaining presence of large-scale borrow/spoil and RTM area landscape effects; and introduction of tall, steel transmission lines would all contribute to this impact. This impact would be significant because of the substantial visual changes that would result from conveyance facility construction. Mitigation Measures AES-1a through AES-1g would partially reduce impacts, but not to a less-than-significant level because not all of the visual changes could be eliminated and permanent changes would be made to the regional landscape. Thus, Alternative 2D would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4.

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

NEPA Effects: Effects related to scenic vistas under Alternative 2D would be similar to but greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. During construction, the introduction of construction equipment and removal of vegetation would alter the scenic elements that contribute to the viewing experience from scenic vistas. The five intakes would introduce visually dominant and discordant features in the foreground and middleground views in vistas that would be very noticeable to all viewer groups in areas of low to high landscape sensitivity levels. As described for Alternative 4, the effects of permanent access roads effects on scenic vistas would not be adverse. The effects of shaft site pads and access hatches on scenic vistas could be adverse. The large scale of intakes, the visual presence of large-scale borrow/spoil and RTM area landscape effects, and transmission lines may result in adverse effects on scenic vistas (see discussions under 17.3.1.2 and 17.3.1.3). Overall, effects on scenic vistas associated with Alternative 2D would be adverse because some elements of the conveyance facilities would permanently change views to scenic vistas. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 2D would have effects on scenic vistas similar to and greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Because proposed permanent access roads generally follow existing ROWs, they would have less-than-significant impacts on scenic vistas. The presence of the intake structures and pumping plants, large-scale borrow/spoil and RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vistas in the study area. Mitigation Measure AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level. Thus, impacts on scenic vistas associated with Alternative 2D would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

NEPA Effects: Effects on state scenic highways under Alternative 2D would be similar to but greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Intakes 1.2, 3, 4, and 5, the RTM area north of Intake 2, and the intermediate forebay would be immediately and prominently visible in the foreground from SR 160 and would result in an overall noticeable effect on viewers relative to their current experience of the study area's scenic resources along SR 160 and River Road, where the landscape sensitivity level is high. As described for Alternative 4, the visual elements introduced by the intakes, RTM area north of Intake 2, and intermediate forebay associated with Alternative 2D would conflict with the existing forms, patterns, colors, and textures along River Road and SR 160; would dominate riverfront available from SR 160; and would alter broad views and the general nature of the visual experience presently available from River Road and SR 160. These changes would reduce the visual quality near intake structure locations and result in noticeable changes in the visual character of scenic vista viewsheds in the study area. This effect would be adverse for the same reasons discussed for Alternative 4. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 2D would have effects on scenic highways similar to but greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Because proposed permanent access roads generally follow existing ROWs, they would have less-than-significant impacts on scenic vistas. The presence of the intake structures and pumping plants, RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vista viewsheds in the study area. Mitigation Measures AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level for the same reasons identified for Alternative 4. Thus, impacts on scenic vistas associated with Alternative 2D would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

NEPA Effects: Effects resulting from light and glare under Alternative 2D would be similar to but greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Intakes 1, 2, 3, 4, and 5 and their associated facilities would create noticeable effects relating to light and glare (Figures 17-85 through 17-86b). Overall, because the study area currently experiences low levels of light and because there are a larger number of viewers in and around the waterways, intake structures, and forebay that would be affected by these noticeable changes that contrast with the existing rural character, effects associated with new sources of daytime and nighttime light and glare are considered adverse. Mitigation Measures AES-4a through AES-4c are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 2D would have effects, related to light and glare similar to but greater, than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The impacts associated with light and glare under Alternative 2D are significant because there are a larger number of viewers in and around the waterways, intake structures, and intermediate forebay; project facilities would increase the amount of nighttime lighting in the Delta above existing ambient light levels; and the study area currently experiences low levels of light because there are fewer light/glare producers than are typical in urban areas. Mitigation Measures AES-4a through AES-4c would partially reduce these impacts but not to a less than significant level because all instances of light and glare impacts would not be reduced by the available mitigation measures. Thus, the new sources of daytime and nighttime light and glare associated with Alternative 2D would result in significant and unavoidable impacts on public views in the project vicinity.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours Within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4.

Impact AES-5: Substantial Alteration in Existing Visual Quality or Character during Conveyance Facility Operation

NEPA Effects: Effects on the visual environment through operations and maintenance of the water conveyance facilities under Alternative 2D would be similar to and greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The greatest visual effects resulting from operations would be maintenance of the intakes and dredging the forebays. However, all activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. These effects on the existing visual quality and character during operation would not be adverse because the activities would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features.

CEQA Conclusion: Operation of Alternative 2D would have visual quality effects similar to but greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Maintenance of the conveyance facilities (i.e., intakes, tunnels, forebays and transmission lines) would be required periodically and would involve painting, cleaning, and repair of structures; dredging at forebays; vegetation removal and care along embankments; tunnel inspection; and vegetation removal within transmission line ROWs. These activities could be visible from the water or land by sensitive viewers in proximity to these features. All activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. Maintenance and operation of Alternative 2D once constructed, would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features. Thus, overall, operation and maintenance of Alternative 2D would have a less-than-significant impact on existing visual quality and character in the study area because operations would not change the visual quality of the environment and maintenance activities would be minor and intermittent. No mitigation is required.

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 2D related to the potential for alteration of existing visual quality or character from implementing these environmental commitments would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, *Introduction*, in this RDEIR/SDEIS, Alternative 2D would restore up to 17,766 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitments 15 and 16 would be implemented only at limited locations.

Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 2D would likely be smaller than those associated with Alternative 4.

NEPA Effects: Effects on the existing visual character, scenic vistas, scenic highways, and light and glare would be similar to those under Alternative 4 (in Appendix A of this RDEIR/SDEIS) because restored/enhanced lands would result in incremental and site-specific changes to the landscape in a similar manner. Because only portions of the restoration environmental commitments and fewer of the other stressor reduction environmental commitments would be implemented under Alternative 2D, it is likely that the visual and aesthetic effects would be less than those presented for Alternative 4. However, these visual and aesthetic impacts are considered to be adverse because site-specific, localized adverse visual effects could occur at the sites of projects implemented under the Alternative 2D environmental commitments. Mitigation Measures AES-1a through AES-1g and Mitigation Measures AES-4a through AES-4c are available to address effects from implementation of the Environmental Commitments.

CEQA Conclusion: Implementation of environmental commitments under Alternative 2D would have similar but less impacts than identified for Alternative 4 in Appendix A of this RDEIR/SDEIS. Alternative 2D has the potential to affect existing visual quality and character, views of scenic vistas, views from scenic highways, and introduce new sources of light and glare in the study area. These potential impacts are considered to be significant because construction of environmental commitments could potentially change views from public areas, negatively affect sensitive receptors and require multiple year construction at specific locations that are currently unknown.

Implementing mitigation measures AES 1a–1g would partially reduce the impacts of Alternative 2D on aesthetic and visual resources but not to a less-than-significant level because restoration and other actions implemented under this alternative could create considerable changes to the visual character of sensitive receptors that may not be fully mitigated by these mitigation measures. Thus, implementation of environmental commitments under Alternative 2D would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please refer to Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please refer to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please refer to Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please refer to Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours Within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Please refer to Mitigation Measure AES-6a under Impact AES-6 in the discussion of Alternative 4.

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-Intensity and Lights Off Policy

Please refer to Mitigation Measure AES-6b under Impact AES-6 in the discussion of Alternative 4.

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

Please refer to Mitigation Measure AES-6c under Impact AES-6 in the discussion of Alternative 4.

Impact AES-7: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Aesthetics and Visual Resources

NEPA Effects: Constructing water conveyance facilities and implementing other environmental commitments under Alternative 2D would generally have the same potential for incompatibilities with one or more plans and policies related to preserving the visual quality and character of the Delta as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. As described for Alternative 4, potential incompatibility with plans and policies could exist related to preserving the visual quality and character of the Delta (i.e., The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, Delta Protection Commission Land Use and Resource Management Plan for the Primary Zone of the Delta, Delta Plan, Brannan Island and Franks Tract State Recreation Areas General Plan). In addition, with the exception of Solano County, the alternative may be incompatible with county general plan policies that protect visual resources in the study area.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts AES-1 through AES-6, above and no additional CEQA conclusion is required related to the compatibility of Alternative 2D with relevant plans and policies.

4.4.14 Cultural Resources

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4 with the addition of two river intakes. Constructing the water conveyance facilities under Alternative 2D would result in impacts on identified archaeological sites greater than those disclosed under Alternative 4 in Appendix A of this RDEIR/SDEIS. This encompasses the previously recorded archeological sites occurring in the footprint of the conveyance facility. Site descriptions summarizing available information regarding these resources, are provided in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2 *Archaeological Site Descriptions*, of the Draft EIR/EIS.

The significance of the identified archeological sites is the same as described for Alternative 4. Because many of these resources are large (typically in excess of 30 meters across), they are each likely to contain sufficient integrity to yield artifacts in their original associations in a manner that will convey the significance themes outlined in the Alternative 4 discussion in Appendix A of this RDEIR/SDEIS. These resources are likely to qualify as historical resources under CEQA and historic properties under the NRHP.

The mechanisms that could impact the archeological sites under Alternative 2D would be similar to those described for Alternative 4. These resources occur within the footprint of both temporary work areas and permanent surface impacts and would be subject to the same types of disturbance described under Alternative 4. Construction of the water conveyance facilities has the potential to materially impair these resources under CEQA and to adversely affect the resources as defined by Section 106 of the NHPA.

NEPA Effects: Construction may disturb and damage NRHP and CRHR-eligible archaeological resources. This effect is considered adverse because the damage may impair the integrity of these resources and thus reduce their ability to convey their significance

CEQA Conclusion: Construction of conveyance facilities would affect identified archaeological resources that occur in the footprint of this alternative. DWR identified these resources and found that they are likely to qualify as historical resources under CEQA (see the individual site descriptions in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2 *Archaeological Site Descriptions*, of the Draft EIR/EIS). This impact would be significant because construction could materially alter or destroy the physical integrity of the resources and/or their potential to yield information useful in archaeological research through excavation and disruption of the spatial associations that contain meaningful information. Identified but currently inaccessible resources may also be significant under other register criteria; indirect effects such as introduction of inconsistent changes to the setting may also diminish the significance of these resources. Mitigation Measure CUL-1 would reduce this impact, by recovering data at affected significant archeological sites and by monitoring and protecting resources during construction. However, this measure would not ensure preservation of the physical integrity of the resources or ensure that all of the scientifically important material would be retrieved because feasible archaeological excavation only typically retrieves a sample of the deposit, and portions of the site containing important information may remain after treatment. The impact on identified archaeological sites is considered significant and unavoidable because construction could damage the remaining portions of the deposit.

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Please see Mitigation Measure CUL-1 under Impact CUL-1 in the discussion of Alternative 4.

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

The potential effects of constructing water conveyance facilities on archaeological sites identified through future inventories would be greater under Alternative 2D when compared to Alternative 4. These future impacts could occur because most of the area crossed by the proposed water conveyance facility is not currently legally accessible and as such has not been surveyed for the presence of archaeological sites. Alternative 2D would also require more geotechnical testing than Alternative 4 because of the larger footprint. This testing could damage or destroy archaeological sites. Although the majority of the footprint of the water conveyance facility has not been surveyed, sensitive resources have been located within and near the portions of the alignment that have been surveyed. For this reason, additional prehistoric archaeological resources are likely to be found in the portion of the footprint where surveys have not yet been conducted. For the reason enumerated under Alternative 4, these sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

The potential effects on historic sites under Alternative 2D would be greater than those disclosed for Alternative 4. In summary, historic sites are likely to be associated with the historic-era themes of settlement, reclamation, agriculture, and flood management in the Delta region and as such contributed to the economic base for developing urban centers. These historic sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

Absent mitigation, ground-disturbing construction is likely to physically damage many of these resources by disrupting the spatial associations that convey data useful in research or changing the setting such that the resource no longer contains its significance. These impacts would materially impair these resources within the meaning of CEQA and adversely affect the resources within the meaning of Section 106 of the NHPA. These effects would be adverse.

NEPA Effects: Alternative 2D has the potential to damage previously unidentified archaeological sites. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA Conclusion: The footprint for Alternative 2D is sensitive for both prehistoric and historic-era resources that cannot be identified at this time because much of the footprint is not legally accessible. Because many of these resources are likely to have data useful in prehistoric and historic archaeological research, as well as the integrity to convey this significance, they are likely to qualify as historical resources or unique archaeological sites under CEQA or historic properties under the Section 106 of the NHPA. Ground-disturbing construction may materially alter the significance of these resources by disrupting the spatial associations that could yield important data, resulting in a significant effect. Mitigation Measure CUL-2 would address the impacts of both prehistoric and historic resources through conducting inventories, evaluating significance, and proposing treatment of archeological and historic resources as well as monitoring during the construction phase. However, this mitigation cannot guarantee that all eligible or significant resources would be preserved in place, or that all important data would be retrieved before construction destroys these resources. The scale of the project, investment into existing designs, and the presence of other important environmental resources such as habitat, natural communities, and wetlands that should be avoided are constraints on the flexibility and feasibility of avoidance. For these reasons this impact is significant and unavoidable.

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Please see Mitigation Measure CUL-2 under Impact CUL-2 in the discussion of Alternative 4.

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

The potential effects of construction of the water conveyance facilities on archaeological sites that may not be identified during inventory efforts under Alternative 2D would be greater when compared to Alternative 4 because of the larger footprint. Although surveys will be completed for the water conveyance footprint, such surveys cannot guarantee that all sites will be identified prior to construction.

Ground-disturbing activities occurring under Alternative 2D, including the construction of surface features such as intakes, subterranean tunnel boring operations, and access may disturb and damage these resources before they can be identified and avoided during monitoring efforts required under Mitigation Measure CUL-3. This damage and disturbance may materially impair these resources within the meaning of CEQA or adversely affect the resources within the meaning of Section 106 because this disturbance would impair the ability of these resources to yield data useful in research. While Mitigation Measure CUL-3 would reduce the potential for this impact, it would not guarantee the impact would be avoided entirely. Therefore, this impact is adverse.

NEPA Effects: Constructing Alternative 2D has the potential to damage previously unidentified archaeological sites that also may not necessarily be identified prior to construction. While cultural resource inventories will be completed once legal access is secured, no inventory can ensure that all resources are identified prior to construction. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA Conclusion: This impact on archeological resources not identified during inventory efforts would be considered significant for the same reasons described for Alternative 4. Construction has the potential to disturb previously unidentified archaeological sites qualifying as historical resources, historic properties, or unique archaeological resources. Mitigation Measures CUL-3 would reduce but not entirely avoid the potential for this impact, by implementing construction worker training, monitoring and discovery protocols. This impact would remain significant and unavoidable because all archaeological resources may not be identified prior to disturbance.

Mitigation Measure CUL-3: Implement an Archaeological Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Please see Mitigation Measure CUL-3 under Impact CUL-3 in the discussion of Alternative 4.

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Effects on buried human remains during construction of Alternative 2D would be greater than Alternative 4 because the footprint of the water conveyance facilities would be larger. As describe in greater detail for Alternative 4, the footprint of the water conveyance facilities is sensitive for buried historic and prehistoric human remains While inventory and monitoring efforts are prescribed by Mitigation Measures CUL-2 and CUL-3, the large land area subject to disturbance under Alternative 2D make exhaustive sampling to identify all buried and isolated human remains technically and economically infeasible. For these reasons the potential remains that such resources may be damaged or exposed before they can be discovered through inventory or monitoring.

NEPA Effects: Buried human remains may be damaged by constructing Alternative 2D because such remains may occur either in isolation or as part of identified and previously unidentified archaeological resources where construction will occur. This effect would be adverse.

CEQA Conclusion: Damage to buried human remains during construction of Alternative 2D would be considered a significant impact for the same reasons described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The project area is sensitive for buried human remains and construction of Alternative 2D would likely result in disturbance of these features. Disturbance of human remains, including remains interred outside of cemeteries is considered a significant impact in the CEQA Appendix G checklist. Mitigation measure CUL-4 would reduce the severity of this impact by following state and federal guidelines, including notifying the county coroner and NAHC, if human remains are discovered during construction. This impact is considered significant and unavoidable, because mitigation would not guarantee that these features could be discovered and treated in advance of construction and the scale of construction makes it technically and economically infeasible to perform the level of sampling necessary to identify all such resources prior to construction.

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains if Such Resources Are Discovered during Construction

Please see Mitigation Measure CUL-4 under Impact CUL-4 in the discussion of Alternative 4.

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on built-environment resources under Alternative 2D would be greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. As described in greater detail in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, of the Draft EIR/EIS, a total of 17 built-environment resources have the potential to be directly or indirectly affected by constructing the water conveyance facilities. These effects would materially impair the resources within the meaning of CEQA and result in adverse effects within the meaning of Section 106 because they would diminish the characteristics that convey the significance of the resources.

NEPA Effects: Alternative 2D would result in direct and indirect effects on NRHP and CRHR eligible built environment resources. These alterations may diminish the integrity of these resources. For these reasons this effect would be adverse.

CEQA Conclusion: Alternative 2D could result in greater impacts on identified historic-era built-environment resources than described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The impacts on -environment resource are considered significant because construction may require demolition or alter the character of the resource to such a degree that each resource may no longer be able to convey its significance. Mitigation measure CUL-5 would reduce the impact by implementing a built environment treatment plan that includes preparing an HSR, assessing preconstruction conditions, implementing protection measures, and preparing HABS records for CRHR and NRHP-eligible historic buildings and structures that will be demolished. The impact on historic-era built-environment resources would remain significant and unavoidable because even with mitigation, the scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely.

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Please see Mitigation Measure CUL-5 under Impact CUL-5 in the discussion of Alternative 4.

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on unidentified and unevaluated historic architectural and built-environment resources under Alternative 2D would likely be greater than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because the footprint of the water conveyance facility would be greater. As described in detail for Alternative 4, although DWR does not have legal access to the majority of the footprint for the water conveyance, historical documentation suggests numerous additional resources occur in the footprint of the water conveyance facilities that have not been identified or which cannot currently be accessed and evaluated. Construction may result in direct demolition of these resources, damage through vibration, or indirect effects such as changes to the setting.

The resources may exhibit significance under both CEQA (State CEQA Guidelines Section 15064.5[a][3]) and the NRHP (30 CFR 60.4). In addition, because many of the historic-era structures in the Delta region are intact, and retain their rural agricultural setting, many of these resources are likely to have integrity within the meaning of CEQA and the NRHP (14 CCR Section 4852[c], 30 CFR 60.4). Because many unidentified resources are likely to have significance and integrity, they may qualify as historical resources under CEQA and historic properties under Section 106 of the NHPA.

NEPA Effects: Alternative 2D may result in direct modification or indirect changes to the setting for inaccessible and NRHP and CRHR-eligible resources. These changes may diminish the integrity of these resources. For these reasons, this effect would be adverse.

CEQA Conclusion: Alternative 2D may result in greater impacts on unidentified and unevaluated historic architectural and built-environment resources than described for Alternative 4. Construction may also result in permanent indirect effects such as changes to the setting. Direct demolition or changes to the setting would be material alterations because they would either remove the resource or alter the resource character, resulting in an inability of the resource to convey its significance. Many of these resources are likely to qualify as historic properties or historical resources under the NHPA and CEQA. Mitigation measure CUL-6 would reduce these impacts by requiring surveys be conducted on previously inaccessible properties to determine if constructing the water conveyance facilities would impact the properties and if so, requiring the development and implementation of treatment plans. The scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely. For these reasons this impact remains significant and unavoidable even with implementation of the following mitigation measures.

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Please see Mitigation Measure CUL-6 under Impact CUL-6 in the discussion of Alternative 4.

Impact CUL-7: Effects of Environmental Commitments on Cultural Resources

Implementing conservation and stressor reduction components at part of Alternative 2D would result in impacts on cultural resources similar to those described under Alternative 4. The extent of these impacts occurring under Alternative 2D would be much less than under Alternative 4 because the total acreage that would be affected by the habitat restoration and enhancement activities would be substantially less. The following Environmental Commitments could result in impacts on cultural resources because they involve ground-disturbing activities.

- *Environmental Commitment 3: Natural Communities Protection and Restoration*
- *Environmental Commitment 4: Tidal Natural Communities Restoration*
- *Environmental Commitment 6: Channel Margin Enhancement*
- *Environmental Commitment 7: Riparian Natural Community Restoration*
- *Environmental Commitment 8: Grassland Natural Community Restoration*
- *Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration*
- *Environmental Commitment 10: Nontidal Marsh Restoration*

These Environmental Commitments would result in effects on cultural resources when ground-disturbing work is performed to construct improvements and enhance or restore natural communities. Similar to Alternative 4, direct effects would occur through demolition or destruction of NRHP-, CRHR-, and/or local registry-eligible prehistoric and historic archaeological sites, unique archaeological sites, TCPs, human remains, and built-environment resources. In addition, indirect effects may occur where changes to the setting alter the existing setting in a manner that is inconsistent with the feeling and association of the resource. Because the ability of the resources to convey their significance would be lost, this effect would materially alter these resources under CEQA and would be adverse under NEPA. For example, reclaimed agricultural landscapes that are converted to habitat may no longer convey the themes of agriculture and settlement, and thus would be inconsistent with remaining features associated with rural historic landscapes created by reclamation, cultivation, and ranching.

Mitigation Measure CUL-7 below addresses the impact on cultural resources as a result of implementing the conservation and stressor reduction environmental commitments. Because of the large acreages of land included in all these commitments, it is unlikely that all effects on NRHP-, CRHR-, and /or local registry-eligible resources and unique archaeological sites could be avoided. Therefore, this impact would be adverse.

NEPA Effects: Implementation of environmental commitments will result in ground disturbing work and introduction of new infrastructure to the project area. These physical modifications may result in direct effects on NRHP and CRHR eligible resources and therefore reduce the integrity of these resources. For these reasons these effects would be adverse.

CEQA Conclusion: Implementing environmental commitments would require ground-disturbing activities that could alter the significant characteristics of NRHP, CRHR, and/or local registry-eligible cultural resources, including prehistoric and historic archaeological sites, TCPs, and built-environment resources such as historic architectural structures and rural historic landscapes. The same construction may damage unique archaeological sites. This construction would likely result in materially adverse changes for the following reasons.

- Ground-disturbing construction in archaeological sites disrupts the spatial associations that contain data useful in research, thus diminishing or destroying the basis for the significance of the resource.
- Ground-disturbing construction may either directly demolish or indirectly affect the setting of built-environment resources, resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may either directly demolish or change the setting of TCPs resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may inadvertently disturb human remains.

The alteration of a resource that changes the characteristics that convey its significance is a material alteration under CEQA. The inadvertent disturbance of human remains is a significant impact under CEQA under the Appendix G checklist. Because this construction would materially alter these categories of resources and disturb human remains it would result in a significant impact. Mitigation measure CUL-7 would reduce these impacts by identifying and evaluating resources, avoiding resources where possible, and developing treatment where avoidance is not possible. In addition construction would be monitored. However, because of the acreage that could be disturbed as a result of implementing the components, as well as the multiple constraints associated with other environmental resources that require mitigation or avoidance, it is unlikely that all cultural resources could be avoided. Therefore, this impact remains significant and unavoidable.

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

Please see Mitigation Measure CUL-7 under Impact CUL-7 in the discussion of Alternative 4.

Impact CUL-8: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments with Plans and Policies

Similar to Alternative 4 (as described in Appendix A of this RDEIR/SDEIS), constructing the proposed water conveyance facilities and implementing conservation and stressor reduction environmental commitments under Alternative 2D could result in the potential for incompatibilities with plans and policies adopted to protect the cultural resources of the Delta. A number of plans and policies that coincide with the study area provide guidance for protection of cultural resources as overviewed in Section 18.2.3, *Regional and Local Plans, Policies, and Regulations,* of the Draft EIR/EIS. The policies include the Alameda County East Area Plan, Contra Costa County General Plan, San Joaquin County General Plan, Sacramento County General Plan, Solano County General Plan, and the Yolo County General Plan. A detailed summary of the policies is provided in Alternative 4. Similar to Alternative 4, the construction of the water conveyance facilities and conservation and stressor reduction environmental commitments under Alternative 2D would be compatible with the cultural resource protection policies indicated in the Alameda County East Area Plan, San Joaquin County General Plan, Yolo County General Plan and potentially incompatible with the Contra Costa County General Plan, Sacramento County General Plan and Solano County General Plan. Similar to Alternative 4, restoration actions under Alternative 2D would be compatible with policies that emphasize mitigation and incompatible with policies that emphasize preservation.

It should be noted that, as described in *Land Use*, Section 13.2.3 of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment.

NEPA Effects: Because federal agencies are not regulated by local land use policy, the project alternatives would not result in a conflict with local land use laws.

CEQA Conclusion: As with Alternative 4 in Appendix A of this RDEIR/SDEIS, constructing the proposed water conveyance facilities under Alternative 2D is governed by cultural resource management policies adopted by the various counties with jurisdiction in this region. For policies that emphasize preservation or mitigation Alternative 2D will be compatible with these policies because DWR and appropriate federal agencies will implement cultural resource management practices that will identify significant resources, preserve such resources where feasible, and complete mitigation to reduce significant effects where preservation is not feasible. For policies that emphasize preservation, the project is incompatible in some instances because multiple constraints governing the location of proposed facilities makes preservation of all significant cultural resources unlikely. It should be noted that, as described in *Land Use*, Section 13.2.3, of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment.

4.4.15 Transportation

Impact TRANS-1: Increased Construction Vehicle Trips Resulting in Unacceptable LOS Conditions

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. Increased traffic volumes generated during construction of Alternative 2D would therefore range between those generated under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-1 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 19-8 and 19-25 in Appendix A of this RDEIR/SDEIS, under baseline plus background growth (BPBG) conditions[1], Alternative 1A would exacerbate an already unacceptable LOS under BPBG conditions on **22** roadway segments and Alternative 4 would exacerbate conditions on **15** roadway segments. The estimated number of vehicles generated by Alternative 2D would be higher compared to Alternative 4 due to the increase in the number of intakes. Localized impacts identified under Alternative 1A in the vicinity of Intakes 1 and 5 would occur under Alternative 2D. The effect of increased traffic volumes in excess of LOS thresholds would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of the necessary improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion**:** Construction under Alternative 2D would add hourly traffic volumes to study area roadways that would exceed acceptable LOS thresholds. This would be a significant impact. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that required roadway capacity improvements outlined under TRANS-1c will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of unacceptable LOS would occur. Accordingly, this impact would be significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

[1] Background traffic growth was included for the traffic operations analysis based on the anticipated year of construction activity. The final result is a set of volumes representing baseline plus background growth (BPBG) and baseline plus background growth plus project (BPBGPP) traffic conditions.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-2: Increased Construction Vehicle Trips Exacerbating Unacceptable Pavement Conditions

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. Increased traffic volumes generated during construction of Alternative 2D would therefore range between those generated under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-2 under Alternatives 1A and Alternative 4.

NEPA Effects: As shown in Tables 19-9 and 19-26 in Appendix A of this RDEIR/SDEIS, construction of Alternatives 1A and 4 would deteriorate existing pavement conditions to less than the acceptable pavement condition index (PCI) or similar applicable threshold on a total of **46** roadway segments. Damage to roadway pavement is also expected throughout the study area on various local and state roads, as well as on a few interstates. The effect of roadway damage in excess of PCI thresholds would be adverse.

Mitigation Measures TRANS-2a through TRANS-2c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, an adverse effect in the form of deficient pavement conditions would occur. Accordingly, this effect could remain adverse. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, adverse effects could be avoided.

CEQA Conclusion**:** Construction under Alternative 2D would add traffic trips to study area roadways that would exacerbate unacceptable pavement conditions. This would be a significant impact. Mitigation Measures TRANS-2a through TRANS-2c would reduce the severity of this impact, but not necessarily to less-than-significant levels, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, a significant impact in the form of deficient pavement conditions would occur. Accordingly, this impact could be significant and unavoidable. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, impacts would be reduced to less than significant.

Mitigation Measure TRANS-2a: Prohibit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2b: Limit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2c: Improve Physical Condition of Affected Roadway Segments as Stipulated in Mitigation Agreements or Encroachment Permits

Please refer to Mitigation Measure TRANS-2c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-3: Increase in Safety Hazards, Including Interference with Emergency Routes during Construction

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to increase safety hazards during construction would therefore be similar to those impacts described under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-3 under Alternatives 1A and 4.

NEPA Effects: Increases in heavy construction traffic on local roadways could increase safety hazards, such as conflicts with recreational and commuter traffic and with farming operations. The increase in heavy construction traffic using emergency routes could also interfere with emergency service response times. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could create localized interferences with emergency service response times in the vicinity of Bryon Highway. The effect of increased safety hazards from increased heavy construction traffic on local roadways and emergency routes would be adverse.

Mitigation Measure TRANS-1c is available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of increased safety hazards would occur. Accordingly, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Construction of Alternative 2D would increase the amount of trucks using the transportation system in the study area, which could increase the potential for safety hazards, including conflicts with farming operations, emergency services, and recreational and commuter traffic. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could also create localized interferences with emergency service response times in the vicinity of Bryon Highway. This would be a significant impact.

Mitigation Measure TRANS-1c will reduce the severity of this impact, but not to less-than-significant levels since the project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of increased safety hazards would occur. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-4: Disruption of Marine Traffic during Construction

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, marine traffic generated by construction of non-intake features structures would be similar to Alternative 4, whereas marine traffic generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to disrupt marine traffic during construction would therefore be similar to those impacts described under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-4 under Alternatives 1A and 4.

NEPA Effects: Commercial barges would be used to transport tunnel segments from three concrete precast yards to temporary barge unloading facilities on Bouldin Island and at the Clifton Court Forebay. Tugboats would also be used during intake and forebay construction. The number of barge trips required to carry tunnel segments would be similar to Alternative 4 (approximately 5,500 trips). This potential effect is not considered adverse because construction of Alternative 2D would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area, such that existing marine traffic would be disrupted. Barge routes and landing sites will be selected to maximize continuous waterway access and a minimum waterway width greater than 100 feet. Moreover, Mitigation Measure TRANS-1a would also reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

CEQA Conclusion: Construction of Alternative 2D would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area such that existing marine traffic would be disrupted (on average, only eight additional barge trips per day are expected through the segment hauling period). Accordingly, this impact would be less than significant. While no mitigation is required, it is important to note that Mitigation Measure TRANS-1a (implemented to reduce effects from Impact TRANS-1) would reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

Impact TRANS-5: Disruption of Rail Traffic during Construction

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to disrupt rail traffic during construction would therefore be similar to those impacts described under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-5 under Alternatives 1A and 4.

NEPA Effects: The water conveyance alignment crosses under the existing BNSF/Amtrak San Joaquin line between Bacon Island and Woodward Island and would therefore have no effect on freight service. Similarly, construction of the Clifton Court Forebay would not disrupt UPRR Tracy Subdivision service since the line is currently inactive. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities may adversely affect new service. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) is available to address this effect.

***CEQA Conclusion*:** Construction of Alternative 2D would not physically cross or require modification to an active railroad. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities at the Clifton Court Forebay may affect new service. This would be a significant impact. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) would reduce this impact to less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-6: Disruption of Transit Service during Construction

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to disrupt transit service during construction would therefore be similar to those impacts described under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-6 under Alternatives 1A and 4.

NEPA Effects: Construction activities associated with Alternative 2D would decrease LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions (refer to Impact TRANS-1). Increased congestion resulting from construction traffic would result in an adverse effect on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

***CEQA Conclusion*:** Construction activities associated with Alternative 2D would decrease LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions. Increased congestion resulting from construction traffic would result in a significant impact on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines. Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this impact, but not necessarily to a level that would not be less than significant, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, a significant and unavoidable impact in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the impact is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-7: Interference with Bicycle Routes during Construction

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to interfere with bicycle routes during construction would therefore be similar to those impacts described under Alternative 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-7 under Alternatives 1A and 4.

NEPA Effects: Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12. The effect of disruption to bicycle routes during construction would be adverse. Mitigation Measure TRANS-1a, which requires alternative access routes via detours or bridges be provided to maintain continual circulation for bicyclists, is available to reduce this effect.

CEQA Conclusion**:** Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12, resulting in a significant impact. However, Mitigation Measure TRANS-1a would reduce the severity of this impact to less-than-significant levels because project proponents would provide alternate access routes via detours or bridges to maintain continual circulation for local travelers in and around construction zones, including bicycle riders.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-8: Increased Traffic Volumes and Delays during Operations and Maintenance

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Traffic volumes generated during operation of Alternative 2D would therefore be slightly higher than Alternative 4, as described below. See the discussion of Impact TRANS-8 under Alternative 4.

NEPA Effects: Based on the number of employees required for routine operations and yearly maintenance under Alternative 4 (40 and 35, respectively) and the estimated number of employees required to maintain two additional intakes (10), Alternative 2D would require 50 and 35 employees for routine operations and yearly maintenance, respectively. While the labor force would be slightly greater than under Alternative 4, given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during project operations would not be adverse.

CEQA Conclusion**:** Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections under Alternative 2D would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during operations would therefore be less than significant. No mitigation is required.

Impact TRANS-9: Permanent Alteration of Transportation Patterns during Operations and Maintenance

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Traffic volumes generated during operation of Alternative 2D would therefore be slightly higher than Alternative 4, as described above under Impact TRANS-8. See the discussion of Impact TRANS-9 under Alternative 4.

NEPA Effects: Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. The effect of permanent alteration of transportation patterns during operations would therefore not be adverse.

CEQA Conclusion**:** Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. Accordingly, the impact of permanent alteration of transportation patterns during operations would be less than significant. No mitigation is required.

Impact TRANS-10: Increased Traffic Volumes during Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Effects of Alternative 2D related to increased traffic volumes during implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar to, but less than, those described for Alternative 4. See the discussion of Impact TRANS-10 under Alternative 4 in Appendix A in this RDEIR/SDEIS.

NEPA Effects: Habitat restoration and enhancement activities that require personnel or heavy-duty equipment transport would generate traffic on area roadways. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. This would be an adverse effect. The magnitude of the effect would vary according to the amount of traffic generated by implementation of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the roadway and traffic conditions at the time of implementation.

Alternative 2D would restore up to 17,766 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,839 acres under Alternative 4. Therefore, the magnitude of traffic volumes and associated traffic impacts under Alternative 2D would be smaller than those associated with Alternative 4. Nevertheless, the effect of increased traffic volumes during construction and maintenance of Environmental Commitments 3, 4, 6-10 would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion**:** Impacts on roadways could result in circulation delays or the inability to maintain adequate vehicular access in or around restoration or enhancement work zones. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. The impact of increased traffic volumes during implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be significant. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact would occur. Therefore, the project's impacts on roadway segment LOS would be conservatively significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-11: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments with Plans and Policies

Constructing the proposed water conveyance facilities and environmental commitments could result in the potential for incompatibilities with plans and policies related to transportation and circulation. These inconsistencies may result from increases in traffic volumes in excess of regional forecasts, modification of transportation infrastructure, or disruption in regional circulation patterns. Since traffic volumes generated during construction of Alternative 2D would range between those generated under Alternative 1A and those described for Alternative 4, Alternative 2D would generally have the same potential for incompatibilities with one or more transportation plans and policies as described for Alternatives 1A and 4 (which are similar) in Appendix A of this RDEIR/SDEIS. See the discussion of Impact TRANS-11 under Alternative 4.

NEPA Effects: As described for Alternative 4, the project would be constructed with regulations related to transportation and circulation enforced by local (including the local metropolitan planning organizations [MPOs]) and federal (including the FHWA [Federal Highway Administration] and FAA [Federal Aviation Administration]) agencies. The project would also be consistent with the Delta Protection Act of 1992 and Delta Plan. See the discussion of Impact TRANS-11 under Alternative 4 for additional information. Accordingly, there would be no adverse effect.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts TRANS-1 and TRANS-10, above and no additional CEQA conclusion is required related to the compatibility of Alternative 2D with relevant plans and policies.

Impact TRANS-12: Potential Effects on Navigation from Changes in Surface Water Elevations Caused by Construction of Water Conveyance Facilities

The potential impacts to navigation caused by changes in surface water elevation during construction of the proposed intakes under Alternative 2D would be similar to those described for Alternative 4A. Although Alternative 2D includes two additional intakes (Alternative 2D includes five intakes compared to three for Alternative 4A), the effects to surface water elevation caused by construction of the proposed intakes is highly localized, and therefore, the higher number of intakes would not result in a greater level of impacts to navigation.

Alternative 2D would include the construction of five fish-screened intakes on the west bank of the Sacramento River. Alternative 2D, however, could potentially entail two different intake and intake pumping plant locations. As an alternative to Intakes 1–5, intake locations 1, 2, 3, 6, and 7 are being considered. Unlike the other intakes, Intakes 6 and 7 would be downstream of Sutter and Steamboat Sloughs. Construction of the intakes would be accomplished using coffer dams at each location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Intakes and screens have been designed and located on-bank to minimize changes to river flow characteristics. Nevertheless, some localized water elevation changes will occur upstream and adjacent to each coffer dam at these intake sites due to facility location within the river. These localized surface elevation changes will not exceed an increase of 0.10 feet at any intake location even at high river flows (when surface elevation changes would be expected to be highest). This represents the highest surface upstream elevation increase after coffer dam removal and during intake operation. Because this maximum increase in elevation is entirely localized, downstream surface elevation changes during intake construction would be insignificant and changes to river depth and width at any location will be insignificant. As a result, boat passage and river use, including Sacramento River tributaries, will not be affected.

As explained in Chapter 6, *Surface Water*, construction of facilities within or adjacent to waterways could change surface water elevations or runoff characteristics. Alternative 2D would have potential impacts associated with alterations to drainage patterns, stream courses, and runoff, and potential for increased surface water elevations in the rivers and streams from construction of facilities located within the waterway, as described under Alternative 1A. Construction of the facilities under Alternative 2D would not result in a substantial decrease in surface water elevations on any navigable waterways and therefore would not have an adverse effect on navigation. Although the increase in surface water elevations in rivers and streams under Alternative 2D creates a potential impact regarding flooding (which is considered less-than-significant with implementation of Mitigation Measure SW-4) the changes in surface water elevation would not have any adverse effects on navigation. See Chapter 6, *Surface Water*, for additional information regarding changes to surface water under Alternative 2D.

NEPA Effects: Water surface changes and potential impacts associated with intake construction are not considered adverse to navigation. Water depth and surface elevations will not be substantially effected during construction of the water conveyance facilities (either localized or downstream of the intake structures). Although some construction activities and in-water features (i.e., cofferdams) may cause minor changes in surface water elevations, these effects are highly localized and surface water elevations would not increase by more than .10 feet at any location, even during flood events. These changes would not result in a substantial decrease in surface water elevations on any navigable waterways. Therefore, surface water changes associated with construction of the water conveyance facilities would not cause an adverse impact to navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during construction of the intakes will not have a significant impact on navigation.

Impact TRANS-13: Potential Effects of Navigation from Changes in Surface Elevations Caused by Operation of Intakes

The potential impacts to navigation caused by changes in surface water elevation during operation of the proposed intakes under Alternative 2D would be identical to those described for Alternative 4A, despite the fact that Alternative 2D includes five intakes (two more than Alternative 4A) and despite the fact that Alternative 2D has a 15,000 cfs total conveyance capacity (compared to 9,000 cfs for Alternative 4A). This is because the hydraulic modeling scenario and analysis included five intakes because that is the maximum number of intakes included under any alternative. The modeling also assumed the highest North Delta diversion capacity allowed under any alternative (15,000 cfs).

With respect to Alternative 2D, operation of Intakes 1, 2, 3, 4, and 5, or Intakes 1, 2, 3, 6, and 7 may have localized effects on water surface elevation during certain operational regimes and at various river flows. While intake operations and pumping levels are dictated by many factors, Sacramento River diversions are limited during low flows by operational rules. The nature and extent of impacts caused by diversions at an intake are dependent in large part on the location of the intake on the river. To minimize the intake effects on river surface elevations, intakes were designed as on-bank structures and were placed so that river flood and flow characteristic will be minimally altered. Based on hydrologic modelling, even at the lowest river flows (taking into account both seasonal and tidal variations) and at maximum intake operation (full diversions at each of five alternative intakes), estimates are that boat draft depths of at least 16.5 feet will be maintained within the Sacramento River. (*Planning and Design of Navigation Locks* United States Army Corps of Engineers, EM 1110-2-2602 (September 30, 1995) pages 3-8.) This river depth has occurred historically and has been adequate to support navigation along the Sacramento River. Additionally, under these same intake divisions/river flows, water surface elevations would be lowered by no more than 0.7 feet, which represents a localized and maximum estimate. Surface elevations downstream of the intakes would be affected less, and during higher river flow and lower intake diversions, river depths would be greater than the minimum estimate.

The minimal changes in surface water elevation anticipated under Alternative 2D, even assuming a maximum lowering of 0.7 feet, would not likely expose any currently unexposed natural or man-made features that would affect or impede navigation and there would be no new snags or obstructions that would impede navigation.

Moreover, even when operating at maximum capacity, the intakes would not alter flows in a way that would affect commercial vessels or recreational watercraft. The intakes are designed to ensure pumping velocities will have minimal impacts to aquatic species. It is unlikely that changes in flow velocity would be perceptible to operators of marine vessels or recreational watercraft and would have no effect on navigation.

Additional information regarding changes to surface water elevations can be found in Chapter 6, *Surface Water*.

NEPA Effects: Water surface changes and potential impacts associated with intake operation are not considered adverse. Water depth and surface elevations will not be significantly effected (either localized or downstream of the intake structures) and will therefore not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during operation of the intakes will not have a significant impact on navigation.

Impact TRANS-14: Potential Effects on Navigation Caused by Sedimentation from Construction of Intakes

The potential impacts to navigation caused by sedimentation under Alternative 2D would be similar to those described for Alternative 4A. Although Alternative 2D includes two additional intakes (Alternative 2D includes five intakes compared to three for Alternative 4A), the effects to sedimentation caused by construction of the proposed intakes is highly localized, and therefore, the higher number of intakes would not result in a greater level of impacts to navigation.

Construction for Intakes 1, 2, 3, 4, and 5 or Intakes 1, 2, 3, 6, and 7 would be accomplished using coffer dams at each intake location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Construction of coffer dams would require sheet pile driving that would result in incremental suspension of bed sediments. These effects would be temporary and would not have an effect on navigation. Sheet piles at the edge of the levee embankment would likely change eddy currents locally, but rock slope in the transition zone would limit those currents and potential changes to bed load dynamics. As a result, erosion and sedimentation into the Sacramento River during intake construction would be minimal

Moreover, potential sedimentation effects will be further minimized by limiting the duration of in-water construction activities and through implementing the environmental commitments described in Appendix 3B, *Environmental Commitments,* including the commitment to *Develop and Implement Erosion and Sediment Control Plans* to control short-term and long-term erosion and sedimentation effects and to restore soils and vegetation in areas affected by construction activities following construction. This commitment is related to Avoidance and Minimization Measure (AMM) 4, *Erosion and Sediment Control Plan*, described in BDCP Appendix 3.C. It is anticipated that multiple erosion and sediment control plans will be prepared for construction activities, each taking into account site-specific conditions such as proximity to surface water, erosion potential, drainage, etc. The plans will include all the necessary state requirements regarding erosion control and will implement BMPs for erosion and sediment control that will be in place for the duration of construction activities.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Construction of coffer dams and intake construction would not have an adverse effect on navigation through increased sedimentation and erosion/deposition in the navigable channel.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during construction of the intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-15: Potential Effects on Navigation Caused by Sedimentation from Construction of Barge Facilities

The potential impacts to navigation caused by sedimentation under Alternative 2D would be similar to those described for Alternative 4A. Although Alternative 2D includes a greater number of barge fleeting facilities, the effects to sedimentation caused by construction of the facilities is highly localized, and therefore, the greater number of barge facilities would not result in a greater level of impacts to navigation.

Alternative 2D includes six barge unloading facilities to be built on or near the tunnel alignment similar to those described for Alternative 2A. The facilities would be used to transfer pipeline construction equipment and materials to and from construction sites and would be removed after construction was completed. The facilities would likely include in-water and over-water structures, such as piling dolphins, docks, ramps, and possibly conveyors for loading and unloading materials; and vehicles and other machinery. Construction of the facilities would involve piles at each location.

To address potential erosion and sedimentation impacts from barge facility construction associated with Alternative 2D, the project proponents will ensure that a Barge Operations Plan is developed and implemented for facility construction. The requirements for the Barge Operations Plan are described in Draft EIR/EIS Appendix 3B, *Environmental Commitments*. This commitment is related to AMM7, *Barge Operations Plan*, described in BDCP Appendix 3.C. This plan will be developed and submitted by the construction contractors per standard DWR contract specifications. Erosion control measures during construction activities at project locations are provided in Appendix 3B, *Environmental Commitments*, as noted above in the discussion of the intakes. Fleeting facilities will be either docking facilities built through pile and wharves or loaded and unloaded using landward positioned cranes. In either case, through AMM7 and the Environmental Commitments, impacts to sedimentation through construction related activities will be localized and minimal.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

***NEPA Effects*:** Construction and operation of the barge facilities under Alternative 2D would not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation from the temporary barge facilities will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-16: Potential Effects on Navigation Caused by Sedimentation from Construction of Clifton Court Forebay

The potential impacts to navigation from sedimentation at Clifton Court Forebay under Alternative 2D would be identical to those described for Alternative 4A. Clifton Court Forebay would be dredged and redesigned to provide an area where water flowing from the new north Delta facilities will be isolated from water diverted from south Delta channels. While Clifton Court Forebay is a "navigable water," use of the forebay is limited to maintenance operations and is not open to commercial or recreational navigation.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact TRANS-17: Potential Effects on Navigation Caused by Sedimentation from Operation of Intakes

The potential impacts to navigation caused by sedimentation under Alternative 2D would be similar to those described for Alternative 4A. Although Alternative 2D includes two additional intakes (Alternative 2D includes five intakes compared to three for Alternative 4A), the effects to sedimentation during operation of the proposed intakes under Alternative 2D would be similar to those described for alternative 4A for the reasons described below.

Sediment loads are present in the Sacramento River as bed loads or distributed within the water column. The Sacramento River is sediment "starved" for most of the year since upstream reservoirs act as settling basins for suspended sediments. In most cases, sediment load is concentrated on the river bed and this bed load depends on several factors including particle size, particle density and flow velocity. To exclude bed loads from entering intake structures during operation, design criteria for the intakes require that the lowest point of the screen is placed above the river bed in such a way that there is no change in bed sediment erosion/distribution patterns. Additionally, screen locations for this alternative are placed on the outer bends of the river to minimize scour, erosion and sediment loading at those locations. Flow control baffles at intakes would be adjusted to control sedimentation near the screens as needed and air jets at screens are proposed to re-suspend sediments as needed.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Operational criteria and design specifications for intake operations will result in no change to water column or bed load sediment dynamics. Erosion and deposition patterns will change little if any during intake operation. As a result, there will be no adverse effect on navigation either near or downstream of the intake locations.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during operation of the proposed intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-18: Potential Effects on Navigation from Construction and Operations of Head of Old River Barrier

Under Alternative 2D, an operable barrier would be placed at the head of Old River at the confluence with the San Joaquin River. The potential navigation impacts from construction and operations of Head of Old River barrier would be identical to those described for Alternative 4A.

Alternative 2D proposes work at the Head of Old River including the construction of fish and flow control gates as well as a small boat lock to allow recreational boat passage. An analysis of potential impacts of this work on navigation was completed in 2005 by Jones and Stokes (South Delta Improvements Program Vol I: Environmental Impact Statement/Environmental Impact Report. Draft. October. (J&S 020533.02.) State Clearinghouse #2002092065. Sacramento, CA.) ("SDIP EIS/EIR"). The SDIP EIS/R analyzed whether the proposed barrier/gates facility and locks would cause a change in south Delta flows or water level, river flows or surface water elevations that would result in substantial changes to existing recreational or commercial boating activity and opportunities.

The changes in access to Delta waterways by boats and other vessels during construction and operation of the gates, during channel dredging activities, and attributable to changes in water levels/depths were addressed. Most of the waterways in the immediate project vicinity are public waterways navigable by recreational craft, including rowboats, large houseboats, and cabin cruisers. These waterways are also navigable by smaller commercial vessels, including towing and salvage vessels, clamshell dredges, dredges for repair and maintenance of levees and channels, and pile-driving vessels. Boat access points in the project area include River's End Marina, located on the south side of the DMC, at the confluence with Old River; Tracy Oasis Marina Resort, located on the east side of Tracy Boulevard and the north side of Old River; and possibly at Heinbockle Harbor, located at Tracy Boulevard, on the south side of Grant Line/Fabian and Bell Canal.

According to a California Department of Parks and Recreation (DPR) survey, minimal boat launching and use occurs in the project area. The channels within the project area are too small to accommodate large commercial vessels, and because the channels are also part of an existing temporary barriers project, larger vessels cannot use these channels when the barriers are in place. A boat lock at the proposed facility would ensure boat access upstream of the gate regardless of gate operations. In this regard, upstream boat access could improve over current conditions. Additionally, from June 16 through September 30, the gates will be open and no boat lock operations will be necessary.

With respect to both recreational and commercial navigation, and based on analysis provided in the SDIP EIS/EIR, boat access impacts during facility construction will be less than significant (p. 5.8-14, 5.8-18, 5.8-21), impacts to navigation caused by water level changes during barrier operation will be less than significant (p. 5.8-15. 5.8-19, 5.8-22), impact to non-recreational boaters due to temporary dredging operation will be less than significant (p. 5.8-16, 5.8-19, 5.8-22), and impacts on recreation as a result of constructing and operating any of the alternatives will not be significant (p. 7.4-1).

Construction of the operable barrier could result in increased sedimentation near the gates. Maintenance dredging around the gate would be necessary to clear out sediment deposits. Dredging around the gates would be conducted using a sealed clamshell dredge. Depending on the rate of sedimentation, maintenance would occur every 3 to 5 years. A formal dredging plan with further details on specific maintenance dredging activities will be developed prior to dredging activities. Guidelines related to dredging activities, including compliance with in-water work windows and turbidity standards are described further in Appendix 3B, *Environmental Commitments*, under *Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material*. These activities would ensure that sedimentation would not result in an adverse impact to navigation.

NEPA Effects: With respect to construction and operations of the Head of Old River barrier, Alternative 2D would have no adverse effect on either commercial or recreational navigation activities.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, construction and operations of the Head of Old River barrier will not have a significant impact on navigation.

Impact TRANS-19: Potential Cumulative Effects on Navigation from Construction and Operations of Water Conveyance Facilities

As explained above and with respect to the construction and operation of these facilities, Alternative 2D would not result in an adverse effects to navigation due to water level elevation changes or altered sedimentation patterns. It is highly unlikely that other projects would combine with these impacts of the project to result in cumulative effects on navigation. This is because the minimal effects of these elements of the project on navigation are localized and would combine only with probable future projects if the projects were located immediately adjacent to the project components. There are no other reasonably foreseeable projects proposed to be located near or adjacent to the planned Alternative 2D facilities.

NEPA Effects: Alternative 2D in combination with other reasonably foreseeable projects would not have a cumulatively adverse effect on navigation.

CEQA Conclusion**:** Because it does not involve a physical change in the environment, effects to navigation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, Alternative 2D in combination with other reasonably foreseeable projects would not have a cumulatively significant impact on navigation.

4.4.16 Public Services and Utilities

Impact UT-1: Increased Demand on Law Enforcement, Fire Protection, and Emergency Response Services from New Workers in the Project Area as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the provision of law enforcement, fire protection, and emergency response services as a result of construction of the proposed water conveyance facilities would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but slightly greater due to the need for additional workers to build the two additional intakes. Increased service demands would be experienced in the communities in which new construction workers relocate and in the areas in which construction would take place. However, it is anticipated that many construction jobs would be filled from the existing labor force in the five-county project area region. Effects on services from the presence of new workers in the project area would be anticipated to be marginally greater for this alternative because they would extend to an additional location with the potential construction of an operable barrier at the Head of Old River. The minor increase in construction workers relocating into the project area for specialized jobs (e.g., tunnel construction) during the construction period of approximately 13.5 years would be spread across a large multi-county area. Increases in demand for law enforcement, fire protection and medical services related to this small change in population in any one county are expected to be negligible.

Similarly, the scale and duration of construction required for Alternative 2D could result in increased demand on law enforcement services, especially near major construction sites. Incorporation of an environmental commitment that would provide 24-hour onsite private security at construction sites (Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS) would ensure there would be no adverse effect on local law enforcement agencies associated with construction property protection. Incorporation of environmental commitments that would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires would reduce adverse effects related to the potential demand for law enforcement, fire protection, or emergency services (Appendix 3B, *Environmental Commitments* in Appendix A of the RDEIR/SDEIS).

Construction of Alternative 2D would not increase the demand on law enforcement, fire protection, and emergency response services from new workers in the project area such that it would result in the need for, new or physically altered governmental facilities. Impacts to emergency response times from construction traffic using emergency routes are discussed in Chapter 19 Impact TRANS-3. Accordingly, there would be no adverse effect.

CEQA Conclusion: The potential for impacts on law enforcement and fire services and facilities is not expected to be significant because the estimated increase in population in the project area associated with construction of the alternative during peak construction would be distributed over multiple cities and counties within the project area. In addition, environmental commitments would be incorporated into the alternative to reduce effects related to demand for law enforcement, fire protection, and emergency response services at or near construction sites from new construction workers in the project area, and effects on local law enforcement agencies associated with construction property protection. Construction of Alternative 2D would not require new or physically altered governmental facilities to support the needs of new workers in the project area. These impacts would be considered less than significant. No mitigation is required.

Impact UT-2: Displacement of Public Service Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Under Alternative 2D, a proposed 28-foot interior diameter single-bore tunnel would be constructed more than 100 feet below the surface of Hood. It would connect north of Hood to pipelines running from Intakes 2 and 3, and south of Hood to the intermediate forebay. There are no public facilities in the proposed tunnel location. Construction of the tunnel is not anticipated to disturb the surface and would not conflict with any public facilities, nor would it require the construction or major alteration of such facilities. This effect would not be adverse.

CEQA Conclusion: Construction of the proposed water conveyance facilities under Alternative 2D would not require the construction or major alteration of public service facilities. Therefore, this impact would be less than significant. No mitigation is required.

Impact UT-3: Effects on Public Schools as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: As discussed under Alternative 4 in Appendix A of this RDEIR/SDEIS, because most of the project construction jobs would be filled by workers from within the existing five-county labor force, it is anticipated that school-aged children from those families would already have planned to attend schools in school districts within the project area and there would be no increased demand for public school services from these workers (see Table 20A-4, Appendix 20A). As shown in Table 20A-4, a small number of schools have current enrollments which are already in excess of the available capacity. Although some workers who relocate from outside of the project area could have school-age children, resulting in an increase in public school enrollment, this minor increase in population in the project area for a limited time, and the likelihood that they would be distributed among multiple schools and districts, would not be expected to result in an increase in enrollment numbers substantial enough to exceed the capacity of any individual district, or to warrant construction of a new facility within the project area. There would not be an adverse effect.

CEQA Conclusion: The majority of construction jobs are expected to be filled by workers from the five-county labor force. The incremental increase in school-age children of construction personnel moving into the area for specialized construction jobs (e.g., tunnel construction) would likely be distributed through a number of schools within the project area. This increase in school enrollment would not be substantial enough to exceed the capacity of any individual district, or to warrant construction of a new facility within the project area. The impact on public schools is less than significant. No mitigation is required.[2]

Impact UT-4: Effects on Water or Wastewater Treatment Services and Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the need for expanded water or wastewater treatment facilities would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. For purposes of this analysis, the amount of water supply required under this alternative would be greater than the amount required under Alternative 4 due to two additional intakes. Considered

[2] Under California law, the rules governing what constitutes adequate mitigation for impacts on school facilities is governed by legislation. Pursuant to the operative statutes, impacts on schools, with some exceptions, are sufficiently mitigated, as a matter of law, by the payment of school impact fees by residential developers. (See Cal. Gov. Code, §§ 65995[h], 65996[a].)

across the alternative, potable water supply needs are substantial in volume; however, these requirements would need to be met over a construction period of approximately 13.5 years, and would be anticipated to be met with non-municipal water sources without any need for new water supply entitlements. If there are no existing water lines in the vicinity, then field offices will require construction of a water tank. Water for construction will be provided by available sources to the extent possible; if needed, water may be brought to the construction sites in water trucks. Also similar to Alternative 4, wastewater created as a result of tunnel boring and concrete batching would be provided by temporary facilities and treated onsite. Construction of Alternative 2D would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. As discussed under Alternative 4, as part of the Environmental Commitments (Appendix 3B) for each alternative, DWR will be required to conduct project construction activities in compliance with the State Water Board's *NPDES Stormwater General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order No. 2009-0009-DWQ/NPDES Permit No. CAS000002). This General Construction NPDES Permit requires the development and implementation of a SWPPP that outlines the temporary construction-related BMPs to prevent and minimize erosion, sedimentation, and discharge of other construction-related contaminants, as well as permanent post-construction BMPs to minimize adverse long-term stormwater related–runoff water quality effects. This effect would not be adverse.

CEQA Conclusion: While construction of this alternative would require a substantial supply of water, this supply could be met by non-municipal sources such as non-municipal water wells or water trucks. Additional needs for wastewater treatment and potable water could also be served by non-municipal entities. Construction of Alternative 2D would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. This impact would be less than significant. Mitigation is not required.

Impact UT-5: Effects on Landfills as a Result of Solid Waste Disposal Needs during Construction of the Proposed Water Conveyance Facilities

NEPA Effects: Potential effects associated with an increased demand for solid waste management providers in the project area and surrounding communities as a result of waste generated from construction of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS. Minor additional needs for landfill services may be generated by the construction of an operable barrier as well as two additional intakes. However, the construction waste that could be generated by implementing Alternative 2D would not result in an adverse effect on the capacity of available landfills because 50% or more of construction waste generated by this alternative would be diverted (in accordance with diversion requirements set forth by the State Agency Model Integrated Waste Management Act (IWMA) and BMP 13 [Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS]), and the construction debris and excavated material that would require disposal at a landfill could be accommodated by, and would have a negligible effect, on the remaining permitted capacity of project area landfills. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. This effect would not be adverse.

CEQA Conclusion: Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it would be expected that construction of the proposed water conveyance facilities would not cause any exceedance of landfill capacity. RTM resulting from construction of tunnel segments would be treated in designated RTM work areas. Debris from structure demolition, power poles, utility lines, piping, and other materials would be diverted from landfills to the maximum extent feasible at the time of demolition. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. Further, implementation of BMP 13 (Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS) would require development of a project-specific construction debris recycling and diversion program to achieve a documented 50% diversion of construction waste. Construction of Alternative 2D would not create solid waste in excess of the permitted capacity of area landfills, nor would it adversely affect the expected lifespan of these solid waste facilities. Therefore, there would be a less-than-significant impact on solid waste management facilities.

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Disruption of utility services or relocation of existing facilities would be similar to that described under Alternative 4 in Appendix A of this RDEIR/SDEIS. While the two additional intakes associated with Alternative 2D may interfere with additional utilities, the rest of the alignment past the intakes would have the same amount of interferences as Alternative 4: 12 overhead power/electrical transmission lines (Figure 24-6 in the Draft EIR/EIS), 6 natural gas pipelines (Table 20-5 and Figure 24-3 in the Draft EIR/EIS), 11 inactive oil or gas wells (Figure 24-5 in the Draft EIR/EIS), the Mokelumne Aqueduct, and 43 miles of agricultural delivery canals and drainage ditches, including approximately 13 miles on Byron Tract, and 7 miles on Bouldin Island. Additionally, active gas wells may need to be plugged and abandoned. Relocation of additional facilities near proposed forebays, RTM, and borrow or spoils areas could also be necessary. The potential damage and disruption to buried and overhead electric transmission lines would be similar for telecommunication infrastructure. Because relocation and disruption of existing utility infrastructure would be required under this alternative and would have the potential to create environmental effects, this effect would be adverse.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce the severity of this effect. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the effect would not be adverse.

CEQA Conclusion: Under this alternative, most features would avoid disrupting existing facilities by crossing over or under infrastructure. However, construction of facilities would conflict with existing utility facilities in some locations. Regional power transmission lines and one natural gas pipeline would require relocation. Because the relocation and potential disruption of utility infrastructure would be required, this impact would be significant.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce these impacts through measures that could avoid disruption of utility infrastructure. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the impact would be less-than-significant. However, because coordination with a third party is required in order to carry out this mitigation, a conservative assessment of significant and unavoidable is being made.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Impact UT-7: Effects on Public Services and Utilities as a Result of Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The proposed water conveyance facilities under this alternative would be operated to provide diversions up to a total of 15,000 cfs from five new north Delta intakes, rather than 9,000 cfs from three intakes under Alternative 4. However, potential effects associated with operation and maintenance of water conveyance facilities would be similar to those described under Alternative 4.

Operation and maintenance activities would require minimal labor. Impacts under Alternative 2D would be similar to those discussed under Alternative 4 in Appendix A of this RDEIR/SDEIS. A few additional workers would be needed given the need to operate the two additional intakes. However, given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial demand for law enforcement, fire protection, or emergency response services. In addition, operation and maintenance would not place service demand on public schools or libraries. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new or physically altered government facilities as a result of increased need for public services.

Potential effects associated with operation and maintenance of water conveyance facilities would be similar to those described under Alternative 4. Therefore, Alternative 2D would not result in physical effects associated with the provision of new or physically altered government facilities.

Operation and maintenance of Alternative 2D facilities would involve use of water for pressure washing intake screen panels and basic cleaning of building facilities and other equipment. Impacts would be similar to those under Alternative 4, but slightly greater due to the need to maintain two additional intakes. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new water supply entitlements, or require construction of new water or wastewater treatment facilities or expansion of existing facilities.

Similar to Alternative 4, the operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to generate solid waste such that there would be an increase in demand for solid waste management providers in the project area and surrounding communities. Therefore, there would be no or minimal effect on solid waste management facilities.

As with Alternative 4, operation and maintenance of proposed water conveyance facilities under this alternative would require new transmission lines for intakes, pumping plants, operable barriers, boat locks, and gate control structures throughout the various proposed conveyance alignments and construction of project facilities. Points of interconnection would be located similarly to Alternative 4.

Construction of permanent transmission lines would not require improvements to the existing physical power transmission system. As such, operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to result in the disruption or relocation of utilities. Effects associated with energy demands of operation and maintenance of the proposed water conveyance facilities are addressed in Chapter 21, *Energy*, of the Draft EIR/EIS.

Overall, operation and maintenance of the conveyance facilities under Alternative 2D would not result in adverse effects on service demands, water supply and treatment capacity, wastewater and solid waste facilities nor conflict with local and regional utility lines. There would not be an adverse effect.

CEQA Conclusion: Operation and maintenance activities associated with the Alternative 2D proposed water conveyance facilities would not result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities. The impact on public services and utilities would be less than significant. No mitigation is required.

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 2D related to the potential for effects on public services and utilities from implementing applicable conservation and other stressor reductions would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, Alternative 2D would protect and restore up to 17,766 acres of habitat under Environmental Commitment 3, 4, and 6–10 as compared with 83,800 acres under Alternative 4. Up to 5.5 miles of channel margin habitat would be enhanced under Alternative 2D with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 2D would be smaller than those associated with Alternative 4.

Public Services

Potential effects of implementing conservation and other stressor reductions under Alternative 2D on law enforcement, fire protection, and emergency response services would primarily involve demand for services related to construction site security and construction-related accidents. The effect would be similar to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS, but because the habitat restoration and enhancement activities under Alternative 2D would be of a smaller magnitude than the Conservation Measures under Alternative 4, it is likely that the effects on public services would be less than those presented for Alternative 4. This effect would not be considered adverse with the implementation of environmental commitments to provide onsite private security services at construction areas and environmental commitments that would minimize the potential for construction-related accidents associated with hazardous materials spills, contamination, or fires, as described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS. These environmental commitments would be incorporated into this alternative and would provide for onsite security at construction sites and minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities.

Utilities

Water and Wastewater

Implementation of some of the Environmental Commitments, in particular those involved with restoration and enhancement of some habitat types, could require a water supply, but would not require city or county treated water sources. Effects would be similar to, but less in magnitude than that those discussed under Alternative 4 in Appendix A of this RDEIR/SDEIS, because Alternative 2D involves smaller acreage amounts of restoration and conservation. Additionally, some components that would require water supply under Alternative 4 are not a part of Alternative 2D (CM5, CM8 of the Draft BDCP). Environmental Commitments that could increase need for water supply are restoration of natural tidal communities (Environmental Commitment 4), channel margin (Environmental Commitment 6), riparian (Environmental Commitment 7), vernal pool and alkali seasonal wetland complex (Environmental Commitment 9), and nontidal marsh habitats (Environmental Commitment 10); and maintenance of these habitats. Measures related to the reduction of stressors on covered species that are a part of Alternative 2D would not generally require a treated water supply or generate wastewater. Because the location and construction or operational details (i.e., water consumption and water sources associated with habitat restoration and enhancement activities) of these facilities and programs have not yet been developed, the need for new or expanded water or wastewater treatment facilities is uncertain. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely.

Solid Waste

Implementation of some of the habitat restoration and enhancement activities would result in construction debris and green waste. Implementation of habitat restoration and enhancement proposed under Environmental Commitments 4, 6, 7, and 9–11 would involve restoration, enhancement, and management of various types of habitat. Construction activities could require clearing and grubbing, demolition of existing structures (e.g., roads and utilities), surface water quality protection, dust control, establishment of storage and stockpile areas, temporary utilities and fuel storage, and erosion control. Effects would be similar to, but less in magnitude than those described under Alternative 4 in Appendix A of this RDEIR/SDEIS, because Alternative 2D involves smaller acreage amounts of restoration and conservation. The estimated tonnage of construction debris and solid waste that would be generated from construction associated with the proposed habitat restoration and enhancement activities is unknown. However, there is a remaining landfill capacity of over 300 million tons in nearby landfills (Table 20A-6 in Appendix 20A of the Draft EIR/EIS). The disposal of construction debris and excavated material would occur at several different locations depending on the type of material and its origin. Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it is expected that construction and operation of the proposed habitat restoration and enhancement activities would not cause any exceedance of landfill capacity.

Electricity and Natural Gas

Habitat restoration and enhancement activities including habitat restoration and enhancement would, in some cases, involve substantial earthwork and ground disturbance. As discussed above under Impact UT-6, construction could potentially disrupt utility services, and ground disturbance has potential to damage underground utilities. The long-term conversion of existing utility corridors to habitat purposes could require the relocation of utility infrastructure, which could carry environmental effects. Mitigation Measures UT-6a, UT-6b, and UT-6c would be available to reduce the severity of these effects.

Effects would be similar to, but less in magnitude than that under Alternative 4, because Alternative 2D involves smaller acreage amounts of restoration and conservation. The locations, construction, and operational details for these and other habitat restoration and enhancement activities have not been identified. Adverse effects due to the construction, operation and maintenance activities associated with the habitat restoration and enhancement activities are not expected to result in the need for new government facilities to provide public services or the need for new or expanded water or wastewater treatment facilities based on increased demand. Environmental commitments would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities. However, there is a potential for the disruption or relocation of utility infrastructure, which has the potential to result in an adverse effect. Further, no substantive adverse effects on solid waste management facilities are anticipated. Because the location and construction and operational details (i.e., water consumption and water sources associated with habitat restoration and enhancement activities) related to these facilities and programs have not yet been developed, the need for new or expanded water facilities is uncertain. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely. This effect would be adverse.

CEQA Conclusion: Significant impacts could occur if implementation of the proposed habitat restoration and enhancement activities would result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities.

Implementation of the proposed habitat restoration and enhancement activities under Alternative 2D is not likely to require alteration or construction of new government facilities due to increased need for public services and utilities. Several measures to reduce stressors on covered species could result in water supply requirements, but are not expected to require substantial increases in demand on municipal water and wastewater treatment services.

Construction and operation activities associated with the proposed Environmental Commitments would result in a less-than-significant impact on solid waste management facilities based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California.

Potential impacts of implementing habitat restoration and enhancement activities on law enforcement, fire protection, and emergency response services within the ROAs would be less-than-significant with the incorporation of environmental commitments into this alternative and would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

The need for new or expanded water facilities and the potential to disrupt utilities in the study area as a result of construction of operation of conservation and other stressor reductions is unknown at this time, nor have construction and operational details been settled upon. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely. Mitigation Measures UT-6a, UT-6b, and UT-6c would reduce the significance of impacts on utilities, but potentially not to a less-than-significant level Therefore, this impact would significant and unavoidable.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

4.4.17 Energy

Impact ENG-1: Wasteful or Inefficient Energy Use for Temporary Construction Activities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A as described in the Draft EIR/EIS. Construction energy use required for Alternative 2D would therefore be slightly higher than Alternative 4, described in Appendix A of this RDEIR/SDEIS, but the potential to result in a wasteful or inefficient energy use would be the same as Alternative 4. Accordingly, the effects from construction energy use under Alternative 2D would be similar to Alternative 4. See the discussion of Impact ENG-1 under Alternative 4.

NEPA Effects: Based on the total construction energy use for Alternative 4 (2,132 GWh) and the estimated demand required to construct two additional intakes (16 GWh), Alternative 2D would require about 2,148 GWh of electricity over the 14-year construction period. Diesel and gasoline consumption by Alternative 2D would be greater than Alternative 4 due to the increased number of intakes, and would likely range between that of Alternatives 1A and 4. Accordingly, the alternative may consume between 104 and 147 million gallons over the construction period.

While Alternative 2D would require slightly more construction energy than Alternative 4, the potential for Alternative 2D to result in a wasteful, inefficient or unnecessary consumption of construction energy would be similar to Alternative 4. Construction best management practices (BMPs) would ensure that only high-efficiency equipment is utilized during construction and that construction activity would not result in an adverse effect on energy resources.

***CEQA Conclusion*:** Energy requirements for construction of the water conveyance facilities associated with Alternative 2D would equate to approximately 2,148 GWh during the construction period. Alternative 2D would also consume between 104 and 147 million gallons of diesel and gasoline. Construction BMPs would ensure that only high-efficiency equipment is utilized during construction and that construction activity would result in a less-than-significant impact on energy resources. No mitigation is required.

Impact ENG-2: Wasteful or Inefficient Energy Use for Pumping and Conveyance

Alternative 2D would have the same operations as Alternative 2A. Accordingly, the effects from operational energy use under Alternative 2D would be similar to Alternative 2A. See the discussion of Impact ENG-2 under Alternative 2A in Appendix A of this RDEIR/SDEIS.

NEPA Effects: As shown in Table 21-12 in Appendix A of this RDEIR/SDEIS, energy use for north Delta intake pumping and tunnel conveyance would be 341 GWh per year under ELT conditions and 328 GWh per year under LLT conditions. Accordingly, increased energy use at the north Delta would be slightly higher under Alternative 2D than estimated for Alternative 4. While Alternative 2D would still increase energy demand at the north Delta, relative to the No Action Alternative, operation of the water conveyance facility would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 2D would not result in a wasteful or inefficient energy use and there would be no adverse effect.

***CEQA Conclusion*:** Operation of Alternative 2D would require an additional 341 GWh per year under ELT conditions and 328 GWh per year under LLT conditions for north Delta pumping, relative to

Existing Conditions. Operation of the water conveyance facility under both scenarios would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 2D would not result in a wasteful or inefficient energy use and this impact would be less than significant. No mitigation is required.

Impact ENG-3: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 with Plans and Policies

Constructing the water conveyance facilities and implementing the environmental commitments under Alternative 2D would generally have the same potential for incompatibilities with one or more plans and policies related to energy resources as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact ENG-3 under Alternative 4.

NEPA Effects: As described for Alternative 4 in Appendix A of this RDEIR/SDEIS, the project would be constructed and operated in compliance with regulations related to energy resources enforced by Federal Energy Regulatory Commission (FERC) and other federal agencies. The project would not conflict with the Warren-Alquist Act or State CEQA Guidelines, Appendix F, *Energy Conservation.* Accordingly, there would be no adverse effect.

***CEQA Conclusion*:** The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts ENG-1 and ENG-2, above and no additional CEQA conclusion is required related to the compatibility of Alternative 2D with relevant plans and policies.

4.4.18 Air Quality and Greenhouse Gases

Impact AQ-1: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4 in Appendix A of this RDEIR/SDEIS, but would include two additional intakes, similar to Alternative 1A. Accordingly, construction emissions generated by Alternative 2D in the Sacramento Metropolitan Air Quality Management District (SMAQMD) would be greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-1 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-12 and 22-99 in Appendix A of this RDEIR/SDEIS, nitrogen oxide (NO_X) emissions generated by Alternatives 2D and 4 would exceed SMAQMD's daily threshold for all years between 2018 and 2029, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS). Since NO_X is a precursor to ozone and particulate matter (PM), violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the national ambient air quality standards (NAAQS) and California ambient air quality standards (CAAQS). Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** NO_X emissions generated during construction of Alternative 2D would exceed SMAQMD regional threshold of significance. Since NO_X is a precursor to ozone and PM, violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation. The impact of generating NO_X emissions in excess of local air district thresholds would violate applicable air quality standards in the study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions to a less-than-significant level by offsetting emissions to quantities below SMAQMD CEQA thresholds.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants[3]

Please refer to Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[3] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-2: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, described in Appendix A of this RDEIR/SDEIS, but would include two additional intakes, similar to Alternative 1A. There would be no construction of physical features in the Yolo-Solano Air Quality Management District (YSAQMD). Accordingly, emissions generated in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions generated in YSAQMD would therefore be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-2 under Alternatives 1A and 4.

NEPA Effects: As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, criteria pollutant emissions generated by Alternative 4 would not exceed YSAQMD regional thresholds. However, construction emissions under Alternative 1A would exceed YSAQMD regional thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments* in the Draft EIR/EIS).

- NO_X: 2022–2024
- Particulate matter less than 10 microns in diameter (PM10): 2022–2028

Since NO_X is a precursor to ozone and PM, violations of YSAQMD's daily NO_X threshold could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of YSAQMD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** Construction emission could exceed YSAQMD's regional thresholds for NOx and PM10. Since NO_X is a precursor to ozone and PM, violations of YSAQMD's daily NO_X threshold could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of YSAQMD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. This would be a significant impact. Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X and PM10 emissions to a less-than-significant level by offsetting emissions to quantities below YSAQMD CEQA thresholds.

Impact AQ-3: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Emissions from construction of physical features in the Bay Area Air Quality Management District (BAAQMD) would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD. Accordingly, total emissions generated in the BAAQMD would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-3 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-12 and 22-99 in Appendix A of this RDEIR/SDEIS, construction emissions generated by Alternatives 1A and 4 would exceed BAAQMD's daily thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

- Reactive organic gases (ROG): 2023–2027 (Alternative 1A); 2020–2028 (Alternative 4)
- NO_X: 2018–2029 (Alternatives 1A and 4)

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could impact both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Mitigation Measures AQ-3a and AQ-3b are available to reduce ROG and NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*: ** Emissions of ROG and NO_X generated during construction would exceed BAAQMD regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could affect both regional ozone and PM formation. The impact of generating ROG and NO_X emissions in excess of BAAQMD's regional thresholds would therefore violate applicable air quality standards in the Study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-3a and AQ-3b would be available to reduce ROG and NO_X emissions to a less-than-significant level by offsetting emissions to quantities below BAAQMD CEQA thresholds.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[4]

Please refer to Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

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[4] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Impact AQ-4: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4 in the San Joaquin Valley Air Pollution Control District (SJVAPCD). Accordingly, emissions from construction of physical features and equipment and material transport in the SJVAPCD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-4 under Alternative 4.

NEPA Effects: As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, construction emissions would exceed SJVAPCD's regional thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

- ROG: 2020–2025
- NO_X: 2018–2028
- PM less than 10 microns in diameter (PM10): 2019–2025

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could impact both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. Mitigation Measures AQ-4a and AQ-4b are available to reduce ROG, NO_X, and PM10 emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** Emissions of ROG, NO_X, and PM10 generated during construction would exceed SJVAPCD's regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. The impact of generating ROG, NO_X, and PM10 emissions in excess of SJVAPCD's regional thresholds would therefore violate applicable air quality standards in the Study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-4a and AQ-4b would be available to reduce ROG, NO_X, and PM10 emissions to a less-than-significant level by offsetting emissions to quantities below SJVAPCD CEQA thresholds.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants[5]

Please refer to Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions

[5] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-5: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, operational emissions generated by Alternative 2D in the SMAQMD would be greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-5 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-13 and 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternatives 1A and 4 would not exceed SMAQMD's regional thresholds of significance. Accordingly, operation of Alternative 2D would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed SMAQMD regional thresholds of significance. Accordingly, Alternative 2D would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-6: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

Operations and maintenance emissions generated by Alternative 2D in the YSAQMD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-6 under Alternative 4.

NEPA Effects: As discussed for Alternative 4, no permanent features would be constructed in the YSAQMD that would require routine operations and maintenance. Accordingly, no operational emissions would be generated in the YSAQMD and operation of Alternative 2D would neither exceed the YSAQMD regional thresholds of significance nor result in an adverse effect to air quality.

***CEQA Conclusion*:** No operational emissions would be generated in the YSAQMD. Consequently, operation of Alternative 2D would not exceed the YSAQMD regional thresholds of significance. This impact would be less than significant. No mitigation is required.

Impact AQ-7: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the Clifton court forebay). Since the water conveyance footprint in BAAQMD under Alternative 2D would be similar to Alternative 4, operational activities required for Alternative 2D in the BAAQMD would be the same as those required for Alternative 4. See the discussion of Impact AQ-7 under Alternative 4.

NEPA Effects: As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternative 4 during the ELT condition would not exceed BAAQMD's regional thresholds of significance. Accordingly, operation of Alternative 2D would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed BAAQMD regional thresholds of significance. Accordingly, Alternative 2D would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-8: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the tunnel segments). Since the water conveyance footprint in SJVAPCD under Alternative 2D would be similar to Alternative 4, operational activities required for Alternative 2D in the SJVAPCD would be the same as those required for Alternative 4. See the discussion of Impact AQ-8 under Alternative 4.

NEPA Effects: As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternative 4 during the ELT condition would not exceed SJVAPCD's regional thresholds of significance. Accordingly, operation of Alternative 2D would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed SJVAPCD regional thresholds of significance. Accordingly, Alternative 2D would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-9: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SMAQMD's Health-Based Concentration Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, construction emissions and associated health risks generated by Alternative 2D in SMAQMD would be greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-9 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-14 and 22-102 in Appendix A of this RDEIR/SDEIS, construction of Alternatives 1A and 4 would exceed the SMAQMD's 24-hour PM10 threshold at several receptor locations. The exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce this effect.

***CEQA Conclusion*:** As shown in Tables 22-14 and 22-102 in Appendix A of this RDEIR/SDEIS, construction of Alternatives 1A and 4 would exceed SMAQMD's 24-hour PM10 threshold at several receptor locations. The exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce impacts to less than significant.

Mitigation Measure AQ-9: Implement Measures to Reduce Re-Entrained Road Dust and Receptor Exposure to PM2.5 and PM10

Please refer to Mitigation Measure AQ-9 under Impact AQ-9 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-10: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of YSAQMD's Health-Based Concentration Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. There would be no construction of physical features in the YSAQMD. Accordingly, increased health risks in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions and associated health risks generated in YSAQMD would therefore be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-10 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-15 and 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under both Alternatives 1A and 4 are less than YSAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to adverse localized particulate matter concentrations.

***CEQA Conclusion*:** As shown in Tables 22-15 and 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under both Alternatives 1A and 4 are less than YSAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-11: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of BAAQMD's Health-Based Concentration Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Emissions and increased health risks from construction of physical features in the BAAQMD would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD. Accordingly, total emissions and associated health risks generated in the BAAQMD would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-11 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-16 and 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 concentrations under both Alternatives 1A and 4 are less than BAAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to adverse localized particulate matter concentrations.

***CEQA Conclusion*:** As shown in Tables 22-16 and 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 concentrations under both Alternatives 1A and 4 are less than BAAQMD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-12: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SJVAPCD's Health-Based Concentration Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4 in the SJVAPCD. Accordingly, emissions and associated health risks from construction of physical features and equipment and material transport in the SJVAPCD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-12 under Alternative 4.

NEPA Effects: As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to adverse localized particulate matter concentrations.

***CEQA Conclusion*:** As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-13: Exposure of Sensitive Receptors to Health Threats from Localized Carbon Monoxide

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. The potential for exposure of sensitive receptors to increased health threats from localized carbon monoxide (CO) would therefore likely range between impacts described under Alternatives 1A and 4. See the discussion of Impact AQ-13 under Alternatives 1A and 4.

NEPA Effects: Given that 1) construction activities typically do not result in CO hot-spots, 2) onsite concentrations must comply with OSHA standards, and 3) CO levels dissipate as a function of distance, equipment-generated CO emissions are not anticipated to result in adverse health threats to sensitive receptors.

With respect to CO hot-spot formation along construction haul routes, as shown in Tables 19-8 and 19-25 in Appendix A of this RDEIR/SDEIS, the highest peak hour traffic volumes under BPBGPP—11,737 vehicles per hour under Alternative 1A and 8,088 vehicles per hour under Alternative 4—would occur on westbound Interstate 80 between Suisun Valley Road and State Route 12. This is about half of the congested traffic volume modeled by BAAQMD (24,000 vehicles per hour) that would be needed to contribute to a localized CO hot-spot, and less than half of the traffic volume modeled by SMAQMD (31,600 vehicles per hour). Accordingly, construction traffic is not anticipated to result in adverse health threats to sensitive receptors.

***CEQA Conclusion*:** Continuous engine exhaust may elevate localized CO concentrations. Receptors exposed to these CO "hot-spots" may have a greater likelihood of developing adverse health effects.

Construction sites are less likely to result in localized CO hot-spots due to the nature of construction activities (Sacramento Metropolitan Air Quality Management District 2014), which normally utilize diesel-powered equipment for intermittent or short durations. Moreover, construction sites must comply with the OSHA CO exposure standards for onsite workers. Accordingly, given that construction activities typically do not result in CO hot-spots, onsite concentrations must comply with the Occupational Safety and Health Administration (OSHA) standards, and CO levels dissipate as a function of distance, equipment-generated CO emissions are not anticipated to result in significant health threats to sensitive receptors. Similarly, peak-hour construction traffic on local roadways would not exceed BAAQMD's or SMAQMD's conservative screening criteria for the formation potential CO hot-spots. This impact would be less than significant. No mitigation is required.

Impact AQ-14: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SMAQMD's Chronic Non-Cancer and Cancer Risk Assessment Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, construction emissions and associated health risks generated by Alternative 2D in SMAQMD would be greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-14 under Alternatives 1A and 4.

NEPA Effects: As shown in Table 22-106 in Appendix A of this RDEIR/SDEIS, neither Alternative 1A nor Alternative 4 would exceed the SMAQMD's chronic non-cancer or cancer thresholds. Therefore, construction of Alternative 2D is not expected to expose sensitive receptors to DPM and health hazards that would be adverse.

***CEQA Conclusion*:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Table 22-106 in Appendix A of this RDEIR/SDEIS, neither Alternative 1A nor Alternative 4 would exceed the SMAQMD's chronic non-cancer or cancer thresholds. As such, construction emissions generated by Alternative 2D would not expose sensitive receptors to substantial health hazards. This impact would be less than significant. No mitigation is required.

Impact AQ-15: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of YSAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. There would be no construction of physical features in the YSAQMD. Accordingly, increased health risks in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions and associated health risks generated in YSAQMD would therefore be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-15 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-19 and 22-107 in Appendix A of this RDEIR/SDEIS, neither Alternative 1A nor Alternative 4 would exceed the YSAQMD's chronic non-cancer or cancer thresholds. Therefore, construction of Alternative 2D is not expected to expose sensitive receptors to DPM and health hazards that would be adverse.

CEQA Conclusion**:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Tables 22-19 and 22-107 in Appendix A of this RDEIR/SDEIS, neither Alternative 1A nor Alternative 4 would exceed the YSAQMD's chronic non-cancer or cancer thresholds. As such, construction emissions generated by Alternative 2D would not expose sensitive receptors to substantial health hazards. This impact would be less than significant. No mitigation is required.

Impact AQ-16: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of BAAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Emissions and increased health risks from construction of physical features in the BAAQMD would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be greater than Alternative 4 due to the increased number of intakes constructed in SMAQMD. Accordingly, total emissions and associated health risks generated in the BAAQMD would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-16 under Alternatives 1A and 4.

NEPA Effects: As shown in Table 22-108 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 1A would result in DPM concentrations in excess of BAAQMD's thresholds at adjacent receptors (see Table 22-20). Since proximity to haul routes contributes DPM emissions to the cancer risk, and Alternative 2D would have increased haul truck activity through BAAQMD due to the construction of five intakes in SMAQMD, similar to Alternative 1A, effects would be adverse under Alternative 2D.

Mitigation Measure AQ-16 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, an adverse effect in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, effects would not be adverse.

CEQA Conclusion**:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Table 22-108 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 1A would result in DPM concentrations in excess of BAAQMD's thresholds at adjacent receptors (see Table 22-20). Since proximity to haul routes contributes DPM emissions to the cancer risk, and Alternative 2D would have increased haul truck activity through BAAQMD due to the construction of five intakes in SMAQMD, similar to Alternative 1A, this impact would be significant under Alternative 2D.

Mitigation Measure AQ-16 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, a significant impact in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, impacts would be less than significant.

Mitigation Measure AQ-16: Relocate Sensitive Receptors to Avoid Excess Cancer Risk

Please refer to Mitigation Measure AQ-16 under Impact AQ-16 in the discussion of Alternative 1A in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-17: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SJVAPCD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Emissions and associated health risks from construction of physical features and equipment and material transport in the SJVAPCD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-17 under Alternative 4.

NEPA Effects: As shown in Table 22-109 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

***CEQA Conclusion*:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 2D construction would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-18: Exposure of Sensitive Receptors to *Coccidioides immitis* (Valley Fever)

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. While construction activities may be slightly greater under Alternative 2D than Alternative 4, the potential for Alternative 2D to expose receptors adjacent to the construction site to spores known to cause Valley Fever would be similar to Alternative 4. See the discussion of Impact AQ-18 under Alternative 4.

***NEPA Effects*:** Earthmoving activities during construction could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of advanced air-district recommended fugitive dust controls outlined in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, the effect of exposure of sensitive receptors to increased Valley Fever risk during construction would not be adverse.

***CEQA Conclusion*:** Construction of the water conveyance facility would involve earthmoving activities that could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of air-district recommended fugitive dust controls outlined in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, this impact would be less than significant. No mitigation is required.

Impact AQ-19: Creation of Potential Odors Affecting a Substantial Number of People during Construction or Operation of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. While construction activities may be slightly greater under Alternative 2D than Alternative 4, the potential for Alternative 2D to expose receptors to nuisance odors during construction and operation of the water conveyance facilities would be similar to Alternative 4. See the discussion of Impact AQ-19 under Alternative 4.

NEPA Effects: Odors from construction activities would be localized and generally confined to the immediate area surrounding the construction site. Moreover, odors would be temporary and localized, and they would cease once construction activities have been completed. Thus, it is not anticipated that construction of water conveyance facilities would create objectionable odors from construction equipment or asphalt paving. Similarly, drying and stockpiling of removed muck and sediment will occur under aerobic conditions, which will limit any potential decomposition and associated malodorous products. Accordingly, tunnel and sediment excavation would not create objectionable odors. Finally, since Alternative 2D would not result in the addition of odors facilities (e.g., wastewater treatment plants), long-term operation of the water conveyance facility would not result in objectionable odors. There would be no adverse effect.

***CEQA Conclusion*:** Alternative 2D would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Likewise, potential odors generated during asphalt paving would be addressed through mandatory compliance with air district rules and regulations. While tunnel excavation would unearth approximately 27 million cubic yards of muck, geotechnical tests indicate that soils in the project area have relatively low organic constituents. Moreover, drying and stockpiling of the removed muck will occur under aerobic conditions, which will further limit any potential decomposition and associated malodorous products. Accordingly, the impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-20: Generation of Criteria Pollutants in the Excess of Federal *De Minimis* Thresholds from Construction and Operation and Maintenance of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Emissions generated by Alternative 2D would therefore likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-20 under Alternatives 1A and 4.

NEPA Effects: As shown in Tables 22-23 and 22-110 in Appendix A of this RDEIR/SDEIS, implementation of Alternatives 1A and 4 would exceed the following federal *de minimis* thresholds:

<u>Sacramento Federal Nonattainment Area (SFNA)</u>

- ROG: 2023-2027 (Alternative 1A); 2019-2027 (Alternative 4)
- NO_X: 2018-2028 (Alternative 1A only)
- PM10: 2023-2024 (Alternative 1A only)

<u>San Joaquin Valley Air Basin (SJVAB)</u>[6]

- ROG: 2020-2025 (Alternative 4)
- NO_X: 2018-2028 (Alternative 4)

<u>San Francisco Bay Area Air Basin (SFBAAB)</u>

- NO_X: 2024-2025 (Alternative 4 only)

ROG and NO_X are precursors to ozone, for which the SFNA, SJVAB, and SFBAAB are in nonattainment for the NAAQS. The SFNA is also a maintenance area for PM10. Since project emissions exceed the federal *de minimis* thresholds for ROG (SFNA and SJVAB), NO_X, and PM10 (SFNA only), a general conformity determination must be made to demonstrate that total direct and indirect emissions of ROG (SFNA and SJVAB), NO_X, and PM10 (SFNA only) would conform to the appropriate SFNA, SJVAB, and SFBAAB state implementation plans (SIPs) for each year of construction in which the *de minimis* thresholds are exceeded.

NO_X is also a precursor to PM and can contribute to PM formation. Sacramento County and the SJVAB are currently designated maintenance for the PM10 NAAQS, whereas the SJVAB, SFBAAB, and portions of the SFBA are designated nonattainment for the PM2.5 NAAQS. NO_X emissions in excess of 100 tons per year in Sacramento County and SJVAB trigger a secondary PM10 precursor threshold, whereas NO_X emissions in excess of 100 tons per year in the SFNA, SJVAB, or SFBAAB trigger a secondary PM2.5 precursor threshold. Since NOx emissions can contribute to PM formation, NO_X emissions in excess of these secondary precursor thresholds could conflict with the applicable PM10 and PM2.5 SIPs.

As shown in Table 22-12 in Appendix A of this RDEIR/SDEIS, NO_X emissions generated by construction activities in SMAQMD (Sacramento County) under Alternative 1A would exceed 100 tons per year between 2022 and 2027. It is therefore likely that Alternative 2D would trigger the secondary PM10 precursor threshold, requiring all NO_X offsets for 2022 through 2027 to occur within Sacramento County. Alternative 1A also triggers the secondary PM2.5 precursor threshold in 2021, and Alternative 4 triggers the threshold in 2025, requiring all NO_X offsets in these years to occur within the federally-designated PM2.5 nonattainment area within the SFNA. The nonattainment boundary for PM2.5 includes all of Sacramento County and portions of Yolo, El Dorado, Solano, and Placer counties.

With respect to NO_X emissions in SJVAB and SFBAAB, the PM2.5 precursor threshold would be exceeded in the SFBAAB in 2024 and 2025. The PM10 and PM2.5 precursor thresholds would be exceeded in the SJVAB in 2021 and 2022. Accordingly, NO_X offsets for these years must occur within the federally-designated PM10 maintenance (SJVAB only) and PM2.5 nonattainment areas of the SJVAB and SFBAAB, which are consistent with the nonattainment boundary for ozone.

Mitigation Measures AQ-3a, AQ-3b, AQ-4a, and AQ-4b are available to fully offset emissions generated by Alternatives 1A and 4 in excess of the federal *de minimis* thresholds in SFBAAB and SJVAB to net zero. However, within SFNA, given the limited geographic scope available for offsets in 2022 through 2027 (Sacramento County), neither Mitigation Measures AQ-1a nor 1b could feasibly

[6] Emissions from construction of physical features and equipment and material transport in the SJVAPCD would be the same as those generated by Alternative 4. Accordingly, violations of the federal *de minimis* thresholds under Alternative 1A are not listed.

reduce NO_X emissions to net zero for the purposes of general conformity.[7] This impact would be adverse. In the event that Alternative 2D is selected as the APA, Reclamation, USFWS, and NMFS would need to demonstrate that conformity is met for NO_X and secondary PM10 formation in SFNA through a local air quality modeling analysis (i.e., dispersion modeling) or other acceptable methods to ensure project emissions do not cause or contribute to any new violations of the NAAQS or increase the frequency or severity of any existing violations.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[8]

Please refer to Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General

[7] The secondary PM precursor thresholds are triggered through the General Conformity Regulation (40 CFR 93.153 (a)(1)). Accordingly, confinement of the geographic scope for available offsets only applies to the General Conformity determination and does not influence mitigation feasibility for Impact AQ-1.

[8] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

CEQA Conclusion: SFNA, SJVAB, and SFBAAB are classified as nonattainment and maintenance areas with regard to the ozone and PM10 NAAQS and the impact of increases in criteria pollutant emissions above the air basin *de minimis* thresholds could conflict with or obstruct implementation of the applicable air quality plans. Since construction emissions in the SFNA, SJVAB, and SFBAAB would exceed the *de minimis* thresholds for ROG (SJVAB and SFNA), NO_X, and PM10 (SFNA only) this impact would be significant.

Mitigation Measures AQ-3a, AQ-3b, AQ-4a, and AQ-4b would ensure project emissions would not result in an increase in regional ROG (SJVAB only) or NO_X in the SFBAAB and SJVAB. These measures would therefore ensure total direct and indirect ROG (SJVAB only) and NO_X emissions generated by the project would conform to the appropriate SFBAAB and SJVAB SIPs by offsetting the action's emissions in the same or nearby area to net zero. Accordingly, impacts would be less than significant with mitigation in the SFBAAB and SJVAB.

Although Mitigation Measures AQ-1a and AQ-1b would reduce NO_X in the SFNA, given the magnitude of NO_X emissions and the limited geographic scope available for offsets (Sacramento County), neither measure could feasibly reduce NO_X emissions to net zero for the purposes of general conformity. This impact would be significant and unavoidable in the SFNA.

Impact AQ-21: Generation of Cumulative Greenhouse Gas Emissions during Construction of the Proposed Water Conveyance Facility

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Total GHG emissions generated by construction of Alternative 2D would therefore be slightly higher than Alternative 4, but the potential effect of those emissions would be the same as Alternative 4. See the discussion of Impact AQ-21 under Alternative 4.

NEPA Effects: Based on the total GHG emissions generated by Alternative 4 (3,019,413 metric tons carbon dioxide equivalent [CO_2e]) and emissions that would be generated by construction of two additional intakes (60,000 metric tons CO_2e), Alternative 2D would emit about 3.1 million metric tons CO_2e over the 14-year construction period. This is equivalent to adding 645,000 typical passenger vehicles to the road during construction (U.S. Environmental Protection Agency 2014e). As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2, of the Draft EIR/EIS, any increase in emissions above net zero associated with construction of the project water conveyance features would be adverse. Mitigation Measure AQ-21, which would develop a GHG

Mitigation Program to reduce construction-related GHG emissions to net zero, is available address this effect.

***CEQA Conclusion*:** Construction of Alternative 2D would generate about 3.1 million metric tons of GHG emissions. As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2, of the Draft EIR/EIS, any increase in emissions above net zero associated with construction of the project water conveyance features would be significant. Mitigation Measure AQ-21 would develop a GHG Mitigation Program to reduce construction-related GHG emissions to net zero. Accordingly, this impact would be less-than-significant with implementation of Mitigation Measure AQ-21.

Mitigation Measure AQ-21: Develop and Implement a GHG Mitigation Program to Reduce Construction Related GHG Emissions to Net Zero (0)

Please see Mitigation Measure AQ-21 under Impact AQ-21 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-22: Generation of Cumulative Greenhouse Gas Emissions from Operation and Maintenance of the Proposed Water Conveyance Facility and Increased Pumping

Alternative 2D would have the same operations from those under Alternative 2A. Accordingly, the potential to result in a cumulative GHG effect during operation and maintenance would be the same as Alternative 2A. See the discussion of Impact AQ-22 under Alternative 2A.

NEPA Effects: Table 4.4.18-1 summarizes long-term operational GHG emissions associated with operations, maintenance, and increased SWP pumping under Alternative 2D at the ELT and LLT timeframes. Emissions are compared to both the No Action Alternative (NEPA point of comparison) and Existing Conditions (CEQA baseline). The equipment emissions presented in Table 4.4.18-1 are representative of project impacts for both the NEPA and CEQA analysis.

Table 4.4.18-1. GHG Emissions from Operation, Maintenance, and Increased SWP Pumping, Alternative 2D

Condition	Equipment CO_2	NEPA Point of Comparison Electricity)	CEQA Baseline (Electricity)	NEPA Point of Comparison (Total)	CEQA Baseline (Total)
ELT	562	204,388	111,643	204,939	112,205
LLT	548	25,621	4,984	26,169	5,532

Note: The *NEPA point of comparison* compares total CO_2e emissions after implementation of Alternative 4 to the No Action Alternative (ELT), whereas the *CEQA baseline* compares total CO_2e emissions to Existing Conditions.

As shown in Table 4.4.18-1, operations, maintenance, and increased SWP pumping under Alternative 2D would generate 26,000 to 205,000 metric tons CO_2e per year, relative to the No Action Alternative. Emissions relative to existing conditions would range from 5,500 metric tons CO_2e per year to 113,000 metric tons CO_2e per year. This increase relative to existing conditions is lower than emissions and potential effects analyzed under the Scenario H1 for Alternative 4 (113,555 metric tons CO_2e).

As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their Climate Action Plan (CAP) goals with implementation of BMPs and modification to DWR's Renewable Energy Procurement Program (REEP). The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines section 15183.5. Since emissions under Alternative 2D would be lower than those analyzed for Alternative 4 (Scenario H1), and because DWR demonstrated that implementation of Alternative 4 (Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 2D would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. There would be no adverse effect

CEQA Conclusion: As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their CAP goals with implementation of BMPs and modification to DWR's REEP. The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines section 15183.5. As shown in Table 22-115, the assessment considers the amount of additional renewable energy that would need to be added to the REPP annually following construction in order for DWR to meet their long-term GHG reduction goals. Since emissions under Alternative 2D ELT conditions would be lower than those analyzed for Alternative 4 ELT conditions, and because DWR demonstrated that implementation of Alternative 4 (Operational Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 2D would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. Prior adoption of the CAP by DWR already provides a commitment on the part of DWR to make all necessary modifications to DWR's REEP or any other GHG emission reduction measure in the CAP necessary to achieve DWR's GHG emissions reduction goals. Therefore no amendment to the approved CAP is necessary to ensure the occurrence of the additional GHG emissions reduction activities needed to account for project-related operational emissions. The effect of Alternative 2D with respect to GHG emissions is less than cumulatively considerable and therefore less than significant. No mitigation is required.

Impact AQ-23: Generation of Cumulative Greenhouse Gas Emissions from Increased CVP Pumping as a Result of Implementation of Water Conveyance Facility

Alternative 2D would have the same operations as Alternative 2A. Accordingly, the potential to result in a cumulative GHG effect from increased CVP pumping under LLT conditions would be the same as Alternative 2A. Potential effects under ELT conditions, which were not analyzed for CVP operation under Alternative 2A, would be slightly higher than those estimated under LLT conditions. See the discussion of Impact AQ-23 under Alternative 2A.

NEPA Effects: Under Alternative 2D, operation of the CVP yields the generation of clean, GHG emissions-free, hydroelectric energy. This electricity is sold into the California electricity market or directly to energy users. Implementation of Alternative 2D could result in an increase of up to 109 GWh in the demand for CVP generated electricity at the ELT timeframe, which would result in a reduction of up to 109 GWh or electricity available for sale from the CVP to electricity users (103 GWh under LLT). This reduction in the supply of GHG emissions-free electricity to the California electricity users could result in a potential indirect effect of the project, as these electricity users would have to acquire substitute electricity supplies that may result in GHG emissions (although additional conservation is also a possible outcome).

It is unknown what type of power source (e.g., renewable, natural gas) would be substituted for CVP electricity or if some of the lost power would be made up with higher efficiency. Given State mandates for renewable energy and incentives for energy efficiency, it is possible that a considerable amount of this power would be replaced by renewable resources or would cease to be needed as a result of higher efficiency. However, to ensure a conservative analysis, indirect emissions were quantified for the entire quantity of electricity (up to 109 GWh) using the current and future statewide energy mix (adjusted to reflect RPS).

Substitution of up to 109 GWh of electricity with a mix of sources similar to the current statewide mix would result in emissions of up to 30,447 metric tons of CO_2e; however, under expected future conditions (after full implementation of the RPS), emissions would be up to 23,659 metric tons of CO_2e. These emissions could contribute to a cumulatively considerable effect and are therefore adverse. The emissions would be caused by dozens of independent electricity users, who had previously bought CVP power, making decisions about different ways to substitute for the lost power. These decisions are beyond the control of Reclamation or any of the other project Lead Agencies. Further, monitoring to determine the actual indirect change in emissions as a result of project actions would not be feasible. In light of the impossibility of predicting where any additional emissions would occur, as well as Reclamation's lack of regulatory authority over the purchasers of power in the open market, no workable mitigation is available or feasible.

CEQA Conclusion**:** Operation of the CVP is a federal activity beyond the control of any State agency such as DWR, and the power purchases by private entities or public utilities in the private marketplace necessitated by a reduction in available CVP-generated hydroelectric power are beyond the control of the State, just as they are beyond the control of Reclamation. For these reasons, there are no feasible mitigation measures that could reduce this potentially significant indirect impact, which is solely attributable to operations of the CVP and not the SWP, to a less than significant level. This impact is therefore determined to be significant and unavoidable.

Impact AQ-24: Generation of Regional Criteria Pollutants from Implementation of Environmental Commitments 3, 4, 6–11

Effects of Alternative 2D related to the generation of regional criteria pollutants during implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-24 under Alternative 4A in Section 4.3.18, *Air Quality and Greenhouse Gases*, in this RDEIR/SDEIS.

NEPA Effects: Habitat restoration and enhancement activities that require physical changes or heavy-duty equipment would generate construction emissions through earthmoving activities and heavy-duty diesel-powered equipment. Criteria pollutants from restoration and enhancement actions could exceed applicable general conformity *de minimis* levels and applicable local thresholds.

The effect would vary according to the equipment used in construction of a specific environmental commitment, the location, the timing of the actions called for in the environmental commitment, and the air quality conditions at the time of implementation. Nevertheless, increases in emissions during implementation of Environmental Commitments 3, 4, 6–11 in excess of applicable general conformity *de minimis* levels and air district regional thresholds could violate air basin SIPs and worsen existing air quality conditions. Mitigation Measure AQ-24 would be available to reduce this effect, but emissions would still be adverse.

CEQA Conclusion**:** Construction and operational emissions associated with the restoration and enhancement actions would result in a significant impact if the incremental difference, or increase, relative to Existing Conditions exceeds the applicable local air district thresholds. Mitigation Measure AQ-24 would be available to reduce this effect, but may not be sufficient to reduce emissions below applicable air quality management district thresholds. Consequently, this impact would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Habitat Restoration and Enhancement Activities and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-25: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter, Carbon Monoxide, and Diesel Particulate Matter from Implementation of Environmental Commitments 3, 4, 6–11

The potential for Alternative 2D to expose sensitive land uses to increased health risks from implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-25 under Alternative 4A in Section 4.3.18, *Air Quality and Greenhouse Gases*, in this RDEIR/SDEIS.

NEPA Effects: Potential health effects from localized pollutant increases would vary according to the equipment used, the location and timing of the actions called for in the environmental commitment, the meteorological and air quality conditions at the time of implementation, and the location of receptors relative to the emission source. Increases in PM, CO, or DPM (cancer and non-cancer-risk) in excess of applicable air district thresholds at receptor locations would be adverse. Mitigation Measures AQ-24 and AQ-25 would be available to reduce this effect.

CEQA Conclusion**:** Construction and operational emissions associated with the restoration and enhancement actions under Alternative 2D would result in a significant impact if PM, CO, or DPM (cancer and non-cancer-risk) concentrations at receptor locations exceed the applicable local air district thresholds. Mitigation Measures AQ-24 and AQ-25 would ensure localized concentrations at receptor locations would be below applicable air quality management district thresholds. Consequently, this impact would be less than significant.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Habitat Restoration and Enhancement Activities and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-25: Prepare a Project-Level Health Risk Assessment to Reduce Potential Health Risks from Exposure to Localized DPM and PM Concentrations

Please see Mitigation Measure AQ-25 under Impact AQ-25 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-26: Creation of Potential Odors Affecting a Substantial Number of People from Implementation of Environmental Commitments 3, 4, 6–11

The potential for Alternative 2D to expose sensitive land uses to nuisance odors from implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-26 under Alternative 4A in Section 4.3.18, *Air Quality and Greenhouse Gases*, in this RDEIR/SDEIS.

NEPA Effects: Diesel emissions from earthmoving equipment could generate temporary odors, but these would quickly dissipate and cease once construction is completed. While restored land uses have the potential to generate odors from natural processes, the odors would be similar in origin and magnitude to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, odor-related effects associated with Environmental Commitments 3, 4, 6–11 would not be adverse.

***CEQA Conclusion*:** Alternative 2D would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Increases in wetland, tidal, and upland habitats may increase the potential for odors from natural processes. However, the origin and magnitude of odors would be similar to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, the impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-27: Generation of Cumulative Greenhouse Gas Emissions from Implementation of Environmental Commitments 3, 4, 6–11

Effects of Alternative 2D related to the generation of GHG emissions during implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-27 under Alternative 4A in Section 4.3.18, *Air Quality and Greenhouse* Gases, in this RDEIR/SDEIS.

NEPA Effects: Construction equipment required for earthmoving could generate short-term GHG emissions. Implementing Environmental Commitments 3, 4, 6–11 would also affect long-term sequestration rates through land use changes, such as conversion of agricultural land to wetlands, inundation of peat soils, drainage of peat soils, and removal or planting of carbon-sequestering plants. Without additional information on site-specific characteristics associated with each of the restoration components, a complete assessment of GHG flux from Environmental Commitments 3, 4, 6–11 is currently not possible. The effect of carbon sequestration and methane generation would vary by land use type, season, and chemical and biological characteristics. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this effect. However, due to the potential for increases in GHG emissions from construction and land use change, this effect would be adverse.

***CEQA Conclusion*:** The restoration and enhancement actions under Alternative 2D could result in a significant impact if activities are inconsistent with applicable GHG reduction plans, do not contribute to a lower carbon future, or generate excessive emissions, relative to other projects throughout the state. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this impact, but may not be sufficient to reduce to a less-than-significant level. Consequently, this impact is would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Habitat Restoration and Enhancement Activities and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-27: Prepare a Land Use Sequestration Analysis to Quantify and Mitigate (as Needed) GHG Flux Associated with Habitat Restoration and Enhancement Activities and Associated Project Activities

Please see Mitigation Measure AQ-27 under Impact AQ-27 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

4.4.19 Noise

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, noise levels generated by construction of non-intake features structures would be similar to Alternative 4, whereas noise levels generated by construction of the intakes would be similar to Alternative 1A. The potential for Alternative 2D to expose noise-sensitive land uses to noise from construction of the water conveyance facilities would therefore range between impacts described under Alternatives 1A and those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact NOI-1 under Alternatives 1A and 4.

NEPA Effects: Noise would be generated by heavy-duty equipment operating at the various construction sites, as well as by haul trucks and worker vehicles traveling on local roadways. Construction noise would also affect onsite workers. However, occupational exposure to noise levels in excess of 85 A-weighted decibels (dBA) requires monitoring and mitigation to protect workers. Given that onsite workers would be protected under OSHA requirements, no adverse impacts would occur to workers. Accordingly, this analysis focuses exclusively on potential noise effects to noise-sensitive land uses adjacent to construction activities.

Potential reasonable worst-case noise levels generated at construction work areas were evaluated against the 60 dBA L_{eq} (1hr) daytime (7 a.m. to 10 p.m.) and 50 dBA L_{max} nighttime (10 p.m. to 7 a.m.) construction thresholds. Construction noise along roadways was evaluated against the 12 decibel (dB) traffic noise threshold. As described in Impact NOI-1 in Appendix A of this RDEIR/SDEIS, Alternative 4 could generate noise levels in excess of daytime and nighttime standards at up to 765 and 1,293 parcels, respectively, depending on the local and land use type. The effect of exposing noise-sensitive land uses to noise increases above established thresholds at intake work areas, conveyance and associated facility work areas, utility construction work areas, borrow/spoil work areas and truck trips and worker commutes would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to reduce this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion*:* Construction activities would expose noise-sensitive land uses adjacent to intake, conveyance, forebay, barge facility, utility, and borrow/spoil work areas to noise levels above the 60 dBA L_{eq} (1hr) daytime and 50 dBA L_{max} nighttime threshold. Receptors near haul roads would also be exposed to noise levels in excess of the 12 dB traffic noise threshold. This would be a significant impact. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1b in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Construction at the intake sites would involve use of impact pile driving, and tunnel construction would involve the use of tunnel boring machines (TBMs) and tunnel locomotives, both of which would cause groundborne vibration in localized areas. The potential for Alternative 2D to expose noise-sensitive land uses to vibration at the intake sites would be greater than that of Alternative 4, as described in Appendix A of this RDEIR/SDEIS, and similar to that of Alternative 1A. The potential for Alternative 2D to expose noise-sensitive land uses to vibration from tunneling activities would be the same as that of Alternative 4. See the discussion of Impact NOI-2 under Alternatives 1A and 4.

NEPA Effects: Vibration effects from pile driving were evaluated against a threshold of 0.2 inches per second peak particle velocity (in/sec PPV) at residential buildings within 70 feet of pile driving sites. As described under Alternative 1A in the Draft EIR/EIS, groundborne vibration from impact pile driving is predicted to exceed vibration thresholds at 102 residential receptors. The effect of exposing sensitive receptors to groundborne vibration would be adverse. Mitigation Measure NOI-2 is available to reduce this effect, but not to a level that would avoid adverse conditions.

Vibration effects from tunneling locomotives and TBMs were evaluated against a threshold of 0.04 in/sec PPV. As described under Alternative 4 in Appendix A of this RDEIR/SDEIS, groundborne vibrations from the TBMs would not exceed 0.008 in/sec PPV and would therefore not result in adverse vibration effects to nearby sensitive receptors. Similarly, tunnel locomotives would be operated at slow speeds inside of tunnels and would not result in excessive vibrations. Groundborne noise from tunnel locomotive operation during construction is therefore not predicted to exceed groundborne noise thresholds or result in an adverse noise impact on sensitive receptors along the tunnel conveyance.

As outlined in Mitigation Measure NOI-2, the potential for tunneling induced ground vibration effects will be thoroughly analyzed in the preliminary and final design phases of the project, using site-specific geotechnical data and the expected TBM configuration. Potential effects on surface structures and human perception will be evaluated in detail during preliminary design. As additional precautions, and where necessary, a ground vibration monitoring program using seismographs and other high-precision equipment will be implemented during construction to ensure ground vibration is within the required contract limits.

CEQA Conclusion*:* Groundborne vibrations during tunneling would not exceed 0.008 in/sec and would therefore be less than significant. Likewise, locomotives are not expected to generate significant noise levels because they will travel at low speeds between 5 and 10 miles per hour. However, the impact of exposing residential structures to groundborne vibration during intake construction would be significant as reasonable worst-case modeling indicates that up to 102 residential parcels could be exposed to vibration levels in excess of 0.2 in/sec PPV during intake pile driving. Although Mitigation Measure NOI-2 will reduce the impact, it is not anticipated that feasible measures will be available in all situations to reduce vibration to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

Please see Mitigation Measure NOI-2 under Impact NOI-2 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-3: Exposure of Noise-Sensitive Land Uses to Noise from Operation of Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes, similar to Alternative 1A. Accordingly, the potential for Alternative 2D to expose sensitive land uses to noise from intake pump operations would be similar to Alternative 1A. Since the number of pumps and noise generating equipment at the combined pumping plant would be the same under Alternative 2D as Alternative 4, noise effects from operation of the combined pumping plant would be similar to impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. See the discussion of Impact NOI-3 under Alternatives 1A and 4.

NEPA Effects: Operation of pumping equipment at the intakes and combined pumping plant could result in increases in noise levels affecting nearby communities and residences. Noise would also affect onsite workers, although OSHA monitoring requirements would avoid adverse effects to personnel. Accordingly, this analysis focuses exclusively on potential noise effects to noise-sensitive land uses adjacent to the conveyance facilities.

Potential reasonable worst-case pump noise levels generated during operation of the intake and pump structures were evaluated against the 50 dBA L_{max} daytime (7 a.m. to 10 p.m.) and 45 dBA L_{max} nighttime (10 p.m. to 7 a.m.) operational thresholds. As described under Alternative 1A in the Draft EIR/EIS, operational activities would exceed the daytime and nighttime thresholds at noise-sensitive land uses within 1,400 feet and 2,600 feet, respectively, from intake locations. Various residential, recreational, and agricultural receptors would therefore be exposed to adverse noise levels during operation. Operational activities at the combined pumping plant would exceed the nighttime threshold at noise-sensitive land uses within a distance of up to 2,800 feet. Mitigation Measure NOI-3 is available to address this effect.

CEQA Conclusion: The impact of exposing noise-sensitive land uses during operations to noise levels above the daytime (50 dBA L_{max}) or nighttime (45 dBA L_{max}) noise thresholds would be considered significant. Based on reasonable worst-case modeling, various agricultural parcels would be affected by daytime and nighttime noise levels in excess of the operational threshold. Mitigation Measure NOI-3 would reduce operational noise levels below applicable thresholds, thus resulting in a less-than-significant level.

Mitigation Measure NOI-3: Design and Construct Intake Facilities and Other Pump Facilities Such That Operational Noise Does Not Exceed 50 dBA (One-Hour L_{eq}) during

Daytime Hours (7:00 A.M. to 10:00 P.M.) or 45 dBA (One-Hour L_{eq}) during Nighttime Hours (10:00 P.M. to 7:00 A.M.) or the Applicable Local Noise Standard (Whichever Is Less) at Nearby Noise Sensitive Land Uses

Please see Mitigation Measure NOI-3 under Impact NOI-3 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

The potential for Alternative 2D to expose noise-sensitive land uses to noise from implementation of Environmental Commitments 3, 4, and 6-10 would be similar to, but less than, those described for Alternative 4. See the discussion of Impact NOI-4 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Restoration and enhancement activities that require heavy-duty equipment and construction vehicles would generate increases in ambient noise levels. The effect would vary according to the type of construction equipment and techniques used in construction of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the noise environment at the time of implementation.

Alternative 2D would restore up to 17,766 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,839 acres under Alternative 4. Therefore, the number of noise generation equipment and magnitude of potential noise impacts under Alternative 2D would be smaller than those associated with Alternative 4. Nevertheless, receptors within 1,200 feet of an active restoration work area could be exposed to construction noise in excess of the daytime (7 a.m. to 10 p.m.) noise threshold of 60 dBA L_{eq} (1hr). The nighttime threshold of 50 dBA L_{max} would be exceeded within a distance of 2,800 feet. The effect of exposing sensitive land uses to increases in construction noise levels above thresholds would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to address this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion*:* Noise levels during implementation of Environmental Commitments 3, 4, 6-10 are expected to vary according to the type of construction equipment and techniques used, but may exceed the daytime noise threshold within 1,200 feet of an active restoration work area and the nighttime threshold within 2,800 feet. The impact of exposing receptors to noise increases above established thresholds would be significant. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

4.4.20 Hazards and Hazardous Materials

Impact HAZ-1: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Construction of the Water Conveyance Facilities

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. The nature of the impacts related to hazards and hazardous materials under Alternative 2D would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 2D to create substantial hazards through release of hazardous materials during construction of conveyance facilities would be somewhat greater than under Alternative 4 because the geographic extent, magnitude and duration of construction under Alternative 2D would be greater due to two additional intakes. Potential effects include routine use of hazardous materials, possible natural gas accumulation in tunnels, contact with existing contaminants, constituents in RTM, effects of electrical transmission lines, conflicts with utilities containing hazardous materials and routine transport of hazardous materials. Due to the intensity, duration and geographical extent of construction activities associated with constructing the water conveyance facilities under this alternative, this would constitute an adverse effect on the physical environment. In addition to Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and Trans-1a, implementation of SWPPPs, HMMPs, SPCCPs, SAPs, and a Barge Operations Plan would be available to reduce the severity of these effects.

CEQA Conclusion: During construction of the water conveyance facilities, the potential for direct impacts on construction personnel, the public and/or the environment associated with a variety of hazardous physical or chemical conditions under Alternative 2D would be greater than under Alternative 4 because there would be two additional intakes. The nature of the impacts, however, would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Impacts related to hazards and/or hazardous materials may arise as a result of the intensity and duration of construction activities at the north Delta intakes, forebays and conveyance pipelines and tunnels, and the hazardous materials that would be needed in these areas during construction. Potential hazards include the routine use of hazardous materials (as defined by Title 22 of the California Code of Regulations, Division 4.5); natural gas accumulation in water conveyance tunnels; the inadvertent release of existing contaminants in soil, sediment, and groundwater, or release of hazardous materials from existing infrastructure; disturbance of electrical transmission lines; and hazardous constituents present in RTM. Many of these physical and chemical hazardous conditions would occur in close proximity to the towns of Hood and Courtland during construction of the north Delta intakes. Additionally, the potential would exist for the construction of the water conveyance facilities to indirectly result in the release of hazardous materials through the disruption of existing road, rail, or river hazardous materials transport routes because construction would occur in the vicinity of three hazardous material transport routes, three railroad corridors, and waterways with barge traffic. These impacts are considered significant because the potential exists for substantial hazard to the public or environment to occur related to conveyance facility construction. However, implementation of Mitigation Measures HAZ-1a and HAZ-1b, UT-6a and UT-6c (described in Chapter 20, *Public Services and Utilities,* of the Draft EIR/EIS), and TRANS-1a (described in Chapter 19, *Transportation,* of the Draft EIR/EIS), along with environmental commitments to prepare and implement SWPPPs, HMMPs, SPCCPs, SAPs, and a Barge Operations Plan (described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS) would reduce these impacts to a less-than-significant level by identifying and describing potential sources of hazardous materials so that releases can be avoided and materials can be properly handled; detailing practices to monitor pollutants and control erosion so that appropriate measures are taken; implementing onsite features to minimize the potential for hazardous materials to be released to the environment; minimizing risk associated with the relocation of utility infrastructure; and coordinating the transport of hazardous materials to reduce the risk of spills.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please see Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please see Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact HAZ-2: Expose Sensitive Receptors Located within 0.25 Mile of a Construction Site to Hazardous Materials, Substances, or Waste during Construction of the Water Conveyance Facilities

NEPA Effects: The potential under Alternative 2D to expose sensitive receptors, such as parks, schools and hospitals within 0.25 mile to hazardous materials, hazardous substances or waste during construction would be slightly greater than under Alternative 4 in Appendix A of this RDEIR/SDEIS, because there are two additional intakes under Alternative 2D relative to Alternative 4. Regardless, Alternative 2D would not have an adverse effect on sensitive receptors because no parks or hospitals are located within 0.25 miles of the construction zone and environmental commitments such as SWPPPs, SPCCPs, and HMMPs would be implemented to minimize potential effects on Excelsior Middle School (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).

CEQA Conclusion: The potential for exposure of sensitive receptors to hazardous substances or conditions under Alternative 2D would be slightly greater than under Alternative 4 (described in Appendix A of this RDEIR/SDEIS). However, like Alternative 4, there are no parks or hospitals located within 0.25 mile of the water conveyance facilities alignment. However, Excelsior Middle School is located within 0.25 mile of a proposed permanent 230 kV transmission line. Additionally, under this alternative, an operable barrier would be constructed at the head of Old River near the Mossdale Village area of Lathrop, adjacent to land designated for public use and which could include future schools or parks. If a school or park were built prior to the completion of construction of the operable barrier, sensitive receptors would be in close proximity to Alternative 2D construction activities, creating the potential for an impact on those types of sensitive receptors. However, no school or park is currently proposed within 0.25 mile of the proposed operable barrier site.

Construction of the 230 kV transmission line would require the routine use of hazardous materials (e.g., fuels, solvents, oil and grease) because heavy machinery such as cranes, off-road work trucks, and dozers would be required. Consequently, there would be the risk of accidental spills and equipment leaks of these types of hazardous materials during construction of the transmission line. However, the quantities of hazardous materials likely to be used during construction activities are likely to be small. Were hazardous materials to be released inadvertently, spills or equipment leaks would be localized and minimal, and thus there would be no risk to anyone not in immediate proximity to these releases. Further, BMPs to minimize the potential for the accidental release of hazardous materials and to contain and remediate hazardous spills, as part of the SWPPPs, SPCCPs, and HMMPs, would be implemented (described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, staff and students at Excelsior Middle School would not be at risk or adversely affected by exposure to hazardous materials, substances, or waste during construction of the water conveyance facilities. This impact would be less than significant because no sensitive receptors within 0.25 mile of a construction zone would be exposed to hazardous materials, substances or waste. No mitigation is required.

Impact HAZ-3: Potential to Conflict with a Known Hazardous Materials Site and, as a Result, Create a Significant Hazard to the Public or the Environment

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. The nature of the impacts related to hazards and hazardous materials under Alternative 2D would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 2D to create conflicts with, or result in exposure to known hazardous material sites during conveyance facility construction would be somewhat greater than under Alternative 4 due to the two additional intakes because the geographic extent, magnitude and duration of construction. However, because there are no known SOCs within the construction footprint of the water conveyance facility of Alternative 2D, there would be no conflict with known hazardous materials sites during construction of the water conveyance facilities, and therefore, no related hazard to the public or the environment. Therefore, there would be no effect. The potential for encountering unknown hazardous materials sites during the course of construction is discussed under Impact HAZ-1.

CEQA Conclusion: The potential under Alternative 2D to create the potential for conflicts with, or result in exposure to known hazardous material sites during conveyance facility construction would be somewhat greater than under Alternative 4 due to the two additional intakes because the geographic extent, magnitude and duration of construction. However, because there are no known SOCs within the construction footprint of the water conveyance facility under this alternative, there would be no conflict with known hazardous materials sites during construction of the water conveyance facilities, and therefore, no related hazard to the public or the environment. Accordingly, there would be no impact. No mitigation is required. The potential for encountering unknown hazardous materials sites during the course of construction is discussed under Impact HAZ-1.

Impact HAZ-4: Result in a Safety Hazard Associated with an Airport or Private Airstrip within 2 Miles of the Water Conveyance Facilities Footprint for People Residing or Working in the Study Area during Construction of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 2D to result in a safety hazard associated with activities within 2.0 miles of an airport or private airstrip is similar to effects described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two additional intakes under Alternative 2D relative to Alternative 4, the geographical extent of Alternative 2D is greater. Three private airports (Borges-Clarksburg Airport, Walnut Grove Airport, and Spezia Airport) and one public airport (Byron Airport) are located within 2 miles of the water conveyance facilities for Alternative 2D. The Borges-Clarksburg Airport, located 2 miles northeast of the town of Clarksburg, is within 0.5 miles of a proposed intake work area (Intake 1) and less than one mile from the intake. These are water conveyance feature construction areas where high-profile construction equipment may be used. Walnut Grove and Spezia Airports, on Andrus Island and Tyler Island, respectively, are within 2 miles of the following proposed features or areas: a temporary 69 kV transmission line; a permanent 230 kV transmission line; a RTM area; the tunnel; a tunnel work area; and the main construction shaft for the tunnel. Byron Airport, less than 1.5 miles west of Clifton Court Forebay, is within 2 miles of a proposed 12 kV temporary transmission line; a proposed 230 kV permanent transmission line; and a borrow and/or spoils area. With the exception of the proposed transmission lines, construction of these features or work in these areas would not require the use of high-profile construction equipment. Because construction of the proposed transmission lines would potentially require high-profile equipment (e.g., cranes), and because construction of the 230 kV transmission line would require the use of helicopters during the stringing phase, the safety of air traffic arriving or departing from either of these airports could be compromised during construction of the proposed transmission lines.

This potential for implementation of Alternative 2D to result in a safety hazard associated with an airport or private airstrip within 2 miles of the water conveyance facility is not considered adverse because, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as part of an environmental commitment pursuant to the State Aeronautics Act (described in Section 24.2.2.17 in Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics to eliminate any potential conflicts prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron Airport).

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 2D to result in a safety hazard associated with activities within 2.0 miles of an airport or private airstrip is similar in nature to impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS, although there would be two additional intakes relative to Alternative 4 so the geographical extent of Alternative 2D is greater. The use of helicopters for stringing the proposed 230 kV transmission lines and relocating the existing 230 kV and 500 kV transmission lines, and of high-profile construction equipment (200 feet or taller), such as cranes, for installation of pipelines, and potentially pile drivers, such as would be used during the construction of the intakes, have the potential to result in safety hazards to aircraft during takeoff and landing if the equipment is operated too close to runways. Three private airports (Borges-Clarksburg Airport, Walnut Grove Airport, and Spezia Airport) and one public airport (Byron Airport) are located within 2 miles of the water conveyance facilities for Alternative 2D. The Borges-Clarksburg Airport, located 2 miles northeast of the town of Clarksburg, is within 0.5 miles of a proposed intake work area (Intake 1) and less than one mile from the intake.

As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as part of an environmental commitment pursuant to the State Aeronautics Act (described in Section 24.2.2.17 in Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron Airport). These recommendations, which could include limitations necessary to minimize potential problems such as the use of temporary construction equipment, supplemental notice requirements, and marking and lighting high-profile structures, would reduce potential impacts on air safety. This impact would be less than significant because recommendations to avoid conflicts with existing airports located near construction areas would be implemented by DWR prior to construction as required by Caltrans. No mitigation is required.

Impact HAZ-5: Expose People or Structures to a Substantial Risk of Property Loss, Personal Injury or Death Involving Wildland Fires, Including Where Wildlands Are adjacent to Urbanized Areas or Where Residences Are Intermixed with Wildlands, as a Result of Construction, and Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 2D to result in exposure of people or structures to risks associated with wildfire would be similar to the impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two additional intakes under Alternative 2D relative to Alternative 4, the geographical extent of Alternative 2D is greater. Regardless, this potential effect is not adverse because no portion of Alternative 2D is located in or near an area designated as a High or Very High Fire Hazard Severity Zone and measures to prevent and control wildland fires would be implemented by DWR during construction, operation, and maintenance of the water conveyance facilities in full compliance with Cal-OSHA standards for fire safety and prevention.

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 2D to result in exposure of people or structures to risks associated with wildfire would be similar to the impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two additional intakes under Alternative 2D relative to Alternative 4, the geographical extent of Alternative 2D is greater. People or structures would not be subject to a significant risk of loss, injury or death involving wildland fires during construction or operation and maintenance of the water conveyance facilities because the alternative would comply with Cal-OSHA fire prevention and safety standards; DWR would implement standard fire safety and prevention measures as part of an FPCP (described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS); and because the water conveyance facilities would not be located in a High or Very High Fire Hazard Severity Zone. This impact would be less than significant because conditions do not exist near construction areas that would result in exposure of people or structures to significant risk of exposure to wildfire and DWR would implement standard fire safety and prevention measures. No mitigation is required.

Impact HAZ-6: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4 but would include two additional intakes. The nature of the impacts related to hazards and hazardous materials under Alternative 2D would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 2D to create substantial hazards through release of hazardous materials during maintenance and operation of the water conveyance facilities would be somewhat greater than under Alternative 4 because the geographic extent and magnitude of O&M activities under Alternative 2D would be greater due to two additional intakes.

The Borges-Clarksburg, Walnut Grove, and Spezia Airports (all private air facilities), and the Byron Airport (a public airport), are within 2 miles of the Alternative 2D construction footprint, as discussed under Impact HAZ-1 for this alternative. With the exception of power transmission lines supplying power to pumps, and other equipment used for water conveyance facilities operation and maintenance, water conveyance facilities operations and maintenance are not anticipated to require high-profile equipment (i.e., equipment with a vertical reach of 200 feet or more), the use of which near an airport runway could result in an adverse effect on aircraft. DWR would adhere to all applicable FAA regulations (14 CFR Part 77) and, as part of an environmental commitment pursuant to the State Aeronautics Act (See Appendix 3B, Environmental Commitments in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics prior to initiating maintenance activities requiring high-profile equipment to assess whether a site investigation is necessary. If a site investigation is performed, DWR would adhere to Caltrans' recommendations in order to avoid any adverse effects on air safety. Further, compliance with the results of the OE/AAA for Byron Airport would reduce the risk for adverse effects on air traffic safety by implementing recommendations which could include limitations necessary to minimize potential problems, supplemental notice requirements, and marking and lighting high-profile structures.

During routine operation and maintenance of the water conveyance facilities the potential would exist for the accidental release of hazardous materials and other potentially hazardous releases (e.g., contaminated solids and sediment). Accidental hazardous materials releases, such as chemicals directly associated with routine maintenance (e.g., fuels, solvents, paints, oils), are likely to be small, localized, temporary and periodic; therefore, they are unlikely to result in adverse effects on workers, the public, or the environment. Further, BMPs and measures implemented as part of SWPPPs, SPCCPs, SAPs, and HMMPs would be developed and implemented as part of the project, as described under Impact HAZ-1, and in detail as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, which would reduce the potential for accidental spills to occur and would result in containment and remediation of spills should they occur. Solids collected at solids lagoons and sediment dredged during periodic maintenance dredging at the intakes may contain potentially hazardous constituents (e.g., persistent pesticides, mercury, PCBs). Contaminated solids could pose a hazard to the environment if improperly disposed of, which would be an adverse effect. Implementation of Mitigation Measure HAZ-6 (described below) would help ensure that there are no adverse effects on soil, groundwater or surface water due to improperly disposed of lagoon solids. Dewatered solids may require special management to meet discharge/disposal requirements. To ensure that potentially contaminated sediment from maintenance dredging activities at the intakes would not adversely affect soil, groundwater or surface water, a SAP would be implemented prior to any dredging activities, as described under Impact HAZ-1 for this alternative. All sediment would be characterized chemically prior to reuse and/or disposal to ensure that reuse of this material would not result in a hazard to the public or the environment.

CEQA Conclusion: The potential for operation and maintenance of conveyance facilities under Alternative 2D to result in a substantial hazard to the public or environment would be similar to the effects described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 2D to create substantial hazards through release of hazardous materials during maintenance and operation off conveyance facilities would be somewhat greater than under Alternative 4 because the geographic extent and magnitude of O&M activities under Alternative 2D would be greater due to two additional intakes. The accidental release of hazardous materials (including contaminated solids and sediment) to the environment during operation and maintenance of the water conveyance facilities could result in significant impacts on the public and environment. However, implementation of the BMPs and other activities required by SWPPPs, HMMPs, SAPs, SPCCPs, as well as adherence to all applicable FAA regulations (14 CFR Part 77) and, as part of an environmental commitment pursuant to the State Aeronautics Act (See Appendix 3B, *Environmental Commitments* in Appendix A of this RDEIR/SDEIS), coordination/compliance with Caltrans' Division of Aeronautics when performing work with high-profile equipment within 2 miles of an airport would ensure that impacts are reduced to a less-than-significant level. Contaminated solids could pose a hazard to the environment if improperly disposed of, and would be considered a significant impact because of the large volume of sediment/solids that would be handled and the potential for improper disposal. However, implementation of Mitigation Measure HAZ-6, would reduce this impact to a less-than-significant level by requiring sampling and characterizing solids from the solids lagoons to evaluate options to dispose of material at an appropriate, licensed facility.

Mitigation Measure HAZ-6: Test Dewatered Solids from Solids Lagoons Prior to Reuse and/or Disposal

Please see Mitigation Measure HAZ-6 under Impact HAZ-6 in the discussion of Alternative 4.

Impact HAZ-7: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means as a Result of Implementing Environmental Commitments 3, 4, 6-12, 15 and 16

Effects of Alternative 2D related to the potential for release of hazardous materials from implementing these environmental commitments would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, *Introduction*, under Alternative 2D the project would restore up to 17,766 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitment 16 would be implemented only at limited locations. Conservation Measures 13, 14, and 18 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 2D would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, 6-10, 11, 12, 15, and 16 at limited locations could result in multiple potentially hazardous effects related to the release of or exposure to hazardous materials or other hazards including increased production, mobilization and bioavailability of methylmercury; release of existing contaminants (e.g., pesticides in agricultural land); air safety hazards; and wildfires. These effects are considered adverse because of the potential for substantial hazards to occur while constructing restoration actions. However, implementation of Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a, as well as activities required by SWPPPs, HMMPs, SAPs, SPCCPs, and fire prevention and fire control BMPs as part of a FPCP (described under Alternative 4 in Chapter 24, *Hazards and Hazardous Materials,* in Appendix A of this RDEIR/SDEIS) are available to reduce/minimize these potential effects.

CEQA Conclusion: The potential for impacts related to the release and exposure of workers and the public to hazardous substances or conditions during construction, operation, and maintenance of Environmental Commitments 3, 4, 6-12, 15, and 16, is considered significant because implementation of these environmental commitments would involve extensive use of heavy equipment during construction and transporting hazardous chemicals during operations and maintenance (e.g., herbicides for nonnative vegetation control). These chemicals could be inadvertently released, exposing construction workers or the public to hazards. Construction of restoration projects on or near existing agricultural and industrial land and/or SOCs may also result in a conflict with or exposure to known hazardous materials, and the use of high-profile equipment (i.e., 200 feet or higher) in close proximity to airport runways could result in safety hazards to air traffic. However in addition to implementation of SWPPPs, HMMPs, SPCCPs, SAPs, and fire prevention and fire control BMPs as part of a FPCP(described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS), Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a would be implemented to ensure no substantial hazards to the public or the environment would occur from implementation of Environmental Commitments 3, 4, 6-12, 15, and 16 and that impacts would be reduced to a less-than-significant level.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please refer to Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4. Implementation of this mitigation measure will result in the avoidance, successful remediation or containment of all known or suspected contaminated areas, as applicable, within the construction footprint, which would prevent the release of hazardous materials from these areas into the environment.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please refer to Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4. Implementation of this measure will ensure that hazardous materials present in or associated with structures being demolished will not be released into the environment.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact HAZ-8: Increased Risk of Bird–Aircraft Strikes during Implementation of Environmental Commitments that Create or Improve Wildlife Habitat

Effects of Alternative 2D related to the potential for increased risk of aircraft bird strikes from implementing restoration actions that improve wildlife habitat would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, *Introduction*, Alternative 2D would restore up to 17,766 acres of habitat under Environmental Commitments 3, 4, and 6-10 as compared with 83,800 acres with Conservation Measures 3–11 under Alternative 4 of the Draft EIR/EIS. Therefore, the magnitude of effects under Alternative 2D would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6-10 under Alternative 2D could result in an increase of aircraft bird strikes in the vicinity of restoration areas that attract waterfowl and other birds in proximity to local airports. This effect is considered adverse because of the potential to affect aircraft safety in the vicinity of restoration projects. Mitigation Measure HAZ-8 is available to reduce this effect.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6-10, because they would create or improve wildlife habitat, could potentially attract waterfowl and other birds to areas in proximity to existing airport flight zones, and thereby potentially result in an increase in bird-aircraft strikes. The potential for this impact is considered significant because of the increased wildlife restoration projects that could occur in the vicinity of Travis Air Force Base; Rio Vista Municipal Airport; Funny Farm Airport; Sacramento International Airport; and Byron Airport. Mitigation Measure HAZ-8 could reduce the severity of this impact by minimizing bird strike hazards, but this impact would not be reduced to a less-than-significant level because of the inherent uncertainty related to bird strike risks for these future projects. Therefore this impact is significant and unavoidable.

Mitigation Measure HAZ-8: Consult with Individual Airports and USFWS, and Relevant Regulatory Agencies

Please see Mitigation Measure HAZ-8 under Impact HAZ-8 in the discussion of Alternative 4.

4.4.21 Public Health

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 2D construction and operation of the water conveyance facilities to increase vector-borne diseases would be similar to that for Alternative 4. Like Alternative 4, Alternative 2D will increase surface water within the study area at an intermediate forebay on Glannvale Tract, and at an expanded Clifton Court Forebay; however, unlike Alternative 4, Alternative 2D has five intakes rather than three intakes (Intakes 2, 3, and 5). Therefore, there would be a greater number of sedimentation basins and solids lagoons under Alternative 2D relative to Alternative 4. These features could provide breeding habitat for mosquitos. However, as described for Alternative 4, the depth, design, and operation of the sedimentation basin and solids lagoons would prevent the development of suitable mosquito habitat. Specifically, the basins would be too deep and the constant movement/circulation of water would prevent mosquitoes from breeding and multiplying. It is unlikely that forebays would provide suitable breeding habitat for mosquitoes given that the water in the forebays would not be stagnant and would generally be too deep to support substantial mosquito habitat. Shallow edges of the forebays could provide some suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of these forebay areas, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity. To further minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs, as necessary, to control mosquitoes and reduce the likelihood that construction and operation of the water conveyance facilities would require an increase in mosquito abatement activities by the local MVCDs (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS). BMP activities would be consistent with the CDPH's *Best Management Practices for Mosquito Control* plan (described in Section 25.2.3.4 in the Draft EIR/EIS). Accordingly, Alternative 2D would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. No adverse effects on public health would result because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented.

CEQA Conclusion: The potential for construction and operation of conveyance facilities under Alternative 2D to result in an increase in exposure of people to vector-borne diseases would be similar in nature to the impacts described for Alternative 4. However, because Alternative 2D has 2 more intakes and a greater number of associated sedimentation basins and solids lagoons than Alternative 4, there would be more surface water created under this alternative relative to Alternative 4. Alternative 2D conveyance facilities could create new and increased surface water areas (relative to baseline) at the intakes, intermediate forebay, and the expanded Clifton Court Forebay, and these areas have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held there. However, during operations, the depth, design, and operation of conveyance facilities would prevent the development of suitable mosquito habitat. Specifically, the water bodies would be too deep to provide suitable mosquito habitat, and the constant movement of water would prevent mosquitoes from breeding and multiplying. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-

Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the sedimentation basins, solids lagoons, the expanded Clifton Court Forebay, the intermediate forebay, and the intermediate forebay inundation area. Therefore, construction and operation of Alternative 2D would not result in a substantial increase in vector-borne diseases in the study area. This impact is considered to be less than significant because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

As described in detail in Section 4.4.4, *Water Quality*, of this RDEIR/SDEIS, the analysis of bromide and DOC (among other constituents) for Alternative 2D in the ELT is based on modeling done for Alternative 4 in the ELT timeframe, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described in Section 4.1.3, *Description of Alternative 2D*, CM2 would not be implemented as a part of Alternative 2D and Environmental Commitment 4 would restore approximately 65 acres of tidal wetlands, as opposed to the 65,000 acres contemplated under CM4. As such, the assessment of bromide for Alternative 2D relative to Existing Conditions and the No Action Alternative (ELT) likely overestimates potential increases in bromide, particularly in the west Delta. Regardless, there is uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 2D and the No Action Alternative (ELT).

NEPA Effects:

Disinfection Byproducts

As described in Section 4.4.4, *Water Quality*, the effects on DOC concentrations in the Delta under Alternative 2D would be similar to Alternative 4. To the extent that habitat restoration actions alter hydrodynamics within the Delta region these effects are included in this assessment. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration and enhancement under this alternative because very little restoration/enhancement would occur relative to Alternative 4.

The geographic extent of effects related to long-term average DOC concentrations within Delta waters with water supply operations under Alternative 2D would be less extensive than Alternative 4 and the magnitude of predicted long-term change and relative frequency of DOC concentration exceedances would be lower than Alternative 4. Relative to the No Action Alternative (ELT), Alternative 2D would result in small increases in long-term average DOC concentrations for the modeled 16-year period and drought period at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1. The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at Contra Costa Pumping Plant #1.

While Alternative 2D would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower. In general, substantial change in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 2D are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed. In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above. Therefore, changes in DOC concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 2D are not anticipated to contribute to increases in disinfection byproducts (DBPs).

As described in Section 4.4.4, *Water Quality* of the RDEIR/SDEIS, operations and maintenance of the water conveyance facilities under Alternative 2D, relative to the No Action Alternative (ELT), would result in increases in long-term average bromide concentrations in the South Fork Mokelumne River at Staten Island and decrease at all other assessment locations. However, at South Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island there would be an increased frequency of exceedance of the 50 µg/L bromide threshold (the CALFED Drinking Water Program goal) for protecting against the formation of DBPs in treated drinking water. The greatest increase in frequency of exceedance of the 50 µg/L threshold would occur in the South Fork Mokelumne River and Sacramento River at Emmaton. Other locations would increase in the frequency of exceedance of the 50 µg/L and 100 µg/L threshold. The 100 µg/L threshold is the concentration believed to be sufficient to meet currently established drinking water criteria for DBPs. The greatest increase in frequency of exceedance this threshold would occur at Franks Tract. Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 2D. As described for Alternative 4, the effects of Alternative 2D in the LLT in the Delta relative to the No Action Alternative (LLT) would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not Alternative 2D, because the primary source of bromide to the Delta is sea water intrusion. The use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. The opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations. Therefore, changes in bromide concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 2D are not anticipated to contribute to increases in DBPs.

Trace Metals

The changes in modeled trace metal concentrations of primarily human health and drinking water concern (arsenic, iron, manganese) in the Delta under Alternative 2D would be similar to those described for Alternative 4A (see Draft BDCP EIR/EIS, Chapter 8, *Water Quality,* Section 8.3.3.9) because the factors that would affect trace metal concentrations in Delta waters would be the same in the ELT and LLT.

The arsenic criterion was established to protect human health from the effects of long-term chronic exposure, while secondary MCLs for iron and manganese were established as reasonable federal regulatory goals for drinking water quality, and enforceable standards in California. Average concentrations for arsenic, iron, and manganese in the primary source water (Sacramento River, San Joaquin River, and the bay at Martinez) are below these criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and, given that the modeled average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be an expected result under this alternative. Accordingly, no adverse effect on public health related to the trace metals arsenic, iron, or manganese from drinking water sources is anticipated.

Pesticides

The changes in modeled pesticide concentrations in the Delta under Alternative 2D would be similar to those described for Alternative 4. The average winter and summer flow rates, relative to the No Action Alternative (ELT) are expected to be similar to or less than changes in flow rates under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis. The main factor influencing pesticide concentrations in Delta waters (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As described in Section 4.4.4, *Water Quality,* of the RDEIR/SDEIS, the percent change in monthly average source water fractions under Alternative 2D would be similar to changes expected under Alternative 4. Modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 2D would not be of sufficient magnitude to substantially alter beneficial uses of the Delta. Therefore, it is not anticipated that there would be adverse effects on public health related to pesticides from drinking water sources.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in trace metals and pesticide concentrations would not increase substantially in magnitude or frequency in the Delta under Alternative 2D relative to the No Action Alternative (ELT and LLT), there would be no adverse effect on public health as a result of operation of the water conveyance facilities.

CEQA Conclusion: Under Alternative 2D, modeled long-term average pesticide levels in the Delta would be similar to or slightly less that described under Alternative 4 and would not be expected to increase substantially, relative to Existing Conditions, such that beneficial use impairments are made measurably worse. Long-term average bromide concentrations would increase in the South Fork Mokelumne River at Staten Island and decrease at all other assessment locations relative to Existing Conditions. However, there would be an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of DBPs in treated drinking water at the South Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The effects of Alternative 2D in the LLT in the Delta relative to Existing Conditions would be expected to be similar. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion. The use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and therefore has historically been opportunistic, and the opportunity to use these intakes would remain. Thus, the increased bromide concentrations would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations, and therefore would not be expected to contribute substantially to

DBP formation. Operations and maintenance activities under Alternative 2D would not cause a substantial long-term change in DOC concentrations in the Delta, although there would be relatively small increases in long-term average DOC concentrations at some interior Delta locations. However, the increases are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC above levels currently employed, and therefore these increases would not be expected to contribute substantially to DBP formation. Further, there would be predicted improvements in long-term average DOC concentrations at Barker Slough relative to Existing Conditions. Average concentrations of trace metals are not expected to increase substantially under Alternative 2D in the primary source water. Therefore, this alternative is not expected to cause additional exceedances of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in trace metals and pesticide concentrations would not increase substantially in magnitude or frequency in the Delta with implementation of water supply operations under Alternative 2D relative to Existing Conditions, there would be no significant impact on public health as a result of operation of the water conveyance facilities. No mitigation is required.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

NEPA Effects: As described in Section 4.4.4, *Water Quality*, of the RDEIR/SDEIS, modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance.

Five intakes would be constructed and operated under Alternative 2D. Sediment-disturbing activities during construction and maintenance of these intakes and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. In-channel construction activities, such as pile driving during the construction of cofferdams at the intakes and pier construction at the barge unloading facilities, which would occur over a period of 5 months, would result in the localized disturbance of river sediment. In addition, maintenance of the five proposed north Delta intakes and the intermediate forebay would entail periodic dredging for sediment removal at these locations. Sediment accumulation in both the northern and southern portion of the expanded Clifton Court Forebay is expected to be minimal in the ELT period as the need for dredging is anticipated to be every 50 years given the design. However, it is anticipated that there may be some sediment accumulation at the inlet structure of the northern portion of Clifton Court Forebay. Therefore, while overall sediment accumulation in this forebay is not expected to be substantial, some dredging may be required at the inlet structure to maintain an even flow path.

Pesticides

Legacy pesticides, such as organochlorines, have low water solubility; they do not readily volatilize and have a tendency to bond to particulates (e.g., soil and sediment), settle out into the sediment, and not be transported far from the source. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree. Therefore, no significant adverse effect on public health would result from construction.

Numerous pesticides are currently used throughout the affected environment. While some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence of their presence in waters affected by SWP and CVP operations (i.e., organophosphate pesticides, such as diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative. Thus, changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. The effects of Alternative 2D on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT) would be similar to or slightly less than those described for the Alternative 4. Alternative 2D would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides.

Methylmercury

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter 8, Section 8.1.3.9, *Mercury,* in Appendix A of the RDEIR/SDEIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 2D are expected to be small. As described in Section 4.4.4, *Water Quality,* the greatest annual average methylmercury concentration for drought conditions under Alternative 2D would be 0.166 ng/L for the San Joaquin River at Buckley Cove, which would be slightly lower than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases for mercury concentrations relative to the No Action Alternative (ELT) based on long-term annual average concentrations in the Delta. Mercury concentrations in fish tissue expected for Alternative 2D (with Equation 1), show increases of 9 percent or less, relative to the No Action Alternative (ELT), in all modeled years. Mercury concentrations in fish tissue expected for Alternative 2D (with Equation 2), are estimated to increase 13 percent at Staten Island relative to the No Action Alternative (ELT), in all modeled years. Because these increases are relatively small, and because it is not apparent that substantive increases are expected throughout the Delta, these estimated changes in mercury concentrations in fish tissue under Alternative 2D are expected to be within the uncertainty inherent in the modeling approach and would not likely be measureable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a discussion of the uncertainty associated with fish tissue estimates of mercury. Therefore, modeled changes in mercury in the Delta and in fish tissues due to operation of Alternative 2D would not be expected to adversely affect public health.

In summary, operation of the water conveyance facilities under Alternative 2D would not alter bioaccumulative pesticide concentrations or mercury concentrations in the Delta such that there would be an effect on public health. As such, there would be no adverse effect.

CEQA Conclusion: Relative to Existing Conditions, operation of the water conveyance facilities under Alternative 2D is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially relative to the Existing Conditions, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. As described in Section 4.4.4, *Water Quality*, concentrations of mercury in fish tissue using Equation 1 under Alternative 2D, would increase 9 percent or less in all years relative to the Existing Conditions. Using Equation 2, there would be increases from 10 percent to 13 percent in Mokelumne River (South Fork) at Staten Island, Old River at Rock Slough, and San Joaquin River at Antioch relative to Existing Conditions in all years. Because these increases are relatively small, and because it is not apparent that substantive increases are expected throughout the Delta, these estimated changes in mercury concentrations in fish tissue under Alternative 2D are expected to be within the uncertainty inherent in the modeling approach and would not likely be measureable in the environment. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury.

The effects of Alternative 2D on bioaccumulative pesticide levels in the Delta would be similar to or slightly less than those described for the Alternative 4. Alternative 2D would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree.

For these reasons, there would be no significant impact on public health due to mercury or bioaccumulative pesticides as a result of construction of or operation of the water conveyance facilities under Alternative 2D. No mitigation is required.

Impact PH-4: Expose Substantially More People to Transmission Lines Generating New Sources of EMFs as a Result of the Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 2D transmission line construction and operation to expose people to new sources of EMFs would be somewhat larger than Alternative 4 because there would be more facilities requiring power (i.e., intakes) under Alternative 2D. As described for Alternative 4, this effect would not be adverse because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or new permanent transmission lines constructed and operated under Alternative 2D.

CEQA Conclusion: The potential for Alternative 2D transmission line construction and operation to expose people to new sources of EMFs would be somewhat larger relative to Alternative 4 because there would be more facilities requiring power (i.e., intakes) under Alternative 2D. Under this alternative the majority of proposed temporary (69 kV and 230 kV) and permanent (230 kV) transmission lines would be located within the rights-of-way of existing transmission lines; any new temporary or permanent transmission lines not within the right-of-way of existing transmission lines would, for the most part, be located in sparsely populated areas generally away from existing sensitive receptors. None of the proposed temporary or permanent transmission lines would be within 300 feet of sensitive receptors. Further, the temporary transmission lines would be removed when construction of the water conveyance facility features is completed, so there would be no potential permanent effects. Therefore, these transmission lines would not substantially increase people's exposure to EMFs. This impact is considered to be less than significant because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or permanent transmission lines constructed and operated under Alternative 2D. No mitigation is required.

Impact PH-5: Increase in Vector-Borne Diseases as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 10 and 11

Effects of Alternative 2D related to the potential for increase in vector-borne diseases from implementing Environmental Commitments 3, 4, 6, 7, 10, and 11 would be slightly greater than described for Alternative 4A. As described under Section 4.1.3, *Description of Alternative 2D*, Alternative 2D would restore more habitat under these Environmental Commitments relative to Alternative 4A and, therefore, the potential for vector-borne disease effects under Alternative 2D would likely be greater than the potential associated with Alternative 4A.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, 6, 7, 10, and 11 under Alternative 2D would involve protecting and restoring wetland and other surface water habitat that could potentially increase suitable mosquito habitat within the study area. This potential effect would not be adverse because the total restoration acreage of these types of habitat implemented under Alternative 2D would generally not be located near densely populated areas, and management plans under Environmental Commitment 11, *Natural Communities Enhancement and Management*, would be implemented in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, of the Draft BDCP EIR/EIS, would be incorporated into Alternative 2D and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. This consultation would occur when specific restoration and enhancement projects and locations are identified.

CEQA Conclusion: The potential for impacts related to increases of vector-borne disease from mosquitos during construction, operation, and maintenance of portions of Environmental Commitment 3, 4, 6, 7, 10, and 11 under Alternative 2D is considered less than significant because the total restoration acreage of wetland and other surface water areas implemented under this alternative would generally not be located near densely populated areas, and management plans under Environmental Commitment 11, *Natural Communities Enhancement and Management*, would be implemented in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, of the Draft BDCP EIR/EIS, would be incorporated and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. No mitigation is required.

Impact PH-6: Substantial Increase in Recreationists' Exposure to Pathogens as a Result of Implementing the Restoration Environmental Commitments

Effects of Alternative 2D related to the potential for increase in recreationists' exposure to pathogens from implementing portions of the restoration environmental commitments would be slightly greater than those described for Alternative 4A. As described under Section 4.1.3, *Description of Alternative 2D*, Alternative 2D would restore more acres of habitat under Environmental Commitments 3, 4, 6, 7, and 9–11 relative to Alternative 4A.

NEPA Effects: The study area currently supports habitat types, such as tidal habitat, upland wetlands, and agricultural lands that produce pathogens as a result of the biological productivity in these areas (e.g., migrating birds, application of fertilizers, waste products of animals). The study area does not currently have pathogen concentrations that rise to the level of adversely affecting beneficial uses of recreation. However, any potential increase in pathogens associated with the proposed habitat restoration and enhancement environmental commitments under Alternative 2D would be localized and within the vicinity of the actual restoration. This localized increase is not expected to be of sufficient magnitude and duration to result in adverse effects on recreationists because these areas would generally not support livestock and most areas would not have public access.

CEQA Conclusion: The potential for an increase in recreationists' exposure to pathogens under Alternative 2D is considered less than significant because of the localized nature of pathogens and because the rapid die-off of pathogens in water would not create sufficient magnitudes of pathogen generation that could affect recreational beneficial uses. No mitigation is required.

Impact PH-7: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Implementing Environmental Commitments 4 and 10

Effects of Alternative 2D related to the potential to mobilize contaminants known to bioaccumulate (pesticides and methylmercury) from implementing portions of the restoration environmental commitments would be slightly greater than those described for Alternative 4A. As described in Section 4.1.3, *Description of Alternative 2D,* Alternative 2D would restore more habitat under Environmental Commitments 4 and 10 relative to Alternative 4A. Therefore, the potential for mobilization of contaminants under Alternative 2D would likely be greater than the potential associated with Alternative 4A.

NEPA Effects: The primary concern with habitat restoration regarding constituents known to bioaccumulate is the potential for mobilizing contaminants sequestered in sediments of the newly inundated floodplains and marshes. The mobilization depends on the presence of the constituent and the biogeochemical behavior of the constituent to determine whether it could re-enter the water column or be reintroduced into the food chain. This potential effect would not be adverse because the total tidal and nontidal habitat restoration acreage implemented under Alternative 2D would be relatively small, bioaccumulation of pesticides and/or methylmercury in these restoration areas is not expected to substantially affect public health because of the limited extent of this type of restored habitat under Alternative 2D, the localized nature of pesticide bioaccumulation, and because current OEHHA standards would be enforced. Implementation of Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats.

CEQA Conclusion: The potential for public health impacts related to mobilization of pesticides and methylmercury in habitat restoration areas related to Environmental Commitments 4 and 10 is considered less than significant because the total tidal and nontidal restoration acreage implemented under Alternative 2D would be relatively small, bioaccumulation of pesticides and/or methylmercury in the these restoration areas is not expected to substantially affect public health because of the limited extent of restored habitat under Alternative 2D, the localized nature of pesticide bioaccumulation, and because current OEHHA standards would be enforced. Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats. No mitigation is required.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Any modified reservoir operations under Alternative 2D are not expected to promote *Microcystis* production upstream of the Delta relative to the No Action Alternative (ELT and LLT) since large reservoirs upstream of the Delta are typically low in nutrient concentrations, as described in Section 4.4.4, *Water Quality*. Further, in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, bloom development would be limited by high water velocity and low hydraulic residence times. These conditions would not be expected to change under Alternative 2D relative to the No Action Alternative (ELT and LLT)

With implementation of water supply operations under Alternative 2D, conditions in the Export Service Areas are not expected to become more conducive to *Microcystis* bloom formation relative to the No Action Alternative (ELT and LLT) because the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms.

As indicated in Section 4.4.4, *Water Quality,* of this RDEIR/SDEIS, there was not modeling available that adequately accounted for the effects of operation of the water conveyance facilities and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the Delta for Alternative 2D. Accordingly, the hydrodynamic effects of Alternative 2D on *Microcystis* were determined qualitatively and the effects discussed for the Delta are related entirely to operations and maintenance and not the hydrodynamic effects of the restoration actions. Although there is uncertainty, water supply operations under Alternative 2D are not expected to increase water residence times or ambient water temperatures throughout the Delta, including Banks and Jones pumping plants, relative to the No Action Alternative (ELT and LLT), and therefore Delta waters are not expected to be adversely affected by *Microcystis* blooms.

CEQA Conclusion: Relative to Existing Conditions, operation of the water conveyance facilities under Alternative 2D is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta because large reservoirs upstream are typically low in nutrient concentrations, and high water velocity and low hydraulic residence times in the upstream area limit the development of *Microcystis* blooms.

The potential for *Microcystis* blooms in the Export Service Areas under Alternative 2D would be less than under Alternative 4, but source waters to the south Delta intakes could be affected by *Microcystis* due to an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased water residence times in the Delta would be mostly related to tidal habitat restoration and improvements to the Yolo Bypass, which are assumed to occur separate from Alternative 2D, as well as to climate change and sea level rise. The combined effect of these factors on increasing *Microcystis* in source waters to the south Delta intakes would likely be a greater influence than that of Alternative 2D operations.

Water supply operations under Alternative 2D could result in localized increases in Delta residence times in some locations and decreased residence times in other Delta locations. As indicated in Section 4.4.4, *Water Quality,* of this RDEIR/SDEIS, there is substantial uncertainty regarding the extent that Alternative 2D operations and maintenance would result in a net increase in water residence times relative to Existing Conditions. Regardless of this uncertainty, it is likely that these potential effects under Alternative 2D would be relatively small compared to the combined effects of tidal habitat restoration and Yolo Bypass improvements unrelated to Alternative 2D, and sea level rise and climate change. Climate change in the ELT is expected to result in a 1.3-2.5°F increase in ambient Delta water temperatures relative to Existing Conditions. The combined effects of restoration activities unrelated to Alternative 2D, climate change, and sea level rise on increased water residence time, as well as the effects of climate change on Delta water temperatures, it is possible that *Microcystis* blooms in the Delta would increase in frequency, magnitude, and geographic extent, relative to Existing Conditions. However, although there is considerable uncertainty regarding this impact, the effects on *Microcystis* due to operations under Alternative 2D would be less than significant. No mitigation is required.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing Environmental Commitment 4.

Effects related to *Microcystis* from implementation of Environmental Commitment 4 under Alternative 2D would be the nearly the same as those described for Alternative 4A because the acreages of tidal natural communities restored under this alternative (65 acres) is nearly the same as under Alternative 4A (59 acres).

NEPA Effects: Under Alternative 2D, Yolo Bypass Fisheries Enhancement would not occur, unlike under Alternative 4. However, improvements in the Yolo Bypass, as well as restoration of 8,000 acres of tidal habitat, would be implemented under a plan separate and distinct from Alternative 2D (see Section 4.1.3, *Description of Alternative 2D*, of this RDEIR/SDEIS). These activities are assumed to occur under both Alternative 2D and the No Action Alternative. Similar to Alternative 4 (under CM 4), there would be tidal habitat restoration in the Delta under Alternative 2D with implementation of Environmental Commitment 4. However, the 65 acres of tidal habitat restored under this alternative would be substantially fewer than under Alternative 4. As discussed in Section 4.4.4, *Water Quality,* of this RDEIR/SDEIS, implementation of Environmental Commitment 4 under Alternative 2D would have negligible effects in terms of the potential for creating conditions conducive to *Microcystis* bloom in the Delta relative to what could result from the development of 8,000 acres of tidal habitat and improvements in the Yolo Bypass in the ELT, which could increase water temperatures and hydraulic residence times relative to the No Action Alternative (LLT). Therefore, implementation of Environmental Commitment 4 under Alternative 2D would not be adverse because it would not increase *Microcystis* bloom formation.

CEQA Conclusion: Implementation of Environmental Commitment 4 (*Tidal Natural Communities Restoration*) under Alternative 2D would result in 65 acres of tidal restoration within the Delta. This would have a negligible effect on creating conditions conducive to *Microcystis* bloom formation, particularly relative to the development of 8,000 acres of tidal habitat and improvements to the Yolo Bypass in the ELT—activities separate and distinct from Alternative 2D. These activities would create shallow backwater areas that could result in a measureable increase in water temperatures and water residence times in the Delta, and therefore *Microcystis*, relative to Existing Conditions. Thus, implementation of Environmental Commitment 4 under Alternative 2D would be less than significant. No mitigation is required.

4.4.22 Minerals

Impact MIN-1: Loss of Availability of Locally Important Natural Gas Wells as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: Alternative 2D would include the same physical/structural components as Alternative 4, described in Appendix A of this RDEIR/SDEIS, with the addition of two river intakes. The configuration of river intakes would be similar to Alternative 1A, described in the Draft EIR/EIS. There are no producing wells within the construction footprint, the temporary construction work areas, or the east-west transmission line alignment option.

Because no producing wells within the construction footprint would be affected, construction of Alternative 2D would not reduce natural gas production in the study area. Alternative 2D would not affect any locally important natural gas wells or result in the loss of any portion of the study area's natural gas production.

CEQA Conclusion: Because no natural gas wells occur in the Alternative 2D water conveyance facility footprint, there would be no change in the number of active natural gas wells or natural gas production. The construction of Alternative 2D would not impact natural gas wells or gas production. No mitigation is required.

Impact MIN-2: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The extent of the construction and permanent footprints of the water conveyance facilities and resulting loss of extraction potential from natural gas fields under Alternative 2D would be the same as described under Alternative 4 in Appendix A of this RDEIR/SDEIS. Constructing the water conveyance facilities would permanently reduce the land surface available for vertical extraction of natural gas from directly underlying gas fields; however most of the affected gas fields could be accessed from other overlying areas. Similarly, effects on potential gas extraction resulting from construction work areas would be small and temporary and would not prevent recovery of natural gas. Therefore, there would be no short or long-term adverse effect on the potential to extract natural gas as a result of constructing the water conveyance facilities.

CEQA Conclusion: Although the Alternative 2D conveyance facilities would reduce the land surface available for vertical extraction of natural gas from underlying gas fields, the proportion of these gas fields affected would be small (less than approximately 3% of the areal extent of natural gas field areas intersected). Additionally, there would be no substantial loss of existing production or permanent loss of access to the resource because the gas fields would continue to be accessible using conventional or directional drilling techniques. The impact is less than significant because the potential to extract natural gas would not be substantially reduced. No mitigation is required.

Impact MIN-3: Loss of Availability of Locally Important Natural Gas Wells as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation and maintenance of the water conveyance facilities under Alternative 2D would be similar to those under Alternative 4, described in Appendix A of this RDEIR/SDEIS, and would include moving water through the new water conveyance infrastructure and in natural channels. These operations would not cause additional effects on natural gas wells beyond those occurring as a result of constructing the water conveyance facilities. Maintenance of these facilities under Alternative 2D would be similar but slightly greater as discussed for Alternative 4. Operation and maintenance activities would occur on or immediately adjacent to the water conveyance facilities. Accordingly, the operation and maintenance associated with the water conveyance facilities would not restrict access to or use of existing active wells. There would be no adverse effect on natural gas wells from operating or maintaining Alternative 2D.

CEQA Conclusion: The operation and maintenance of water conveyance facilities under Alternative 2D would have no impact on access to natural gas wells because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would occur on or immediately adjacent to the facilities and would not require the abandonment of wells, eliminate access to wells, or reduce natural gas production. Therefore, the impact on natural gas wells would be less-than-significant. No mitigation is required.

Impact MIN-4: Loss of Availability of Natural Gas Fields as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 2D would be same as Alternative 2A and would include moving water through the new water conveyance infrastructure and in natural channels. These operations would not cause additional effects on access to natural gas fields beyond those occurring as a result of constructing the water conveyance facilities. Maintenance of the water conveyance facilities under Alternative 2D would be similar but slightly greater than as discussed for Alternative 4 in Appendix A of this RDEIR/SDEIS. Operation and maintenance activities would occur on or immediately adjacent to the water conveyance facilities and as such would not restrict access to or use of existing natural gas fields. There would be no adverse effect on natural gas fields from operating or maintaining Alternative 2D.

CEQA Conclusion: The operation and maintenance of Alternative 2D water conveyance facilities would have no impact on the access to natural gas fields because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would occur on or immediately adjacent to the facilities. The impact on the availability of natural gas fields is considered less than significant because access to these fields would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-5: Loss of Availability of Locally Important Natural Gas Wells as a Result of Implementing Environmental Commitments 3, 4, 6-12, 15 and 16

The type of effects on locally important natural gas wells associated with Environmental Commitments, 4, 6–12, 15, and 16 would be similar to those described for Alternative 4, described in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1.3, *Description of Alternative 2D*, of this RDEIR/SDEIS, Environmental Commitments occurring under Alternative 2D would affect much less land within the project area when compared to Alternative 4. Therefore, the magnitude of effects of Alternative 2D on mineral resources within the project area would be smaller than those disclosed under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Because locations for these activities have not been determined, the extent of the effect of implementing restoration actions on locally important natural gas wells can only be estimated. It is anticipated that implementing the environmental commitments under Alternative 2D would result in adverse effects on locally important natural gas wells however to a lesser degree than under Alternative 4 because much less land would be restored. Similar to Alternative 4, natural gas wells located in areas that would be permanently inundated could remain productive with the use of protective cages or platforms. However, for those instances, modification and maintenance of wells may not be cost effective. It is likely that any producing wells in proposed permanent inundation areas would need to be abandoned because modifications to these wells would not be feasible.

The number of active wells directly affected would vary, depending on the specific lands inundated by the environmental commitments. The active wells that would be affected could be maintained in place if they were only seasonally inundated. In permanently flooded areas, the active wells could be replaced using conventional or directional drilling techniques at a location outside the inundation zone to maintain production. The likelihood of this replacement would depend on the availability of land for lease and the cost of the new construction. If a large number of wells had to be abandoned and could not be re-drilled, there could be a locally adverse effect related to permanent elimination of a substantial portion of a county's active natural gas wells. Mitigation Measure MIN-5 is available to address this effect.

Natural gas wells in upland areas could remain operational and unaffected if they are avoided when restoration activities are implemented and access to the gas well can be maintained. Maintaining access to an oil or gas well is defined by DOC as (1) maintaining rig access to the well, and (2) not building over, or in close proximity to, the well (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources 2007).

CEQA Conclusion: Although the number of natural gas wells likely to be affected may be a small percentage of the total wells in the study area, and some wells may be relocated using conventional or directional drilling, there is potential to affect a significant number of locally important gas wells. Consequently, this impact is considered significant. Because implementation of Mitigation Measure MIN-5 cannot assure that all or a substantial portion of a county's existing natural gas wells will remain accessible after implementation of this alternative, this impact is significant and unavoidable.

Mitigation Measure MIN-5: Design Environmental Commitments 4 and 10 to Avoid Displacement of Active Natural Gas Wells to the Extent Feasible

During final design of Environmental Commitments 4 and 10, the project proponents will avoid permanent inundation of or construction over active natural gas well sites where feasible to minimize the need for well abandonment or relocation.

Impact MIN-6: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Because locations of restoration actions occurring under Alternative 2D have not been determined, the extent of the effect of implementing these actions on natural gas fields within the project area can only be estimated. It is anticipated that restoration actions occurring under Alternative 2D would result in adverse effects on the potential to extract natural gas from these fields although to a lesser degree than under Alternative 4 because less land would be restored. Similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, some natural gas fields could be permanently inundated resulting in potential losses in production. However, most natural gas fields would still be accessible from outside the inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of inundation and the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low, there remains the potential for a locally adverse effect on access to natural gas fields because the resource may be permanently inundated or otherwise become inaccessible to recovery. Mitigation Measure MIN-6 is available to lessen this effect.

CEQA Conclusion: The areal extent of lands overlying study area natural gas fields that would be inundated as a result of restoration actions cannot be precisely determined because the final locations for these measures have not been established. Most of these natural gas fields would still be accessible from outside inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of the restoration sites the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low to moderate, there is potential for a locally significant impact on access to natural gas fields if they are permanently covered (inundated) such that the resource cannot be recovered. Implementation of Mitigation Measure MIN-6 would reduce this impact, but not to a less-than-significant level. Because implementation of Mitigation Measure MIN-6 cannot assure that all or a substantial portion of existing natural gas fields will remain accessible after implementation of Alternative 2D, this impact is significant and unavoidable.

Mitigation Measure MIN-6: Design Environmental Commitments 4 and 10 to Maintain Drilling Access to Natural Gas Fields to the Extent Feasible

During final design of actions to offset the impacts of constructing and operating the water conveyance facilities, the project proponents will identify means to maintain access to natural gas fields that could be adversely affect by implementing Environmental Commitments 4 and 10 where feasible. These could include preserving non-inundated lands either over or adjacent to natural gas fields adequate in size to allow drilling to occur. These measures will ensure that drilling access to natural gas fields is maintained to the greatest extent practicable.

Impact MIN-7: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: Because there are no permitted resource extraction mines (including aggregate mines) and no identified MRZs in the Alternative 2D footprint, including within the footprint for the east-west transmission line alignment option, there would be no effect on the availability of aggregate resources.

CEQA Conclusion: Because there are no permitted mines or MRZs in the construction footprint for Alternative 2D, including within the footprint for the east-west transmission line alignment option, there would be no impact. No mitigation is required.

Impact MIN-8: Loss of Availability of Known Aggregate Resources as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The demand for construction materials, including aggregates and borrow materials for Alternative 2D would be slightly greater than Alternative 4 because of the two additional intakes. The principal demands for construction material would come from the five intakes, Clifton Court Forebay pumping plant and associated facilities, the nearly 40 miles of concrete pipeline tunnels, and forebays. Similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, this demand would not result in a substantial depletion of construction-grade aggregate within the six regional aggregate production study areas, would not cause remaining supplies to be inadequate for future development, and would not substantially contribute to the need for the development of new aggregate resources. Accordingly, it would not have an adverse effect on the availability of known aggregate resources or borrow materials over the water conveyance facilities construction period.

CEQA Conclusion: The use of large amounts of construction aggregate over the 9-year construction period would not result in a substantial depletion of construction-grade aggregate from the study area, would not cause remaining supplies to be inadequate for future development, and would not contribute to the need for development of new aggregate sources. Consequently, although a substantial amount of available aggregate material may be used to construct Alternative 2D, the impact on aggregate resources would be less than significant. No mitigation is required.

Borrow is not a defined mineral resource and is usually developed on an as-needed basis. Consequently, the amount of borrow required for this alternative would not be a significant impact. No mitigation is required.

Impact MIN-9: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 2D would include moving water through both the new water conveyance infrastructure and natural channels. Adverse effects would only occur if operations prevented access to a locally important aggregate resource site; this is not expected to occur because there are no aggregate mines or MRZs in the area where Alternative 2D would operate. Accordingly, operation of Alternative 2D would not block access to existing mines or identified MRZs and similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, there would be no effect. Similarly, routine facilities maintenance activities such as painting, cleaning, and structure repair, landscape maintenance, road work, and periodic replacement of erosion protection on the levees and embankments would occur at or immediately adjacent to water conveyance facilities and would not cover or block access to existing mines or identified MRZs. Accordingly, the operation and maintenance of the water conveyance facilities under Alternative 2D would not have effects on the availability of aggregate resource sites.

CEQA Conclusion: The operation and maintenance of Alternative 2D water conveyance facilities would have no impact on locally important aggregate resources because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would be limited to the water conveyance facilities. The impact on locally important aggregate resources is considered less than significant because access to areas containing these resources would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-10: Loss of Availability of Known Aggregate Resources as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 2D would include moving water through both the new water conveyance infrastructure and natural channels. Adverse effects would only occur if operations prevented access known aggregate resources; this is not expected to occur because there are no known aggregate resources the area where Alternative 2D would operate. Similarly, routine facilities maintenance activities such as painting, cleaning, and structure repair, landscape maintenance, road work, and periodic replacement of erosion protection on the levees and embankments would occur at or immediately adjacent to water conveyance facilities and would not cover or block access known aggregate resources, Accordingly, the operation and maintenance of the water conveyance facilities under Alternative 2D would not have effects on known aggregate resources.

CEQA Conclusion: The operation and maintenance of Alternative 2D water conveyance facilities would have no impact on known aggregate resources because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would be limited to the water conveyance facilities. The impact on known aggregate resources is considered less than significant because access to areas containing these resources would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-11: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15 and 16

NEPA Effects: Implementation of the Environmental Commitments would have the potential to affect locally important aggregate resource sites are those that would inundate large areas of land. The loss of important aggregate resource sites under Alternative 2D would be similar to that described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential for loss of important aggregate resource sites would be less than Alternative 4 because much less land would be restored within the project area and over a much shorter period. Nevertheless, the potential for inundation and loss of this aggregate resource sites would remain under Alternative 2D and is considered an adverse effect. Mitigation Measure MIN-11 is available to reduce this effect.

CEQA *Conclusion:* As described under Alternative 4, an active mine on Decker Island may fall within the inundation footprints associated with implementing restoration actions associated with tidal natural communities and nontidal marsh. Although less acreage would be restored under Alternative 2D, restoration actions could result in inundation of aggregate resources. Although the impact is expected to be less than under Alternative 4, the potential loss would remain significant impact because it would eliminate the potential to recover aggregate resources. Mitigation Measure MIN-11 is designed to reduce the impact to less than significant.

Mitigation Measure MIN-11: Purchase Affected Aggregate Materials for Use in Project Construction

Please see Mitigation Measure MIN-11 under Impact MIN-11 in the discussion of Alternative 4, described in in Appendix A of this RDEIR/SDEIS.

Impact MIN-12: Loss of Availability of Known Aggregate Resources as a Result of Implementing Environmental Commitments 3, 4, 6-12, 15 and 16

NEPA Effects: Restoration actions occurring under Alternative 2D have the potential to reduce the availability of important aggregate resources. When compared to Alternative 4, loss of aggregate resources under Alternative 2D would be less because the total acreage of restoration occurring with the project area would be substantially less. Similar to Alternative 4, described in in Appendix A of this RDEIR/SDEIS, aggregate and riprap would be used for levee, berm, access road, and rock revetment construction, and rock would be placed for erosion control and stability at levee breaches and toe drain earthworks. The amounts of aggregate and riprap necessary for these activities cannot be calculated at this time because of the programmatic nature and general design of the restoration actions. However, the amount needed would be used over a period of years and would be expected to be within the available resources of the study area and adjacent aggregate resource study areas discussed in Section 26.1.2.1, *Aggregate Resources* of the Draft EIR/EIS and identified in Table 26-1. There would be no depletion (loss of availability) of regional aggregate supplies substantial enough to cause remaining supplies to be inadequate for future development or to require development of new aggregate sources to meet future demand. Therefore, the use of aggregate material for the restoration actions under Alternative 2D would not cause an adverse effect on the availability of aggregate resources.

CEQA Conclusion: Restoration actions occurring under Alternative 2D, would use small amounts of aggregate for levee, berm, and access road construction, and placement of rock revetments or riprap for erosion control and stability at level breaches and toe drain earthworks. The amounts of aggregate are unknown but would be within the available resources of the study area or adjacent aggregate resource study areas. The impact on known aggregate resources would be less than significant because implementing environmental commitments would not use an amount of aggregate that would cause remaining supplies to be inadequate to meet future demands or require developing new sources. No mitigation is required.

4.4.23 Paleontological Resources

Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result of Construction of Water Conveyance Facilities

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes. The potential for Alternative 2D to affect unique or significant paleontological resources would be similar to the impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but could include additional impacts associated with constructing Intakes 1 and 4. Construction activities that could result in adverse effects on paleontological resources include excavation for new intakes, new pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an operable barrier at the head of Old River, other water facility components, roads, and borrow sites. The depth, extent, and location of excavation and other ground-disturbing activities vary greatly across the project area would be similar to the description of the extent of impacts on paleontological resources in Alternative 4 and summarized in Table 27-14 in Appendix A of the RDEIR/SDEIS, with the exception of two additional intakes.

NEPA Effects: The ground-disturbing activities that occur in geologic units sensitive for paleontological resources have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would represent an adverse effect because conveyance facility construction could directly or indirectly destroy unknown paleontological resources in geologic units known to be sensitive for these resources.

The shallow excavation and grading in surficial Holocene deposits that would take place for the construction of roads could be addressed through implementation of Mitigation Measures PALEO-1b and 1d.

Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the surface-related ground disturbance activities associated with Alternative 2D. However, while these measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring activities because they would be conducted deep underground and could not be monitored. Moreover, although boring material could be examined by monitors, such work would be subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

Excavation for new intakes, new pumping plants, new/expanded forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for Alternative 2D would most likely destroy unique or significant paleontological resources and would constitute an adverse effect under NEPA.

***CEQA Conclusion*:** Construction of water conveyance facilities proposed under Alternative 2D could cause the destruction of unique paleontological resources. The ground-disturbing activities associated with Alternative 2D would occur in geologic units sensitive for paleontological resources and could therefore have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact because construction of conveyance facilities could substantially affect geologic formations that have potential to contain unique paleontological resources.

Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels necessary for Alternative 2D would most likely destroy unique or significant paleontological resources in the project area and would potentially cause a significant and unavoidable impact.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1b under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1c under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1d under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated with the Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Ground-disturbing activities associated with restoration actions under Alternative 2D would result in impacts that would be similar in nature to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the extent of these impacts would be much less than under Alternative 4 because less ground disturbing activity would occur. The conservation and stressor reduction environmental commitments are described in detail in Section 4.1.3.3, *Environmental Commitments*, and include natural communities protection and restoration, tidal natural communities restoration, channel margin enhancement, riparian natural community restoration, vernal pool and alkali seasonal wetland complex restoration, and nontidal marsh restoration. Land disturbing activities would be required to implement each of the conservation and stressor reduction measures.

NEPA Effects: If fossils are present in the project area, they could be damaged during excavation required to implement the conservation and stressor reduction environmental commitments. The greater the extent of excavation, the greater the potential effect, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be an adverse effect.

Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-disturbing environmental commitments. Mitigation Measures PALEO-1a through PALEO-1d would address all deeper ground-disturbing environmental commitments.

CEQA Conclusion: Ground-disturbing activities associated with implementing the conservation and stressor reduction environmental commitments under Alternative 2D could affect paleontological resources. If fossils are present in the project area, they could be damaged during excavation associated with these environmental commitments. The greater the extent of excavation, the greater the potential impact, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact because construction activities could substantially affect geologic formations that have potential to contain unique paleontological resources.

Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing environmental commitments and Mitigation Measures PALEO-1a through PALEO-1d for all deeper ground-disturbing environmental commitments ensure that unique or significant paleontological resources in the alternative footprint are systematically identified, documented, avoided or protected from damage where feasible, or recovered and curated so they remain available for scientific study and would reduce these impacts to a less-than-significant level.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

4.4.24 Environmental Justice

As described in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS some of the resource topics were not considered in the assessment of disproportionate impacts on minority or low-income populations. For the reasons described in Section 28.5.3.1, *Issues Not Analyzed in Detail*, these resources were also not evaluated as part of the Alternative 2D environmental justice impact assessment. The resource topics not evaluated for a disproportionate impact on minority or low income populations are geology and seismicity, hazards and hazardous materials, mineral resources, water supply, surface water, groundwater, water quality, soils, fish and aquatic resources, terrestrial biological resources, agricultural resources, recreation, transportation, energy, and paleontological resources.

4.3.24.1 Land Use

The potential impact on minority and low-income populations resulting from changes in land use for Alternative 2D would be the same as described for Alternative 4. The discussion of Alternative 4 in Chapter 13, *Land Use*, Section 13.3.3.9 of the Draft EIR/EIS identifies effects caused by incompatibility with local land uses, potential for physical division of established communities, and incompatibility with land use policies, By itself, incompatibility with land use policies is not a physical effect on the environment, and, therefore, does not have the potential to result in a disproportionate effect on a minority or low-income populations. Chapter 13, *Land Use*, Section 13.3.3.9 of the Draft EIR/EIS, also addresses the potential for an alternative to result in the relocation of residents, or a physical effect on existing structures, with the consequence that adverse effects on the physical environment would result. The following adverse effects are relevant to this analysis:

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

The extent of land use changes attributable to construction of Alternative 2D that could affect minority and low-income populations would be the same as disclosed for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives. Alternative 2D would include the same physical/structural components as Alternative 4 and two additional intakes. Therefore, there would be a greater impact related to construction two additional intakes. As for Alternative 4, construction and operation of physical facilities for water conveyance would create temporary or permanent conflicts with existing land uses (including displacement of existing structures and residences) because of the construction of permanent features of the facility. As discussed in detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS, a disproportionate effect on minority populations would occur because construction of intakes would result in the displacement of residential structures and permanent structures within census blocks where the minority population is greater than 50%.

4.3.24.2 Socioeconomics

The potential impact on minority and low-income communities associated with changes in socioeconomic conditions for Alternative 2D would be the same as described for Alternative 4. The discussion of Alternative 4 in Section 13.3.3.9 of the Draft EIR/EIS identified effects on agricultural economics and local employment conditions associated with constructing and operating the water conveyance facility and implementing environmental commitments. These impacts have the potential to disproportionately affect environmental justice populations. The following adverse effects are relevant to this analysis:

Impact ECON-1: Temporary Effects on Regional Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Impact ECON-7: Permanent Regional Economic Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Land use changes that could affect minority and low-income populations for Alternative 2D would be the same as indicated for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher project-related employment effects when compared to Alternative 4. Conversely, adverse effects associated with agricultural employment would also be somewhat higher due to the additional acreages of agricultural land that would be affected by construction of five intake facilities. Also, the two additional intake facilities that would be constructed would likely result in slightly higher effects on employment effects when compared to Alternative 4. As discussed in greater detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the majority of farm-related employment is represented by minority populations, including those of Hispanic origin, and potentially low-income, loss of agriculture land and loses of associated employment is expected to result in a disproportionate effect on minority populations. While a net increase in employment would occur during construction of the water conveyance facility, it is expected that most new construction jobs would not likely be filled by displaced agricultural workers because the skills required are not comparable. This effect would, therefore, remain adverse because job losses would disproportionately accrue to a minority population.

4.3.24.3 Aesthetics and Visual Resources

The potential impact on minority and low-income communities associated with changes in visual resources for Alternative 2D would be the same as described for Alternative 4. However, the potential under Alternative 2D to create substantial alteration in visual quality or character during construction of conveyance facilities would be slightly greater than those impacts described under Alternative 4 and would constitute adverse effects on existing visual character, on scenic vistas, would create new light or glare, and would substantially alter existing visual character. The discussion of Alternative 4 in Section 17.3.3.9 in the Draft EIR/EIS addresses impacts on aesthetics and visual resources in the study area. The impacts on aesthetics and visual resources have the potential to disproportionately affect environmental justice populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Mitigation Measure AES-2D: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-intensity and Lights off Policy

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

The changes in the visual character of the study area that could affect minority and low-income communities under Alternative 2D would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives. As described in detail under Alternative 4, changes in the visual character of the study area would occur as a result of the following:

- Landscape scars left behind from spoil borrow and RTM areas, transmission lines, concrete batch plants and fuel stations, and launching, retrieval, ventilation shafts sites.
- Constructing industrial facilities (i.e., Sacramento River intakes, intermediate forebay, expanded Clifton Court Forebay and pumping plant) in the study area.

The change in visual character as a result of the construction of the water conveyance facilities would be evident from the communities of Walnut Grove, Clarksburg, and Hood as well as rural residences located along the entire alignment. Because of the concentration of minority and low income populations in these communities as well as along the entire alignment, a change in visual character of the study area would disproportionately affect these populations. For these reasons, although mitigation is available to reduce the severity of these effects, this effect would be adverse.

Similar to Alternative 4, implementing conservation and stressor reduction measures as part of Alternative 2D, would result in impacts on the study area's visual quality and character. However because the precise location of the conservation and stressor reduction measures are unknown, this impact is not carried forward for further analysis of environmental justice effects.

4.3.24.4 Cultural Resources

The potential impact on minority and low-income communities associated with changes to cultural resources Alternative 2D would be the same as described for Alternative 4, but with slightly greater magnitude due to construction of two additional intakes. The discussion of Alternative 4 in Section 18.3.5.9 of the Draft EIR/EIS addresses cultural resources in the study area. The impacts on cultural resources have the potential to disproportionately affect minority or low-income populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-7: Effects of Environmental Commitments on Cultural Resources

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Mitigation Measure CUL-3: Implement an Archaeological Cultural Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains If Such Resources Are Discovered during Construction

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of CM2–CM21

The impact that the loss of cultural resources from within the study area could have on minority and low-income populations under Alternative 2D would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of greater magnitude due to construction of two additional intakes. As discussed in greater detail under Alternative 4 of Chapter 18 of the Draft EIR/EIS, the loss or damage to prehistoric cultural resources would result in a disproportionate effect on Native American populations and potentially other minorities. Despite the required mitigation measures and Native Consultation processes, construction of Alternative 2D is likely to result in adverse effects on prehistoric archaeological resources and human remains because the scale of the construction activities makes avoidance of all eligible resources infeasible. The effect on minority populations that may ascribe significance to cultural resources in the Delta would remain disproportionate even after mitigation because mitigation cannot guarantee that all resources would be avoided, or that effects on affected resources would be reduced. For these reasons this effect would be adverse because the effect would disproportionately accrue to a minority population.

4.3.24.5 Public Services and Utilities

The potential impact on minority and low-income communities associated with changes to the availability of public services and utilities under Alternative 2D would be the same as described for Alternative 4, but of greater magnitude due to construction of two additional intakes. The discussion of Alternative 4 in Section 20.3.3.9 of the Draft EIR/EIS addresses potential effects on utility infrastructure and public service providers, such as fire stations and police facilities. The following adverse effects on public services and utilities are relevant to the analysis:

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

The impacts on public services and utilities located within the study area that could disproportionately affect minority and low-income populations under Alternative 2D would be the same as indicated disclosed under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of greater magnitude due to construction of two additional intakes. As discussed in greater detail under Alternative 4, the impact of constructing the proposed water conveyance facilities on public services and utilities would not result in a disproportionate effect on minority or low income populations because relocation of an existing known utility would affect the entire service area of that utility. This effect would not be anticipated to result in a disproportionate effect on a minority or low-income population.

4.3.24.6 Air Quality and Greenhouse Gas Emissions

Alternative 2D would include the same physical/structural components as Alternative 4, described in Appendix A of this RDEIR/SDEIS, but would include two additional intakes, similar to Alternative 1A. Accordingly, construction emissions and associated health risks generated by Alternative 2D in would be similar to but greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4. See the discussion of Impact AQ-14 under Alternatives 1A and 4 of the DEIR/DEIS. The following adverse effects and mitigation measure are relevant to this analysis:

Impact AQ-14: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SMAQMD's Chronic Non-Cancer and Cancer Risk Assessment Thresholds

Impact AQ-16: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of BAAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Mitigation Measure AQ-14: Relocate Sensitive Receptors to Avoid Excess Cancer Risk

Alternative 4 would not exceed the SMAQMD's or BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 1A would result in diesel particulate matter (DPM) concentrations in excess of SMAQMD's and BAAQMD's thresholds at adjacent receptors (see Tables 22-18 and 22-20). Since construction of the intakes contributes the majority of DPM emissions to the cancer risk in the SMAQMD, and Alternative 2D would construction five intakes, similar to Alternative 1A, effects would be adverse under Alternative 2D. Since proximity to haul routes contributes DPM emissions to the cancer risk, and Alternative 2D would have increased haul truck activity through BAAQMD due to the construction of five intakes in SMAQMD, similar to Alternative 1A, effects would be adverse under Alternative 2D.

Mitigation Measure AQ-14 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, an adverse effect in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, effects would not be adverse.

The impacts on air quality during construction of the water conveyance facilities and resulting effects on minority and low-income communities under Alternative 2D would be similar to but greater than Alternative 4 due to the increased number of intakes, and would likely range between those generated under Alternatives 1A and 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of greater magnitude due to construction of two additional intakes. As discussed in greater detail under Alternative 4 in Appendix A of this RDEIR/SDEIS, constructing the water conveyance facilities would result in an adverse impact on air quality that would remain adverse after application of mitigation. Given that the construction and restoration and conservation areas along this alignment are proximate to census blocks and block groups where meaningfully greater minority and low-income populations occur, it is expected that generation of criteria pollutants in excess of local air district thresholds would result in a potentially disproportionate effect on minority and low-income populations.

4.3.24.7 Noise

The potential impact on minority and low-income communities associated with noise occurring under Alternative 2D would be the same as described for Alternative 4, but of greater magnitude due to construction of two additional intakes. The discussion of Alternative 4 in Section 23.4.3.9 of the Draft EIR/EIS identifies the following adverse effects associated with new sources of noise and vibration that would be introduced into the study area under Alternative 4. The following adverse effects and mitigation measure are relevant to this analysis.

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

The impacts of noise and vibration generated during construction of the water conveyance facilities and resulting effects on minority and low-income communities occurring under Alternative 2D would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of greater magnitude due to construction of two additional intakes. As discussed in greater detail under Alternative 4, constructing the water conveyance facilities would generate nose in exceedance of daytime and nighttime noise standards in areas zoned as sensitive land uses including residential, natural/recreational, agricultural residential, and schools. Similarly, ground borne vibration from impact pile driving would exceed vibration thresholds in areas zoned for residential, including agricultural residential. This effect of noise and vibration generated during construction would remain adverse after application of mitigation. Because the alignment of the water conveyance facility is proximate to census blocks and block groups where meaningfully greater minority and low-income populations occur it is expected that generation of noise and vibration in exceedance of thresholds would result in a potentially disproportionate effect on minority and low-income populations.

Impacts of implementing conservation and stressor reduction components (Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16) under Alternative 2D would be expected to be similar to impacts of implementing CM2–CM11 under Alternative 4. However, because fewer acres would be restored under Alternative 2D, it is expected that noise and vibration generated would be less when compared to Alternative 4. Nevertheless, it would be difficult to analyze potential disproportionate effects on environmental justice population because similar to CM3–CM11, the location of the conservation and stressor reduction components are not known. However, because of the distribution of minority and low-income populations in the study area, there is a potential for noise and vibration impacts to disproportionately affect these populations.

4.3.24.8 Public Health

Section 4.4.21, *Public Health*, of this RDEIR/EIS, identifies the potential for construction, operation, and maintenance of Alternative 2D to mobilize or increase constituents known to bioaccumulate. The following adverse effects are relevant to this analysis.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

The amount of habitat restoration completed under Alternative 2D would be substantially less than under Alternative 4. Five intakes would be constructed and operated under Alternative 2D. Sediment-disturbing activities during construction and maintenance of these intakes and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. The effects of Alternative 2D on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT) would be similar to or slightly less than those described for the Alternative 4. Alternative 2D would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments.

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter

8, Section 8.1.3.9, *Mercury,* in Appendix A of the RDEIR/SDEIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 2D are expected to be small. As described in Section 4.4.4, *Water Quality,* the greatest annual average methylmercury concentration for drought conditions under Alternative 2D would be 0.166 ng/L for the San Joaquin River at Buckley Cove, which would be slightly lower than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases for mercury concentrations relative to the No Action Alternative (ELT) based on long-term annual average concentrations in the Delta. Mercury concentrations in fish tissue expected for Alternative 2D (with Equation 1), show increases of 9 percent or less, relative to the No Action Alternative (ELT), in all modeled years. Mercury concentrations in fish tissue expected for Alternative 2D (with Equation 2), are estimated to 13 percent at Staten Island relative to the No Action Alternative (ELT), in all modeled years. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a discussion of the uncertainty associated with fish tissue estimates of mercury.

Because some of the affected species of fish in the Delta are pursued during subsistence fishing by minority and low-income populations, this increase creates the potential for mercury-related health effects on these populations. Asian, African-American, and Hispanic subsistence fishers pursuing fish in the Delta already consume fish in quantities that exceed the US Environmental Protection Agency reference dose of 7 micrograms (μg) per day total (Shilling et al. 2010:5). This reference dose is set at 1/10 of the dose associated with measurable health impacts (Shilling et al. 2010:6). The highest rates of mercury intake from Delta fish occur among Lao fishers (26.5 μg per day, Shilling et al. 2010:6). Increased mercury was modeled based upon increases modeled for one species: largemouth bass. These effects are considered unmitigable (see Chapter 8, *Water Quality,* Mitigation Measure WQ-13).

The associated increase in human consumption of mercury caused by these alternatives would depend upon the selection of the fishing location (and associated local fish body burdens), and the relative proportion of different Delta fish consumed. Different fish species would suffer bioaccumulation at different rates associated with the specific species, therefore the specific spectrum of fish consumed by a population would determine the effect of increased mercury body burdens in individual fish species. These confounding factors make demonstration of precise impacts on human populations infeasible. However, because minority populations are known to practice subsistence fishing and consume fish exceeding US EPA reference doses, any increase in the fish body burden of mercury may contribute to an existing adverse effect. Because subsistence fishing is specifically associated with minority populations in the Delta compared to the population at large this effect would be disproportionate on those populations for Alternative 2D. This effect would be adverse.

4.3.24.9 Summary of Environmental Justice Effects under Alternative 2D

Alternative 2D would result in disproportionate effects on minority and low-income communities resulting from land use, socioeconomics, aesthetics and visual resources, cultural resources, noise, air quality, and public health effects. Mitigation and environmental commitments are available to reduce these effects; however, effects would remain adverse. For these reasons, effects on minority and low-income populations would be disproportionate and adverse.

4.4.25 Climate Change

This section is organized differently from the other sections above because analyzing how Alternative 2D would affect the Delta's resiliency and adaptability to climate change is a fundamentally different analysis than those presented in other resource analyses. Whereas the other sections are organized to identify effects of Alternative 2D and how to mitigate any significant impacts, this section's function is to analyze and disclose how Alternative 2D would affect the Delta's resiliency and adaptability to expected climate change. While climate change is already ongoing and would occur under the ELT timeframe, effects of Alternative 2D on the resiliency and adaptability would be greater under LLT conditions as climate change effects are expected to be more pronounced[9]. Nevertheless, an assessment of conditions under the ELT timeframe is provided below.

Alternative 2D would provide resiliency and adaptation benefits over the No Action/No Project alternative for dealing with the combined effect of increases in sea level rise and changes in upstream hydrology. The benefits would be similar to those anticipated under Alternative 4A (see Section 4.3.25 in this RDEIR/SDEIS) and are primarily derived from the alternative's dual conveyance structure and location of the north Delta facility, which allow for more flexible water movement and protection from potential salinity intrusion. Alternative 2D would also provide more reliable water supplies and increased flexibility to adaptively manage the Delta so that conditions can be optimized across all Delta water uses and habitat conditions.

In addition to added water management flexibility, Alternative 2D includes several environmental commitments that will improve habitat in certain areas and reduce the effects of stressors. Provided benefits would be similar to those anticipated under Alternative 4A and include expanded habitat options during periods of high or low freshwater inflow, increased habitat connectivity, and potential buffers against rising water temperatures. Alternative 2D would also provide additional adaptability to catastrophic failure of Delta levees. Please refer to Section 4.3.25, *Climate Change*, in this RDEIR/SDEIS for more detailed discussion on anticipated resiliency and adaptation benefits.

As described for Alternative 4A, Alternative 2D would not be anticipated to add resiliency to existing levees; levee fragility would remain high and increase with time as in the No Action/No Project Alternative. Similarly, construction and operation of the proposed water conveyance facilities and implementation of environmental commitments under Alternative 2D would not affect the ability of agencies to implement plans and proactive measures associated with climate change resiliency (see Draft EIR/EIS Chapter 29, *Climate Change,* Section 29.7 for a discussion of individual plans and policies). Accordingly, the project would be compatible with these federal and state plans to address climate change.

[9] The ELT timeframe is modeled at 2025. The LLT timeframe is modeled at 2060.

4.4.26 Growth Inducement and Other Indirect Effects

4.4.26.1 Direct Growth Inducement

Construction Jobs

Construction of Alternative 2D would require a peak of approximately the same number of workers as those described for Alternative 4 in Chapter 30, *Growth Inducement and Other Indirect Effects*, in the Draft EIR/EIS. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher project-related employment effects when compared to Alternative 4. It is estimated that approximately 30 percent of these workers would come from out of state (due to the specialized nature of some of the jobs) and reside temporarily in the vicinity. Given the availability of housing in the project vicinity, out-of-state workers would be readily accommodated by existing housing; therefore the influx of these workers during project construction would not induce substantial new housing development.

Permanent Jobs

Alternative 2D would require permanent operations and maintenance workers, who would be anticipated to live in the Delta region. This number would be similar to those required under Alternative 4. However, under Alternative 2D two additional intake facilities would be constructed, which would likely result in slightly higher effects on employment effects when compared to Alternative 4. It is likely that this small number of new jobs would readily be filled by the local labor force and would not induce additional growth in the area. Assuming some or all of the jobs were specialized and required workers from outside the local labor pool, given the availability of housing in the project vicinity, these workers would be readily accommodated by existing housing; therefore the influx of these workers during project operation would not induce substantial new housing development.

4.4.26.2 Indirect Growth Inducement Associated with Facility Construction and Operation

Access Roads within the BDCP Plan Area

Construction of Alternative 2D water conveyance facilities will be similar to Alternative 4. Effects of construction of access roads for this alternative would be similar to that described for Alternative 4A under Section 4.3.26.2, *Indirect Growth Inducement Associated with Facility Construction and Operation*, of this RDEIR/SDEIS.

Flood Risk Reduction

Actions under Alternative 2D are not anticipated to have any substantial impact or change on potential for flooding within the Plan Area and downstream areas (RDEIR/SDEIS Section 4.4.2. *Surface Water*). Effects of this alternative would be similar to that described for Alternative 4A under Section 4.3.26.2, *Indirect Growth Inducement Associated with Facility Construction and Operation*, of this RDEIR/SDEIS. There is not anticipated to have any indirect effect on growth.

4.4.26.3 Indirect Growth Inducement Potential: Summary of Modeling Results

The following sections highlight changes in SWP and CVP deliveries associated with the BDCP alternatives based on modeling conducted using CALSIM II, focusing on changes in municipal and industrial (M&I) deliveries (also referred to as urban deliveries). Figure 4.4.1-26 summarizes overall changes in SWP deliveries to both agricultural and M&I contractors for Alternative 2D relative to Existing Conditions (the CEQA baseline) and the No Action Alternative (ELT) (which reflects with sea level rise and climate change (i.e., effects of precipitation and snowpack). Figure 4.4.1-25 summarizes changes in CVP deliveries under Alternative 2D relative to Existing Conditions as well as the No Action Alternative (ELT).

For purposes of analyzing the project's potential to induce growth, this analysis focuses on the net increase in annual average deliveries; all information on water deliveries presented below is for average annual deliveries in normal hydrologic years. The SWP modeling results reflected in the tables and figures presented in this section include Table A water as well as Article 21 water.[10]

This analysis does not address potential effects of redistribution of SWP water supply among SWP water contractors that might occur from an SWP contract amendment or funding agreements for implementing BDCP, other than as possible multi-year or permanent agricultural to urban water transfer of SWP water. A SWP contract amendment or funding agreement could include provisions for allocating benefits such as a more reliable water supply, to contractors who pay for BDCP and could create the potential for redistributing SWP water. At this time, because a specific SWP amendment or funding agreement has not been developed, it would be too speculative per Section 15145 of the State CEQA Guidelines to evaluate changes in SWP water distribution at this time. If the SWP amendment or agreement, after it is developed, may have potential to have an environmental effect not already contemplated in the BDCP EIR/EIS, DWR would prepare additional analysis.

As described in Section 4.1.3, Alternative 2D would include the construction of five new intakes, among other facilities and would follow the operational criteria described as Scenario B, which includes the Fall X2 action and less negative south Delta Old and Middle River flows than under Scenario A.

The addition of new north Delta intakes as well as changes to Delta regulatory requirements under Alternative 2D would provide operational flexibility that would allow the SWP and CVP to increase Delta exports compared to operations under Existing Conditions. However, Alternative 2D and the No Action Alternative (ELT) also assume that there would be an increase in M&I water rights demands north of the Delta, which would increase overall system demands and reduce the amount of CVP water available for total export south of the Delta. Consequently, SWP M&I deliveries under

[10] Article 21 water is interruptible water allocated under certain conditions. Water supply under Article 21 becomes available only during wet months of the year (December through March). A SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of SWP; therefore not all SWP contractors can take advantage of this additional supply. Article 21 is a section of the contract between DWR and the water contractor that permits delivery of water in excess of delivery of SWP Table A. It is apportioned to contractors that request it in the same proportion as their SWP Table A water. Article 21 water is allocated under certain conditions: (a) SWP's share of San Luis Reservoir is full or projected to fill in the near term; (b) other SWP reservoirs are full or at their storage targets, or conveyance capacity to fill these reservoirs is maximized; (c) releases from upstream reservoirs plus unregulated inflow exceed the water supply needed to meet Sacramento Valley in-basin uses; (d) SWP Table A deliveries are being fully met; and (e) Banks Pumping Plant has spare capacity (California Department of Water Resources 2008b:32,39).

Alternative 2D are projected to increase due to increased Delta exports, while in some cases CVP deliveries south of Delta are projected to decrease due to increased water rights demands north of Delta.

See Section 4.4.1 of this RDEIR/SDEIS, for more detail on changes in Delta exports and SWP and CVP deliveries under Alternative 2D.

Changes in Deliveries to the Hydrologic Regions.

SWP. Compared to both Existing Conditions and the No Action Alternative (ELT), Alternative 2D would increase deliveries to all hydrologic regions except for the San Joaquin River region, which would experience no change in deliveries. South Coast would realize the largest net increase (between 117.5 and 202.8 TAF) among the regions, and represents 64–65% of the net increase in M&I deliveries. San Francisco Bay represents 11–13% of the increase, and Colorado River represents 8–9% of the increase. For more information, refer to results for Alternative 2A, 2B, and 2C in Table 30-16 in the Public Draft EIR/EIS.

CVP. Alternative 2D would not change M&I deliveries for the Sacramento River, South Coast, South Lahontan and Colorado River regions because there are no affected CVP contractors located in these regions. Alternative 2D may result in increased or decreased deliveries to the other hydrologic regions depending on whether deliveries are compared to Existing Conditions or the No Action Alternative (ELT). San Francisco Bay is projected to realize the largest potential increase (2.4 TAF) and also the largest decrease (4.8 TAF) among the hydrologic regions. For more information, refer to results for Alternative 2A, 2B and 2C in Table 30-17 in the Public Draft EIR/EIS.

Alternatives 2D Compared to Existing Conditions, Early Long Term.

SWP. By 2025, average annual total SWP deliveries to all SWP contractors are projected to increase by 8% relative to ELT and increase 3% at LLT. Under Alternative 2D, average annual total south of Delta SWP deliveries as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT.

CVP. By 2025, deliveries to all contractors under Alternative 2D, average annual total CVP deliveries as compared to Existing Conditions, would increase by up to 2% at ELT and decrease by up to 1% at LLT. Under Alternative 2D, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 2% at ELT and by up to 6% at LLT.

Alternatives 2D Compared to No Action Alternative (ELT).

SWP. By 2025, average annual total SWP deliveries as compared to No Action Alternative (ELT), would increase (by about 15%). Under Alternative 2D, average annual total south of Delta SWP deliveries as compared to No Action Alternative (ELT), would increase (by about 21%).

CVP. By 2025, deliveries to all CVP contractors are projected to increase by 3% relative to the No Action Alternative (ELT) and by up to 2% at LLT. Under Alternative 2D, average annual total south of Delta CVP deliveries as compared to No Action Alternative (ELT), would increase by up to 5%.

4.4.27 References

4.4.1 Water Supply

None.

4.4.2 Surface Water

None.

4.4.3 Groundwater

None.

4.4.4 Water Quality

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4.4.9 Land Use

None.

4.4.10 Agricultural Resources

None.

4.4.11 Recreation

None.

4.4.12 Socioeconomics

None.

4.4.13 Aesthetics and Visual Resources

None.

4.4.14 Cultural Resources

None.

4.4.15 Transportation

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None.

4.4.17 Energy

None.

4.4.18 Air Quality and Greenhouse Gases

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4.4.19 Noise

None.

4.4.20 Hazards and Hazardous Materials

None.

4.4.21 Public Health

None.

4.4.22 Minerals

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4.4.23 Paleontological Resources

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4.5 Impacts of Alternative 5A

4.5.1 Water Supply

Facilities construction under Alternative 5A would be identical to that described under Alternative 4, except this alternative would include two fewer intakes. Alternative 5A water conveyance operations would be similar to the operations that would occur under Alternative 5.

Model simulation results for Alternative 5A Early Long-term (ELT) are summarized in Tables B.1-4 and B.1-5 in Appendix B of this RDEIR/SDEIS. Model simulation results for Alternative 5A at Late Long-term (LLT) which are similar to the Alternative 5 (LLT), are summarized in Tables 5-7 through 5-9 in the Draft EIR/EIS.

As indicated in Section 5.3.2, *Determination of Effects*, of Draft EIR/EIS, NEPA adverse effect and CEQA significant impact conclusions are not provided for the impacts discussed in this water supply section.

4.5.1.1 Summary of Water Supply Operations under Alternative 5A

Change in Delta Outflow

Changes in long-term average Delta outflow under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-4 and B.1-5 in Appendix B and Figures 4.4.1-1 through 4.4.1-3 in this RDEIR/SDEIS.

Changes in long-term average Delta outflow under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-3 through 5-5 and Tables 5-7 through 5-9 of the Draft EIR/EIS.

Late-fall and winter outflows remain similar or show minor reductions in Alternative 5A compared to No Action Alternative. In the spring months, outflow would decrease under Alternative 5A as compared to No Action Alternative. SWP and CVP exports in summer months would increase and result in lower outflow as compared to No Action Alternative. In the fall months, outflow under Alternative 5A as compared to No Action Alternative would be similar because of the Fall X2 requirement in wet and above-normal years, and increased or similar outflow in September and October months of all year types due to OMR flow requirements and export reductions.

Long-term average and wet year peak outflows would increase in winter months with a corresponding decrease in spring months because of the shift in system inflows caused by climate change and increased Delta exports as compared to Existing Conditions. In other year types, Alternative 5A would result in higher or similar outflow because of the spring outflow requirements. In summer and fall months, Alternative 5A would result in similar or higher outflow because of changes in export patterns and OMR flow requirements and export reductions in fall months, and also because of the Fall X2 requirements in wet and above normal years. The incremental changes in Delta outflow between Alternative 5A and Existing Conditions would be a function of both the facility and operations assumptions (including north Delta intakes capacity of 15,000 cfs, less negative OMR flow requirements, enhanced spring outflow and/or Fall X2 requirements) and the reduction in water supply availability due to increased north of Delta urban demands, sea level rise and climate change.

Delta outflow under Alternative 5A would likely decrease in winter, spring and summer months, and remain similar or increase in other months, compared to the conditions without the project.

Results for the range of changes in Delta Outflow under Alternative 5A (LLT), which are similar to Alternative 5 (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Change in SWP and CVP Reservoir Storage

Changes in May and September reservoir storage under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Figures 4.4.1-4 through 4.4.1-10 in this RDEIR/SDEIS and Tables B.1-4 and B.1-5 in Appendix B of this RDEIR/SDEIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 4.4.1-11 through 4.4.1-14 for completeness.

Changes in May and September reservoir storage under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of Draft EIR/EIS for Trinity Lake, Shasta Lake, Lake Oroville, and Folsom Lake. SWP and CVP San Luis Reservoir storages are presented in Figures 5-13 through 5-16 of Draft EIR/EIS for completeness.

Results for changes in SWP and CVP reservoir storages under Alternative 5A at LLT, which are similar to Alternative 5 (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Trinity Lake

Under Alternative 5A, average annual end of September Trinity Lake storage as compared to No Action Alternative would remain similar in most years at ELT, and decrease (3%) at LLT.

Under Alternative 5A, average annual end of September Trinity Lake storage as compared to Existing Conditions would decrease by 9% at ELT and 19% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5A and the results show that average annual end of September Trinity Lake storage could remain similar or decrease under Alternative 5A as compared to the conditions without the project.

Shasta Lake

Under Alternative 5A, average annual end of September Shasta Lake storage as compared to No Action Alternative would remain similar in most of the years at ELT, and decrease (3%) at LLT.

Under Alternative 5A, average annual end of September Shasta Lake storage as compared to Existing Conditions would decrease by 9% at ELT and 20% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5A and the results show that average annual end of September Shasta Lake storage could remain similar or decrease under Alternative 5A as compared to the conditions without the project.

Lake Oroville

Under Alternative 5A, average annual end of September Lake Oroville storage as compared to No Action Alternative would increase by up to 4% at ELT and 6% at LLT.

Under Alternative 5A, average annual end of September Lake Oroville storage as compared to Existing Conditions would decrease by 18% at ELT and 28% at LLT. This decrease would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5A and the results show that average annual end of September Lake Oroville storage could increase under Alternative 5A as compared to the conditions without the project.

Folsom Lake

Under Alternative 5A, average annual end of September Folsom Lake storage as compared to No Action Alternative would decrease by about 2%.

Under Alternative 5A, average annual end of September Folsom Lake storage as compared to Existing Conditions decrease by up to 17% at ELT and 29% at LLT. This decrease primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5A and the results show that average annual end of September Folsom Lake storage could decrease under Alternative 5A as compared to the conditions without the project.

San Luis Reservoir

Under Alternative 5A, average annual end of September San Luis Reservoir storage as compared to the No Action Alternative would mostly decrease, due to changes in export patterns.

Under Alternative 5A, average annual end of September San Luis Reservoir storage as compared to Existing Conditions would decrease. This decrease primarily would occur due to changes in export patterns, sea level rise, climate change, and increased north of Delta demands.

A comparison with storages under the No Action Alternative provides an indication of the potential change due to Alternative 5A and the results show that average annual end of September San Luis Reservoir storage would generally decrease under Alternative 5A as compared to the conditions without the project.

Change in Delta Exports

Changes in average annual Delta exports under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-4 and B.1-5 in Appendix B and Figures 4.4.1-15 through 4.4.1-18 in this RDEIR/SDEIS.

Changes in average annual Delta exports under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-17 through 5-20 and Tables 5-7 through 5-9, of Draft EIR/EIS.

The addition of the north Delta intakes and changes to Delta regulatory requirements under Alternative 5A change SWP and CVP Delta exports as compared to Delta exports under Existing Conditions and the No Action Alternative.

Delta exports would increase in wetter years and either increase (at ELT) or decrease (at LLT) in drier years under Alternative 5A as compared to exports under No Action Alternative because of the additional capability to divert water at the north Delta intakes.

Total long-term average annual Delta exports under Alternative 5A would increase at ELT and decrease by up to 1% at LLT as compared to exports under Existing Conditions reflecting changes in operations due to less negative OMR flows, implementation of Fall X2 and/or spring outflow under Alternative 5A, and sea level rise and climate change.

The incremental change in Delta exports under Alternative 5A as compared to No Action Alternative would be caused by the facility and operations assumptions of Alternative 5A. Delta exports would increase in wetter years and remain similar or decrease in the drier years under Alternative 5A as compared to the conditions without the project.

Change in SWP and CVP Deliveries

Impact WS-1: Changes in SWP CVP Water Deliveries during Construction

NEPA Effects: During construction of water conveyance facilities associated with Alternative 5A, operation of existing SWP and CVP water conveyance would continue. Construction would not affect the timing or amount of water exported from the Delta through SWP and CVP facilities.

***CEQA Conclusion*:** Constructing Alternative 5A water conveyance facilities would not impact operation of existing SWP or CVP facilities.

Impact WS-2: Change in SWP and CVP Deliveries

The addition of the north Delta intakes under Alternative 5A provides operational flexibility compared to deliveries under Existing Conditions and the No Action Alternative.

Changes in SWP and CVP Deliveries under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.1-4 and B.1-5 in Appendix B and Figures 4.4.1-22 through 4.4.1-28 in this RDEIR/SDEIS.

Changes in SWP and CVP Deliveries under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 5-6 through 5-12 and Tables 5-7 through 5-9 of Draft EIR/EIS.

Results for SWP and CVP deliveries under Alternative 5A (LLT), which are similar to Alternative 5 (LLT), are presented in more detail in Appendix 5A, *BDCP EIR/S Modeling Technical Appendix*, of the Draft EIR/EIS.

Total CVP Deliveries

Under Alternative 5A, average annual total CVP deliveries as compared to No Action Alternative, would increase by up to 3% at ELT and by up to 2% at LLT. Under Alternative 5A, average annual total south of Delta CVP deliveries as compared to No Action Alternative, would increase by up to 5%.

Under Alternative 5A, average annual total CVP deliveries as compared to Existing Conditions, would increase by up to 2% at ELT and decrease by up to 1% at LLT. Under Alternative 5A, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 2% at ELT and by up to 6% at LLT. However, the decrease would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change. Therefore, average annual total CVP deliveries and average annual total CVP south of Delta deliveries would increase under Alternative 5A scenarios as compared to the conditions without the project.

CVP North of Delta Agricultural Deliveries

Under Alternative 5A, average annual CVP north of Delta agricultural deliveries would increase by up to 4% at ELT and by up to 2% at LLT as compared to No Action Alternative.

Under Alternative 5A, average annual CVP north of Delta agricultural deliveries as compared to Existing Conditions, would decrease by up to 17% at ELT and by up to 30% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP north of Delta agricultural deliveries would generally increase under Alternative 5A as compared to the conditions without the project.

CVP South of Delta Agricultural Deliveries

Under Alternative 5A, average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would increase by up to 13% at ELT and by up to 14% at LLT.

Under Alternative 5A, average annual CVP south of Delta agricultural deliveries as compared to Existing Conditions would decrease by up to 1% at ELT and 14% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta agricultural deliveries as compared to No Action Alternative would generally increase. Therefore, average annual CVP south of Delta agricultural deliveries would increase under Alternative 5A as compared to the conditions without the project.

CVP Settlement and Exchange Contract Deliveries

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 5A as compared to deliveries under the No Action Alternative.

There would be negligible change to CVP Settlement Contract deliveries during dry and critical years under Alternative 5A at ELT as compared to deliveries under the Existing Conditions. Under Alternative 5A at LLT, CVP Settlement Contract deliveries during dry and critical years as compared to Existing Conditions would decrease. This is due to Shasta Lake storage declining to dead pool more frequently, as described previously, under increased north-of Delta demands and climate change and sea level rise conditions. As described in the methods section in Chapter 5, *Water Supply* of the Draft EIR/EIS, model results and potential changes under these extreme reservoir storage conditions may not be representative of actual future conditions because changes in assumed operations may be implemented to avoid these conditions.

There would be no changes in deliveries to CVP Exchange Contractors under Alternative 5A.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years would remain similar. Therefore, CVP Settlement Contract and CVP Exchange Contractors deliveries during dry and critical years under Alternative 5A would be similar to the deliveries under the conditions without the project.

CVP North of Delta Municipal and Industrial Deliveries

Under Alternative 5A, average CVP north of Delta M&I deliveries as compared to No Action Alternative would remain similar of result in minor increase.

Under Alternative 5A, average annual CVP north of Delta M&I deliveries as compared to Existing Conditions would increase by up to 88% at ELT and 82% at LLT. However, this increase primarily would occur because there would be an increase in north of Delta M&I water rights demands under Alternative 5A and No Action Alternative as compared to demands under Existing Conditions.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP north of Delta M&I deliveries would remain similar or show minor increase under Alternative 5A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP north of Delta M&I deliveries would remain similar or increase under Alternative 5A as compared to the conditions without the project.

CVP South of Delta Municipal and Industrial Deliveries

Under Alternative 5A, average CVP south of Delta M&I deliveries as compared to No Action Alternative, would increase by about 4%.

Under Alternative 5A, average annual CVP south of Delta M&I deliveries as compared to Existing Conditions would decrease by up to 1% at ELT and by up to 7% at LLT. However, this decrease primarily would occur due to sea level rise and climate change, and increased north of Delta demands.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual CVP south of Delta M&I deliveries would remain similar or increase under Alternative 5A as compared to the deliveries under the No Action Alternative. Therefore, average annual CVP south of Delta M&I deliveries would increase under Alternative 5A as compared to the conditions without the project.

Total SWP Deliveries

Under Alternative 5A, average annual total SWP deliveries as compared to No Action Alternative, would increase (by about 15%). Under Alternative 5A, average annual total south of Delta SWP deliveries as compared to No Action Alternative, would increase (by about 21%).

Under Alternative 5A, average annual total SWP deliveries as compared to Existing Conditions, would increase (8%) at ELT and increase (3%) at LLT. Under Alternative 5A, average annual total south of Delta SWP deliveries as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that under Alternative 5A average annual total SWP deliveries would increase. Therefore, average annual total SWP deliveries and average annual total SWP south of Delta deliveries under Alternative 5A would show an increase as compared to the conditions without the project.

SWP Table A Deliveries

Under Alternative 5A, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative (ELT), would increase (by about 16%). Under Alternative 5A, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to No Action Alternative (ELT), would increase (by about 16%).

Under Alternative 5A, average annual total SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT. Under Alternative 5A, average annual total south of Delta SWP Table A deliveries with Article 56 (without Article 21) as compared to Existing Conditions, would increase (10%) at ELT and would increase (4%) at LLT. However, the decrease in deliveries primarily would occur due to sea level rise and climate change.

Deliveries under the No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that under Alternative 5A average annual total SWP Table A deliveries with Article 56 (without Article 21) would increase.

SWP Article 21 Deliveries

Under Alternative 5A, average annual total SWP Article 21 deliveries as compared to No Action Alternative, would increase by about 231%.

Under Alternative 5A, average annual total SWP Article 21 deliveries as compared to Existing Conditions, would increase by up to 10% at ELT and by up to 1% at LLT. However, this decrease primarily would occur due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual Article 21 deliveries would increase under Alternative 5A as compared to the deliveries under the No Action Alternative. Therefore, average annual Article 21 deliveries would increase under Alternative 5A as compared to the conditions without the project.

SWP Feather River Service Area

Under Alternative 5A, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to No Action Alternative would increase or remain similar.

Under Alternative 5A, average annual total SWP Feather River Service Area deliveries during dry and critical years as compared to Existing Conditions, would decrease by up to 4% at ELT and by up to 5% at LLT. The primary cause of this reduction would be change in SWP operations due to sea level rise and climate change.

Deliveries compared to No Action Alternative are an indication of the potential change due to Alternative 5A in the absence of the effects of increased north of delta demands and sea level rise and climate change and the results show that average annual SWP Feather River Service Area deliveries would increase or remain similar under Alternative 5A as compared to the deliveries under No Action Alternative. Therefore, average annual SWP Feather River Service Area deliveries would remain similar under Alternative 5A as compared to the conditions without the project.

NEPA Effects: SWP and CVP deliveries under Alternative 5A as compared to deliveries under No Action Alternative would increase or remain similar. Indirect effects of changes in water deliveries in addition to potential effects on urban areas caused by changes in SWP and CVP water supply deliveries under Alternative 5A, are addressed in Section 4.5.26, *Growth Inducement and Other Indirect Effects,* and other sections addressing specific resources.

CEQA Conclusion: SWP and CVP deliveries under Alternative 5A would decline as compared to deliveries under Existing Conditions. The primary cause of the reduction is increased north of Delta water demands that would occur under No Action Alternative and Alternative 5A and changes in SWP and CVP operations due to sea level rise and climate change. As shown above in the NEPA analysis, SWP and CVP deliveries would generally increase or remain similar under Alternative 5A as compared to deliveries under conditions in 2025 and 2060 without Alternative 5A if sea level rise and climate change conditions are considered the same under both scenarios (Alternative 5A and No Action Alternative). SWP and CVP deliveries under Alternative 5A would generally increase or remain similar as compared to deliveries under Existing Conditions without the effects of increased north of Delta water demands, sea level rise, and climate change. Some reductions in the SWP south of Delta deliveries could occur under Alternative 5A with higher spring outflow requirements. Indirect effects of changes in water deliveries including potential effects on urban areas caused by changes in SWP and CVP water supply deliveries are addressed in Section 4.5.26, *Growth Inducement and Other Indirect Effects,* and other sections addressing specific resources in this RDEIR/SDEIS.

Impact WS-3: Effects of Water Transfers on Water Supply

Alternative 5A increases project water supply allocations as compared to the No Action Alternative, and consequently will decrease cross-Delta water transfer demand compared to the No Action Alternative. Alternative 5A would change the combined SWP Table A and CVP south-of-Delta agricultural water supply allocations as compared to Existing Conditions, and the frequency of years in which cross-Delta transfers are assumed to be triggered would change as well, assuming an estimated cross-Delta transfer supply of 600,000 acre-feet in any one year.

Under Alternative 5A as compared to Existing Conditions, the frequency of years in which cross-Delta transfers would increase, and the average annual volume of those transfers would increase. Under Alternative 5A as compared to the No Action Alternative, the frequency of years in which cross-Delta transfers would occur would decrease.

Alternative 5A provides a separate cross-Delta facility with additional capacity to move transfer water from areas upstream of the Delta to export service areas and provides a longer transfer window than allowed under current regulatory constraints. In addition, the facility provides conveyance that would not be restricted by Delta reverse flow concerns or south Delta water level concerns. As a result of avoiding those restrictions, transfer water could be moved at any time of the year that capacity exists in the combined cross-Delta channels, the new cross-Delta facility, and the export pumps, depending on operational and regulatory constraints, including criteria guiding the operation of water conveyance facilities under Alternative 5A.

NEPA Effects: Alternative 5A would decrease water transfer demand compared to existing conditions. Alternative 5A would decrease conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to No Action Alternative. Prior to approval, each transfer must go through NEPA review and be evaluated by the export facility agency, and may also be subject to CEQA review and/or SWRCB process. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, and other sections addressing specific resources.

CEQA Conclusion: Alternative 5A would increase water transfer demand compared to existing conditions. Alternative 5A would increase conveyance capacity, enabling additional cross-Delta water transfers that could lead to increases in Delta exports when compared to existing conditions. Prior to approval, each transfer must go through the CEQA and/or SWRCB process and be evaluated by the export facility agency, and may also be subject to NEPA review. Indirect effects of changes in Delta exports or water deliveries are addressed in Section 4.3.26, *Growth Inducement and Other Indirect Effects*, and other sections addressing specific resources.

4.5.2 Surface Water

Facilities construction under Alternative 5A would be similar to those described under Alternative 4, except Alternative 5A includes only one intake. Alternative 5A water conveyance operations would be similar to the operations that would occur under Alternative 5.

Model simulation results for Alternative 5A Early Long-term (ELT), which are represented by the Alternative 5 (ELT), are summarized in Tables B.2-7 through B.2-12 in Appendix B of the RDEIR/SDEIS. Model simulation results for Alternative 5A at Late Long-term (LLT) which are similar to Alternative 5 (LLT), are summarized in Tables 6-2 through 6-9 in the Draft EIR/EIS.

Section 6.3.2, *Determination of Effects*, of the Draft EIR/EIS describes criteria used for the NEPA adverse effect and CEQA significant impact determinations.

SWP CVP Reservoir Storage and Related Changes to Flood Potential

Impact SW-1: Changes in SWP or CVP Reservoir Flood Storage Capacity

Reservoir storage in Shasta Lake, Folsom Lake, and Lake Oroville during the October through June period is compared to the flood storage capacity of each reservoir to identify the number of months where the reservoir storage is close to the flood storage capacity.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-12 in Appendix B of this RDEIR/SDEIS.

Changes in the number of months where the reservoir storage is close to the flood storage capacity under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Tables 6-2 through 6-7 of Draft EIR/EIS.

NEPA Effects: Under Alternative 5A, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be similar (or show no more than 10% increase) under the No Action Alternative.

A comparison with storage conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that reservoir storages would not be consistently high during October through June under Alternative 5A as compared to the conditions under the No Action Alternative. Therefore, Alternative 5A would not result in adverse effects on reservoir flood storage capacity as compared to the conditions without the project.

CEQA Conclusion: Under Alternative 5A, the number of months where the reservoir storage is close to the flood storage capacity in Shasta Lake, Folsom Lake, and Lake Oroville would be less than under Existing Conditions. These differences represent changes under Alternative 5A, increased demands from Existing Conditions to No Action Alternative, and changes due to sea level rise and climate change. Alternative 5A would not cause consistently higher storages in the upper Sacramento River watershed during the October through June period. Accordingly, Alternative 5A would result in a less-than-significant impact on flood management. No mitigation is required.

Highest Monthly Flows in Sacramento and San Joaquin Rivers and Related Changes to Flood Potential

Impact SW-2: Changes in Sacramento and San Joaquin River Flood Flows

Changes in highest monthly flows under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-9 in Appendix B and Figures 4.4.2-1 through 4.4.2-15 in this RDEIR/SDEIS.

Changes in highest monthly flows under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figures 6-8 through 6-22 and Tables 6-2 through 6-4 of Draft EIR/EIS.

Sacramento River at Bend Bridge

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would increase by about 2% of the channel capacity (100,000 cfs) as compared to the flows under Existing Conditions. The increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Sacramento River at Bend Bridge as compared to the conditions without the project.

Sacramento River at Freeport

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would decrease by about 1% of the channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Sacramento River at Freeport as compared to the conditions without the project.

San Joaquin River at Vernalis

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar to (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar (or show less than 1% change with respect to the channel capacity: 52,000 cfs) as compared to the flows under Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the San Joaquin River at Vernalis as compared to the conditions without the project.

Sacramento River at Location Upstream of Walnut Grove (downstream of north Delta intakes)

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would decrease by about 4% of channel capacity (110,000 cfs) as compared to the flows under the No Action Alternative. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 5A.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would decrease by about 3% of channel capacity (110,000 cfs) as compared to the flows under Existing Conditions. This decrease primarily would occur due to the diversion of Sacramento River flow at the north Delta intakes under Alternative 5A.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Sacramento River upstream of Walnut Grove as compared to the conditions without the project.

Trinity River Downstream of Lewiston Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would increase by about 4% of channel capacity (6,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Trinity River downstream of Lewiston Lake as compared to the conditions without the project.

American River Downstream of Nimbus Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar to (or show less than 1% change with respect to the channel capacity: 152,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would increase by no more than approximately 1% of the channel capacity (152,000 cfs) as compared to the flows under Existing Conditions. This increase primarily would occur due to sea level rise, climate change, and increased north of Delta demands.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the American River at Nimbus Dam as compared to the conditions without the project.

Feather River Downstream of Thermalito Dam

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar as compared to the flows under the No Action Alternative depending on the range of spring Delta outflow requirements.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would remain similar as compared to the flows under Existing Conditions. A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Feather River at Thermalito Dam as compared to the conditions without the project.

Yolo Bypass at Fremont Weir

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A would increase no more than approximately 1% of the channel capacity (343,000 cfs) as compared to the flows under the No Action Alternative.

Average of highest flows simulated (flows with probability of exceedance of 10% or less) under Alternative 5A at ELT would increase no more than 1% of the channel capacity (343,000 cfs) and at LLT would increase no more than 2% of the channel capacity (343,000 cfs) as compared to the flows under the Existing Conditions.

A comparison with flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change and the results show that there would not be a consistent increase in high flow conditions under Alternative 5A as compared to the No Action Alternative. Therefore, Alternative 5A would not result in adverse impacts on flow conditions in the Yolo Bypass at Fremont Weir as compared to the conditions without the project.

NEPA Effects: Overall, Alternative 5A would not result in an increase in potential risk for flood management compared to the No Action Alternative. Highest monthly flows under Alternative 5A in the locations considered in this analysis either were similar to or less than the highest monthly flows that would occur under the No Action Alternative; or the increase in the highest monthly flows would be less than the flood capacity for the channels at these locations.

Therefore, Alternative 5A would not result in adverse effects on flood management.

***CEQA Conclusion*:** Alternative 5A would not result in an increase in potential risk for flood management compared to Existing Conditions when the changes due to sea level rise and climate change are eliminated from the analysis. Highest monthly flows under Alternative 5A in the locations considered in this analysis either were similar to or less than those that would occur under Existing Conditions without the changes in sea level rise and climate change; or the increased highest monthly flows would not exceed the flood capacity of the channels at these locations. Accordingly, Alternative 5A would result in a less-than-significant impact on flood management. No mitigation is required.

Reverse Flows in Old and Middle River

Impact SW-3: Change in Reverse Flow Conditions in Old and Middle Rivers

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 5A (ELT) as compared to the No Action Alternative (ELT) and Existing Conditions are shown in Tables B.2-7 through B.2-9 in Appendix B and Figure 4.3.2-16 in this RDEIR/SDEIS.

Changes in average monthly reverse flow conditions for Old and Middle River flows under Alternative 5A (LLT) [similar to Alternative 5 (LLT)] as compared to the No Action Alternative (LLT) and Existing Conditions are shown in Figure 6-23 and Tables 6-2 through 6-4 of Draft EIR/EIS.

Reverse flow conditions for Old and Middle River flows would be reduced in all months under Alternative 5A on a long-term average basis except in April, compared to reverse flows under both Existing Conditions and the No Action Alternative. Compared to flows under the No Action Alternative, Old and Middle River flows would be generally less positive in April.

NEPA Effects: A comparison with reverse flow conditions under the No Action Alternative provides an indication of the potential change due to Alternative 5A without the effects of sea level rise and climate change. The results show that reverse flow conditions under Alternative 5A would be reduced in all months on a long-term average basis except in April as compared to No Action Alternative. In April the reverse flow conditions would be generally greater than 1% under Alternative 5A as compared to No Action Alternative. The effects to beneficial use of the surface water for water supplies and aquatic resources, is described in this RDEIR/SDEIS in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*.

***CEQA Conclusion*:** Alternative 5A would provide positive changes related to reducing reverse flows in Old and Middle Rivers in May through March and negative changes in the form of increased reverse flow conditions in April, compared to Existing Conditions. The increase (more negative) in reverse flow conditions is generally greater than 1% as compared to Existing Conditions. The significance of the impact to beneficial use of the surface water for water supplies and aquatic resources, and appropriate Mitigation Measures for those impacts to beneficial uses is described in this RDEIR/SDEIS in Section 4.3.4, *Water Quality* and Section 4.3.7, *Fish and Aquatic Resources*.

Impact SW-4: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Conveyance Facilities

NEPA Effects: Effects associated with construction and operations of facilities under Alternative 5A would be similar to those described under Alternative 1A with the exception of four fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 5A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. However, the measures included in Alternative 1A to avoid adverse effects would be included in Alternative 5A.

Alternative 5A would involve excavation, grading, stockpiling, soil compaction, and dewatering that would result in temporary and long-term changes to drainage patterns, drainage paths, and facilities that would in turn, cause changes in drainage flow rates, directions, and velocities. Construction of cofferdams could impede river flows at the intake locations, but would not increase water surface elevations upstream by more than 0.10 feet during flood events. Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. Mitigation Measure SW-4 is available to address effects of runoff and sedimentation.

***CEQA Conclusion*:** Alternative 5A could result in alterations to drainage patterns, stream courses, and runoff; and potential for slightly increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. Although intakes have been designed and located on-bank to minimize changes to river flow characteristics, some localized water elevation changes would occur upstream and adjacent to each cofferdam at the intake sites due to facility location within the river. These localized surface elevation changes would not exceed an increase of 0.10 feet at any intake location even under flood flow conditions. Potential impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, and from changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

Impact SW-5: Substantially Alter the Existing Drainage Pattern or Substantially Increase the Rate or Amount of Surface Runoff in a Manner That Would Result in Flooding during Construction of Habitat Restoration Area Facilities under Environmental Commitments 3, 4, 6-11

NEPA Effects: Alternative 5A would include construction of the restoration area facilities under Environmental Commitments 3, 4, and 6-11.

Riparian habitat restoration is anticipated to occur primarily in association with the restoration of tidal marsh habitat, and channel margin habitat. The restored vegetation has the potential of increasing channel roughness, which could result in increases in channel water surface elevations, including under flood flow conditions, and in decreased velocities. Modified channel geometries could increase or decrease channel velocities and/or channel water surface elevations, including under flood flow conditions. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. The specific permits/decisions/approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations.

***CEQA Conclusion*:** Alternative 5A would include construction of the restoration area facilities under Environmental Commitments 3, 4, and 6–11. Alternative 5A could result in alterations to drainage patterns, stream courses, and runoff; and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway. These impacts are considered significant. Under existing regulations, the USACE, CVFPB, and DWR would require the habitat restoration projects to be flood neutral. Measures to reduce flood potential could include channel dredging to increase channel capacities and decrease channel velocities and/or water surface elevations. The specific permits/decisions/approvals required are included in Table 1-1 of this RDEIR/SDEIS, and in Table 1-2 of the Draft EIR/EIS. Mitigation Measure SW-4 would reduce this impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

Impact SW-6: Create or Contribute Runoff Water Which Would Exceed the Capacity of Existing or Planned Stormwater Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff

Effects associated with construction and operations of facilities under Alternative 5A would be similar to those described under Alternative 1A with the exception of four fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 5A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A because there would be fewer construction sites under this alternative.

NEPA Effects: Paving, soil compaction, and other activities would increase runoff during facilities construction and operations. Construction and operation of dewatering facilities and associated discharge of water would result in localized increases in flows and water surface elevations in receiving channels. These activities could result in adverse effects if the runoff volume exceeds the capacities of local drainages. As noted below in the CEQA Conclusion section, compliance with permit design requirements would avoid adverse effects on surface water quality and flows from dewatering activities. The use of dispersion facilities would reduce the potential for channel erosion. Mitigation Measure SW-4 is available to address adverse effects.

***CEQA Conclusion*:** Alternative 5A actions would include installation of dewatering facilities in accordance with permits issued by the Regional Water Quality Control Board and CVFPB (See Section 6.2.2.4 in the Draft EIR/EIS). Alternative 5A would include provisions to design the dewatering system in accordance with these permits to avoid significant impacts on surface water quality and flows. However, increased runoff could occur from facilities sites during construction or operations and could result in significant impacts if the runoff volume exceeds the capacities of local drainages. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

Impact SW-7: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to the Construction of New Conveyance Facilities

NEPA Effects: Effects associated with construction of conveyance facilities under Alternative 5A would be identical to those described under Alternative 1A with the exception of four fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 5A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A.

Alternative 5A would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with USACE, CVFPB, and DWR requirements to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 in the Draft EIR/EIS. Additionally, DWR would consult with local reclamation districts to ensure that construction activities would not conflict with reclamation district flood protection measures. Determination of design flood elevations would need to consider sea level rise to reduce impacts.

***CEQA Conclusion*:** Alternative 5A would not result in an increase to exposure of people or structures to flooding due to construction of the conveyance facilities because the project proponents would be required to comply with the requirements of USACE, CVFPB, and DWR to avoid increased flood potential and levee failure due to construction and operation of the facilities as described in Section 6.2.2.4 in the Draft EIR/EIS. If the design flood elevations did not consider sea level rise to reduce impacts, these impacts are considered significant. Mitigation Measure SW-7 would reduce this impact to a less-than-significant level.

Mitigation Measure SW-7: Implement Measures to Reduce Flood Damage

Please see Mitigation Measure SW-7 under Impact SW-7 in the discussion of Alternative 1A.

Impact SW-8: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding Due to Habitat Restoration under Environmental Commitments 3, 4, 6-11

Tidal marsh habitat, and channel margin habitat could increase flood potential due to impacts on adjacent levees. The newly flooded areas would have larger wind fetch lengths (unobstructed distance which wind can travel over water and potentially develop large waves caused by wind force not tidal force) compared to the existing fetch lengths of the adjacent leveed channels. An increase in fetch length would result in increases in wave height and velocities that reach the existing levees along adjacent islands and floodplains. These potential increases in wave action could also reach the land-side of the remaining existing levees around the restoration area. In accordance with existing requirements of the USACE, CVFPB, and DWR, Alternative 5A would be designed to avoid increased flood potential as compared to Existing Conditions or No Action Alternative.

NEPA Effects: Alternative 5A would not result in an increase to exposure of people or structures to flooding due to the operation of the Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. This impact could become more substantial with sea level rise and climate change.

***CEQA Conclusion*:** Alternative 5A would not result in an increase to exposure of people or structures to flooding due to the operations of Environmental Commitments because the facilities would be required to comply with the requirements of the USACE, CVFPB, and DWR to avoid increased flood potential. However, increased wind fetch near open water areas of habitat restoration could cause potential damage to adjacent levees. These impacts are considered significant. Mitigation Measure SW-8 would reduce this potential impact to a level of less than significant.

Mitigation Measure SW-8: Implement Measures to Address Potential Wind Fetch Issues

Please see Mitigation Measure SW-8 under Impact SW-8 in the discussion of Alternative 1A.

Impact SW-9: Place within a 100-Year Flood Hazard Area Structures Which Would Impede or Redirect Flood Flows, or Be Subject to Inundation by Mudflow

Effects associated with construction and operations of facilities under Alternative 5A would be identical those described under Alternative 1A with the exception of four fewer intakes, elimination of the pumps at the intake locations, and reduction of the intermediate forebay acreage. Additional pumps would be constructed near Clifton Court Forebay under Alternative 5A as compared to Alternative 1A. Because similar construction methods and similar features would be used as under Alternative 1A, the types of effects would be similar. However, the potential for effects would be less than described under Alternative 1A. The measures included in Alternative 1A to avoid adverse effects would be included in Alternative 5A. As described under Impact SW-1, Alternative 5A would not increase flood potential on the Sacramento River, San Joaquin River, Trinity River, American River, or Feather River, or Yolo Bypass as described under Impact SW-2. Alternative 5A would include measures including Mitigation Measure SW-4 to address potential issues associated with alterations to drainage patterns, stream courses, and runoff and potential for increased surface water elevations in the rivers and streams during construction and operations of facilities.

NEPA Effects: Potential adverse effects could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages; and changes in sediment accumulation near the intakes. These effects are considered adverse. Mitigation Measure SW-4 is available to address these potential effects.

***CEQA Conclusion*:** Alternative 5A would not result in an impedance or redirection of flood flows or conditions that would cause inundation by mudflow due to construction or operations of the conveyance facilities or construction of the habitat restoration facilities because the project proponents would be required to comply with the requirements of USACE, CVFPB, and DWR to avoid increased flood potential as described in Section 6.2.2.4 in the Draft EIR/EIS. Potential adverse impacts could occur due to increased stormwater runoff from paved areas that could increase flows in local drainages, as well as changes in sediment accumulation near the intakes. These impacts are considered significant. Mitigation Measure SW-4 would reduce this potential impact to a less-than-significant level by implementing a number of measures which would prevent an increase in runoff volume and rate from land-side construction areas; and which would prevent an increase in sedimentation in the runoff from the construction areas.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please see Mitigation Measure SW-4 under Impact SW-4 in the discussion of Alternative 1A.

4.5.3 Groundwater

4.5.3.1 Delta Region

Alternative 5A would include the same physical/structural components as Alternative 4 but would include two fewer intakes. Facilities construction under Alternative 5A would be similar to those described for Alternative 4, but with a smaller footprint due to two fewer intakes.

Impact GW-1: During Construction, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

Construction activities under Alternative 5A would be similar to those under Alternative 4. The impacts on groundwater levels resulting from dewatering activities are dependent on the local hydrogeology and the depth and duration of dewatering required. Because all of the pump stations associated with the intakes are located in areas of similar geology and hydrogeology, and the dewatering configurations are identical for each of the facilities, it would be expected that the impacts of construction activities on local groundwater levels and associated well yields would be similar. The only difference would be associated with the number of intakes used. This alternative would use one intake instead of three intakes used in Alternative 4. Dewatering activities would result in decreased groundwater level impacts and fewer wells being affected.

NEPA Effects: Similarly to the impacts described under Alternative 4, the sustainable yield of some wells might temporarily be affected by the lower water levels resulting from construction dewatering under Alternative 5A, such that they are not able to support existing land uses. The construction of conveyance features would result in effects on groundwater levels and associated well yields that would be temporary. It should be noted that these estimated impacts reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis.

CEQA Conclusion: Similarly to the impacts described under Alternative 4, wells in the vicinity of the construction dewatering areas under Alternative 5A could experience significant reductions in yield, if they are shallow wells and may not be able to support existing land uses. The temporary impact on groundwater levels and associated well yields is considered significant because construction-related dewatering might affect the amount of water supplied by shallow wells located near the construction sites. Mitigation Measure GW-1 identifies a monitoring procedure and options for maintaining an adequate water supply for land owners that experience a reduction in groundwater production from wells within the impacted areas due to construction-related dewatering activities. It should be noted that these estimated impacts reflect a worst-case scenario as the option of installing seepage cutoff walls during dewatering was not considered in the analysis. Implementing Mitigation Measure GW-1 would help address these effects; however, the impact may remain significant because replacement water supplies may not meet the preexisting demands or planned land use demands of the affected party. In some cases this impact might temporarily be significant and unavoidable until groundwater elevations recover to pre-construction conditions which could require several months after dewatering operations cease.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A.

Impact GW-2: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Local Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

See Impact GW-2 under Alternative 4; operations under Alternative 5A would be similar to those under Alternative 4.

NEPA Effects: The new Intermediate Forebay and the expanded Clifton Court Forebay would be constructed to comply with the requirements of the DSD which include design features intended to minimize seepage under the embankments. In addition, the forebays will include a seepage cutoff wall installed to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 5A would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 4.

Operation of the tunnel would have no impact on existing wells or yields given the facilities would be located more than 100 feet underground and would not substantially alter groundwater levels in the vicinity.

CEQA Conclusion: The new Intermediate Forebay and the expanded Clifton Court Forebay will include design features intended to minimize seepage under the embankments and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. Any potential vertical seepage under the smaller Intermediate Forebay would also be captured by the toe drain. However, operation of Alternative 5A would result in groundwater level increases in the vicinity of the expanded Clifton Court Forebay portion at Byron Tract due to groundwater recharge, similar to Alternative 4, which would not reduce the yields of nearby wells.

Operation of the tunnel would have no impact on existing wells or yields given these facilities would be located over 100 feet underground and would not substantially alter groundwater levels in the vicinity.

Therefore, this impact would be less than significant. No mitigation is required.

Impact GW-3: Degrade Groundwater Quality during Construction and Operation of Conveyance Facilities

See Impact GW-3 under Alternative 4; the construction and operations activities under Alternative 5A would be similar to those under Alternative 4, with a lesser magnitude, because one intake would be constructed (instead of three).

NEPA Effects: Dewatering would temporarily lower groundwater levels and cause small changes in groundwater flow patterns near the intake pump stations along the Sacramento River, Intermediate Forebay, and Clifton Court Forebay. Since no significant regional changes in groundwater flow directions are anticipated, and the inducement of poor-quality groundwater into areas of better quality is unlikely, it is anticipated that there would be no change in groundwater quality for

Alternative 5A. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality. There would be no adverse effect.

CEQA Conclusion: No significant groundwater quality impacts are anticipated during construction activities. Because of the temporary and localized nature of construction dewatering, the potential for the inducement of the migration of poor-quality groundwater into areas of higher quality groundwater will be low. Further, the planned treatment of extracted groundwater prior to discharge into adjacent surface waters would prevent significant impacts on groundwater quality.

No significant groundwater quality impacts are anticipated in most areas of the Delta during the implementation of Alternative 5A, because changes to regional patterns of groundwater flow are not anticipated. However, degradation of groundwater quality near the Suisun Marsh area are likely, due to the effects of saline water intrusion caused by slightly rising sea levels. Effects due to climate change are provided for informational purposes only and do not lead to mitigation. This impact would be less than significant. No mitigation is required.

Impact GW-4: During Construction of Conveyance Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-4 under Alternative 4; construction activities under Alternative 5A would be similar to those under Alternative 4, with a lesser magnitude, because one intake would be constructed (instead of three).

NEPA Effects: In the absence of seepage cutoff walls intended to minimize local changes to groundwater flow, the lowering of groundwater levels due to construction dewatering would temporarily affect localized shallow groundwater flow patterns during and immediately after the construction dewatering period. For the Byron Tract Forebay site, only a portion of the shallow groundwater flow will be directed inward toward the dewatering operations. Forecasted temporary changes in shallow groundwater flow directions and areas of impacts are minor near the intakes. Therefore, agricultural drainage during construction of conveyance features is not forecasted to result in adverse effects under Alternative 5A. In some instances, the lowering of groundwater levels in areas that experience near-surface water level conditions (or near-saturated root zones) would be beneficial. There would be no adverse effect.

CEQA Conclusion: The forecasted changes in shallow groundwater flow patterns due to construction dewatering activities in the Delta are localized and temporary and are not anticipated to cause significant impacts on agricultural drainage. This impact would be less than significant. No mitigation is required.

Impact GW-5: During Operations of New Facilities, Interfere with Agricultural Drainage in the Delta

See Impact GW-5 under Alternative 4; operations under Alternative 5A would be similar to those under Alternative 4.

NEPA Effects: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 5A would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, where groundwater recharge from surface water would result in groundwater level increases, similar to Alternative 4. If existing agricultural drainage systems adjacent to the forebay are not adequate to accommodate the additional drainage requirements, operation of the forebay could interfere with agricultural drainage in the Delta.

CEQA Conclusion: The Intermediate Forebay and the expanded Clifton Court Forebay will include a seepage cutoff wall to the impervious layer and a toe drain around the forebay embankment, to capture water and pump it back into the forebay. These design measures will greatly reduce any potential for seepage onto adjacent lands and avoid interference with agricultural drainage in the vicinity of the Intermediate Forebay. Once constructed, the operation of the forebay would be monitored to ensure seepage does not exceed performance requirements.

However, operation of Alternative 5A would result in local changes in shallow groundwater flow patterns adjacent to the expanded Clifton Court Forebay portion at Byron Tract, caused by groundwater recharge from surface water, and could cause significant impacts to agricultural drainage where existing systems are not adequate to accommodate the additional drainage requirements, similar to Alternative 4. Implementation of Mitigation Measure GW-5 is anticipated to reduce this impact to a less-than-significant level in most instances, though in some instances mitigation may be infeasible due to factors such as costs that would be imprudent to bear in light of the fair market value of the affected land. The impact is therefore significant and unavoidable as applied to such latter properties.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-6: Deplete Groundwater Supplies or Interfere with Groundwater Recharge Alter Local Groundwater Levels Reduce the Production Capacity of Preexisting Nearby Wells, or Interfere with Agricultural Drainage as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Implementation of the environmental commitments under Alternative 5A could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*). Effects associated with the implementation of those environmental commitments be considered adverse. The implementation of Mitigation Measure GW-5 would help address these effects by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed.

CEQA Conclusion: Implementation of the environmental commitments under Alternative 5A could result in additional increased frequency of inundation of areas associated with the proposed tidal habitat, channel margin habitat, and seasonally inundated floodplain restoration actions, which would result in increased groundwater recharge. Such increased recharge could result in groundwater level rises in some areas. More frequent inundation would also increase seepage, which is already difficult and expensive to control in most agricultural lands in the Delta (see Chapter 14, *Agricultural Resources*). Impacts associated with the implementation of those environmental commitments would result in significant impacts. This impact would be reduced to a less-than-significant level in most instances, with the implementation of Mitigation Measure GW-5 by identifying areas where seepage conditions have worsened and installing additional subsurface drainage measures, as needed. However, in some instances mitigation may be infeasible due to factors such as costs. The impact is therefore considered significant and unavoidable as applied to such latter properties.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A.

Impact GW-7: Degrade Groundwater Quality as a Result of Implementing Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 5A would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in an adverse effect on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 is available to address this effect.

CEQA Conclusion: The increased inundation frequency in restoration areas from the environmental commitments under Alternative 5A would increase the localized areas exposed to saline and brackish surface water, which would result in increased groundwater salinity beneath such areas. The flooding of large areas with saline or brackish water would result in significant impacts on groundwater quality beneath or adjacent to flooded areas. It would not be possible to completely avoid this effect. However, if water supply wells in the vicinity of these areas are not useable because of water quality issues, Mitigation Measure GW-7 would help reduce this impact, but the impact would remain significant and unavoidable.

Mitigation Measure GW-7: Provide an Alternate Source of Water

Please see Mitigation Measure GW-7 under Impact GW-7 in the discussion of Alternative 1A.

4.5.3.2 SWP/CVP Export Service Areas

Impact GW-8: During Operations, Deplete Groundwater Supplies or Interfere with Groundwater Recharge, Alter Groundwater Levels or Reduce the Production Capacity of Preexisting Nearby Wells

The groundwater resource impacts of Alternative 5A will be similar to those under Alternative 5, but with the magnitude of the impacts proportional to the change in the quantity of CVP and SWP surface water supplies delivered to the SWP/CVP Export Service Areas compared to the No Action Alternative at ELT.

Table 4.3.3-3 below shows the long-term average SWP and CVP deliveries for Alternative 5A compared to existing conditions and the No Action Alternative at early long-term. See Table 7-7 in Chapter 7, *Groundwater*, of the Draft EIR/EIS for long-term average SWP and CVP surface water deliveries at LLT.

Table 4.3.3-3. Long-Term State Water Project and Central Valley Project Deliveries to Hydrologic Regions Located South of the Delta at Early Long-Term

	Long-Term Average State Water Project and Central Valley Project Deliveries at Early Long Term(TAF/year)		
Alternative	San Joaquin and Tulare Hydrologic Region	Central Coast Hydrologic Region	Southern California Hydrologic Region
Existing Conditions	2,964	47	1,647
No Action Alternative (ELT)	2,682	43	1,580
Alternative 5A ELT	2,924	48	1,746

NEPA Effects: In the San Joaquin and Tulare Hydrologic Region, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 5A at ELT are expected to be higher than the exports under the No Action Alternative at early long-term. Increases in surface water deliveries attributable to project operations from the implementation of Alternative 5A are anticipated to result in a corresponding decrease in groundwater use in the San Joaquin and Tulare Export Service Areas as compared to the No Action Alternative (ELT), as discussed in Section 4.2.4, *Water Supply*, of this RDEIR/DSEIS. Higher groundwater levels associated with reduced overall groundwater use would result in a beneficial effect on groundwater levels. Similarly, total long-term average annual water deliveries to the CVP and SWP Service Areas under Alternative 5A at LLT are expected to be higher than the exports under the No Action Alternative at late long-term.

The total long-term average annual SWP deliveries to Southern California areas under Alternative 5A would be greater than those under the No Action Alternative (ELT) as well as at LLT. Therefore, implementation of Alternative 5A would result in a corresponding decrease in groundwater use. There would be no adverse effects on groundwater levels because of the anticipated decreases in groundwater pumping due to an increase in surface water deliveries.

CEQA Conclusion*:* For the San Joaquin and Tulare Service Areas, total long-term average surface water deliveries under Alternative 5A at ELT would be slightly lower compared to Existing Conditions, largely because of effects due to climate change, sea level rise, and increased water demand north of the Delta. Groundwater pumping under Alternative 5A at ELT is anticipated to be greater than under Existing Conditions, and that groundwater levels in some areas would be lower than under Existing Conditions. Total long-term average surface water deliveries under Alternative 5A at LLT in the San Joaquin Valley and Tulare Basin would be lower compared to Existing Conditions, largely because of effects due to climate change, sea level rise, and increased water demand north of the Delta.

As shown above in the NEPA analysis, SWP and CVP deliveries would increase under Alternative 5A as compared to deliveries under conditions in 2025 without Alternative 5A if sea level rise and climate change conditions are considered the same. For reasons discussed in Section 7.3.1, *Methods for Analysis*, in the Draft EIR/EIS, DWR has identified effects of action alternatives under CEQA separately from the effects of increased water demands, sea level rise, and climate change, which would occur without and independent of the Alternative 5A. Absent these factors, the impacts of Alternative 5A with respect to groundwater levels are anticipated to be less than significant because groundwater pumping is not anticipated to increase due to Alternative 5A.

The total long-term average annual SWP deliveries to Southern California areas under Alternative 5A would be greater than those under Existing Conditions. Therefore, implementation of Alternative 5A would result in a corresponding decrease in groundwater use. Impacts on groundwater levels would be less than significant because of the anticipated decreases in groundwater pumping due to an increase in surface water deliveries.

Impact GW-9: Degrade Groundwater Quality

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 5A are expected to increase as compared to the No Action Alternative (ELT) and at LLT. Increased surface water deliveries could result in a decrease in groundwater use. The decreased groundwater use is not anticipated to alter regional patterns of groundwater flow in these service areas. Therefore, it is not anticipated this would result in an adverse effect on groundwater quality in these areas because similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater as might occur with increased pumping.

Similarly, long-term average annual SWP supplies to Southern California are anticipated to increase under Alternative 5A compared to the No Action Alternative at ELT and LLT, and therefore, groundwater pumping is anticipated to decrease, which would not alter regional groundwater flow patterns. As a result, adverse effects on groundwater quality are not anticipated in this region because similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 5A with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin and in Southern California. Therefore, no significant groundwater quality impacts are anticipated in these areas during the implementation of Alternative 5A because it is not anticipated to alter regional groundwater flow patterns. Therefore, this impact is considered less than significant because groundwater levels and flow patterns would not change compared to Existing Conditions, and similar groundwater flow patterns would not cause poor quality groundwater migration into areas of better quality groundwater.

Impact GW-10: Result in Groundwater Level–Induced Land Subsidence

Groundwater level-induced land subsidence has the highest potential to occur in the San Joaquin and Tulare Export Service Areas, based on historical data, if groundwater pumping substantially increases due to the Alternatives.

NEPA Effects: As discussed under Impact GW-8, surface water deliveries to the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin under Alternative 5A are expected to increase as compared to the No Action Alternative (ELT) as well as at LLT. Increased surface water deliveries could result in a decrease in groundwater pumping. The decreased groundwater pumping would result in higher groundwater levels, and therefore, the potential for groundwater level-induced land subsidence is reduced under Alternative 5A. Operations under Alternative 5A would not result in an adverse effect on the potential for groundwater level-induced land subsidence in these areas because groundwater levels would not decline such that compaction of unconsolidated materials in the unconfined aquifer would occur.

CEQA Conclusion: As discussed under Impact GW-8 above, the impacts of Alternative 5A with respect to groundwater levels are considered to be less than significant in the CVP and SWP Export Service Areas in the San Joaquin Valley and Tulare Basin. Therefore, the potential for groundwater level-induced land subsidence is anticipated to be less than significant in these areas during the implementation of Alternative 5A because it is not anticipated to result in a decline in groundwater levels such that compaction of unconsolidated materials in the unconfined aquifer would occur.

4.5.4 Water Quality

The water quality changes described for Alternative 5A reflect assumed water conveyance facilities operations. The water quality changes described for Alternative 5A are also affected by assumptions regarding the extent of habitat restoration to be implemented. As described in Section 4.1.4, *Description of Alternative 5A*, of this RDEIR/SDEIS, Alternative 5A does not include the full suite of conservation actions included in Alternative 4. Aside from the water conveyance facilities, the most important differences from a water quality perspective are:

- CM2 – Yolo Bypass Improvements: this is included in Alternative 4, but not included in Alternative 5A; and
- CM4 – Tidal Natural Communities Restoration: includes 65,000 acres in Alternative 4, but would be significantly less under Alternative 5A.

This results in somewhat different patterns of water withdrawals from the Delta, and potentially somewhat different effects on water quality and aquatic habitat conditions in the project area than analyzed for Alternative 4. As described in Section 4.1.4, *Description of Alternative 5A*, of this RDEIR/SDEIS, actions associated with Alternative 4 that are not proposed to be implemented under Alternative 5A would continue to be pursued as part of existing, but separate, projects and programs associated with the 2008 USFWS and 2009 NMFS BiOps (e.g., 8,000 acres of tidal habitat restoration and Yolo Bypass improvements), California EcoRestore, and the 2014 California Water Action Plan.

The analysis of boron, bromide, chloride, DOC, EC, and nitrate under Alternative 5A in the ELT is based on modeling conducted for Alternative 5 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described above, Yolo Bypass Improvements are not a component of Alternative 5A and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the modeling. In general, the significance of this difference is that the assessment of bromide, chloride, and EC for Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT), likely overestimates increases in bromide, EC, and chloride that could occur, particularly in the west Delta. Nevertheless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 5A and the No Action Alternative (ELT). Due to the reduced suite of environmental commitments in Alternative 5A compared to Alternative 4 (in particular, significantly less tidal restoration), there generally are fewer significant impacts identified for Alternative 5A than for Alternative 4.

Impact WQ-1: Effects on Ammonia Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), substantial point and non-point sources of ammonia-N do not exist upstream of the SRWTP at Freeport in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Thus, like Alternative 4, operation of the water conveyance facilities under Alternative 5A would have negligible, if any, effect on ammonia concentrations in the rivers and reservoirs upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT). Any negligible increases in ammonia-N concentrations that could occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to ammonia.

Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), a substantial decrease in Sacramento River ammonia concentrations is expected under Alternative 5A relative to Existing Conditions, due to planned lowering of ammonia in the SRWTP effluent discharge, and this is expected to decrease ammonia concentrations for all areas of the Delta that are influenced by Sacramento River water. Concentrations of ammonia at locations not influenced notably by Sacramento River water would change little relative to Existing Conditions, due to the similarity in San Joaquin River and San Francisco Bay concentrations and the lack of expected changes in either of these concentrations. Thus, Alternative 5A would not result in substantial increases in ammonia concentrations in the project area, relative to Existing Conditions.

Relative to the No Action Alternative (ELT and LLT), the primary mechanism that could potentially alter ammonia concentrations under Alternative 5A is decreased flows in the Sacramento River, which would lower dilution available to the SRWTP discharge. This flow change would be attributable only to operations of the water conveyance facilities, since the same assumptions regarding SRWTP discharge ammonia concentrations, water demands, climate change, and sea level rise apply to both Alternative 5A and the No Action Alternative (ELT and LLT). A simple mass balance calculation was performed to calculate ammonia concentrations downstream of the SRWTP discharge (i.e., downstream of Freeport) under Alternative 5A and the No Action Alternative (ELT) to assess the effects of the flow changes. Monthly average CALSIM II flows at Freeport and the upstream ammonia concentration (0.04 mg/L-N; Central Valley Water Board 2010a:5) were used, together with the SRWTP permitted average dry weather flow (181 mgd) and seasonal ammonia limitations (1.5 mg/L-N in Apr–Oct, 2.4 mg/L-N in Nov–Mar), to estimate the average change in ammonia concentrations downstream of the SRWTP. Table 4.5.4-1 of this RDEIR/SDEIS shows monthly average and long-term annual average predicted concentrations under Alternative 5A. As Table 4.5.4-1 shows, average monthly ammonia concentrations in the Sacramento River downstream of Freeport (upon full mixing of the SRWTP discharge with river water) under Alternative 5A and the No Action Alternative (ELT) are expected to be similar. In comparison to the No Action Alternative (ELT), minor increases in monthly average ammonia concentrations would occur during January through March, August, September, and November under Alternative 5A. Minor decreases in ammonia concentrations are expected for Alternative 5A in June and October. A minor increase in the annual average concentration would occur under Alternative 5A, compared to the No Action Alternative (ELT). Relative to the No Action Alternative (LLT), Alternative 5A is expected to result in similar minor increases in Sacramento River ammonia concentration, because the increased water demands, climate change, and sea level rise in the LLT would occur under both alternatives, and neither would affect ammonia sources or loading. The estimated ammonia concentrations in the Sacramento River downstream of Freeport under Alternative 5A would be similar to existing source water concentrations for the San Francisco Bay and San Joaquin River. Consequently, changes in source water fraction anticipated under Alternative 5A, relative to the No Action Alternative (ELT and LLT), are not expected to substantially increase ammonia concentrations at any Delta locations.

Ammonia concentrations downstream of Freeport on the Sacramento River under Alternative 5A would be similar to those under Alternative 4 (see Table 8-67 in Appendix A of the RDEIR/SDEIS). As stated for Alternative 4, any negligible increases in ammonia concentrations that could occur at certain locations in the Delta under Alternative 5A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to ammonia.

Table 4.5.4-1. Estimated Ammonia (mg/L as N) Concentrations in the Sacramento River Downstream of the Sacramento Regional Wastewater Treatment Plant for the No Action Alternative Early Long-term Timeframe (ELT) and Alternative 5A

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Average
No Action Alternative (ELT)	0.076	0.082	0.068	0.060	0.057	0.060	0.058	0.062	0.067	0.060	0.067	0.063	0.065
Alternative 5A	0.075	0.086	0.068	0.061	0.058	0.061	0.058	0.062	0.064	0.060	0.068	0.067	0.066

SWP CVP Export Service Areas

As discussed above, for areas of the Delta that are influenced by Sacramento River water, including Banks and Jones pumping plants, ammonia-N concentrations are expected to decrease under Alternative 5A, relative to Existing Conditions (in association with less diversion of water influenced by the SRWTP). Like Alternative 4, this decrease in ammonia-N concentrations for water exported via the south Delta pumps is not expected to result in an adverse effect on beneficial uses or substantially degrade water quality of exported water, with regard to ammonia. Furthermore, as discussed above, for all areas of the Delta, including Banks and Jones pumping plants, ammonia concentrations are not expected to be substantially different under Alternative 5A relative to the No Action Alternative (ELT and LLT). Thus, any negligible increases in ammonia concentrations that could occur at Banks and Jones pumping plants would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade water quality at these locations, with regard to ammonia.

NEPA Effects: In summary, ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas are not expected to be substantially different under Alternative 5A relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on ammonia are considered to be not adverse.

CEQA Conclusion: The magnitude and direction of changes in ammonia concentrations in water bodies upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas would be approximately the same as expected under Alternative 4, relative to Existing Conditions. There would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 5A relative to Existing Conditions. As such, Alternative 5A is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because ammonia concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-2: Effects on Ammonia Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Although this may decrease ammonia loading to the Delta from agriculture, increased biota in those areas as a result of restored habitat may increase ammonia loading originating from flora and fauna. Ammonia loaded from organisms is expected to be converted rapidly to nitrate by established microbial communities. Thus, these land use changes would not be expected to substantially increase ammonia concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect ammonia sources or loading. Based on these findings, the effects on ammonia from the implementation Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 5A are determined to not be adverse.

***CEQA Conclusion*:** Land use changes that would occur from the environmental commitments are not expected to contribute substantially increase ammonia concentrations, because the amount of area to be converted would be small relative to existing habitat, and any resulting ammonia would likely be rapidly converted to nitrate. Thus, there would be no substantial, long-term increase in ammonia concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. As such, implementation of these environmental commitments would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Because ammonia concentrations would not be expected to increase substantially from implementation of these environmental commitments, no long-term water quality degradation would be expected to occur and, thus, no significant impact on beneficial uses would occur. Ammonia is not CWA Section 303(d) listed within the affected environment and thus any minor increases that could occur in some areas would not make any existing ammonia-related impairment measurably worse because no such impairments currently exist. Because ammonia is not bioaccumulative, minor increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-3: Effects on Boron Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 5A there would be no expected change to the sources of boron in the Sacramento River and east-side tributary watersheds and, thus, resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of boron in the rivers and reservoirs of these watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease by 1%, relative to Existing Conditions (in association with the different operational components of Alternative 5A in the ELT, climate change, and increased water demands) (Table Bo-1 in Appendix B of this RDEIR/SDEIS). The reduced flow relative to Existing Conditions would result in possible increases in long-term average boron concentrations of up to about 0.5% relative to the Existing Conditions. Flows would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial boron increases relative to the No Action Alternative (ELT). The increased boron concentrations, relative to Existing Conditions, under Alternative 5A in the ELT would not increase the frequency of exceedances of any applicable objectives or criteria and would not be expected to cause further degradation at measurable levels in the lower San Joaquin River, and thus would not cause the existing impairment there to be discernibly worse. Consequently, Alternative 5A in the ELT would not be expected to cause exceedance of boron objectives/criteria or substantially degrade water quality with respect to boron, and thus would not adversely affect any beneficial uses of the Sacramento River, the east-side tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 5A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect boron sources in these areas.

Delta

Effects of water conveyance facilities on boron under Alternative 5A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased boron concentrations at western Delta locations associated with restoration environmental commitments under Alternative 5A because very little would occur relative Alternative 4. Other effects of the environmental commitments not attributable to hydrodynamics are discussed in Impact WQ-4. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 5A would result in increased long-term average boron concentrations for the 16-year period modeled at most of the interior Delta locations (increases up to 6% at the S. Fork Mokelumne River at Staten Island, 3% at Franks Tract, and 4% at Old River at Rock Slough) (Table Bo-10 in Appendix B of this RDEIR/SDEIS). The long-term average boron concentrations at most of the western Delta assessment locations would not change measurably. The long-term annual average and monthly average boron concentrations, for either the 16-year period or drought period modeled, would never exceed the 2,000 μg/L human health advisory objective (i.e., for children) or the 500 μg/L agricultural objective at the majority of assessment locations, which represents no change from the Existing Conditions and No Action Alternative (ELT) (Table Bo-8 in Appendix B of this RDEIR/SDEIS). A small increase in the frequency of exceedances 500 μg/L agricultural objective at the Sacramento River at Mallard Island (i.e., as much as 4% in the drought period relative to the No Action Alternative [ELT]) would not be anticipated to substantially affect agricultural diversions which occur primarily at interior Delta locations. There would be no reduction in long-term average assimilative capacity at Delta locations with respect to the 500 μg/L agricultural objective (Table Bo-12 in Appendix B of this RDEIR/SDEIS). Therefore, the risk of exceeding objectives or adverse effects to municipal and agricultural water supply beneficial uses, or any other beneficial uses, would not occur (Figure Bo-2 in Appendix B of this RDEIR/SDEIS).

Effects of Alternative 5A in the Delta in the LLT, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to those described above for the ELT. Boron concentrations may be higher at western Delta locations due to greater effects of climate change on sea level rise that would occur in the LLT; however, these effects are independent of the alternative. Further, boron is of concern in waters diverted for agricultural use, which primarily occurs in the interior Delta, and based on Delta source water characteristics (see Table 8-42 in Appendix A of the RDEIR/SDEIS), boron concentrations in the interior Delta would be expected to remain suitable for agricultural use.

SWP/CVP Export Service Areas

Under the Alternative 5A, long-term average boron concentrations would decrease at Barker Slough (as much as 15%) and at Banks pumping plant (as much as 12%) relative to Existing Conditions, and the reductions would be similar compared to No Action Alternative (ELT) (Table Bo-10 in Appendix B of this RDEIR/SDEIS) as a result of export of a greater proportion of low-boron Sacramento River water. Commensurate with the decrease in exported boron concentrations, boron concentrations in the lower San Joaquin River may be reduced and would likely alleviate or lessen any expected increase in boron concentrations at Vernalis associated with flow reductions (see discussion of Upstream of the Delta), as well as locations in the Delta receiving a large fraction of San Joaquin River water. Reduced export boron concentrations also may contribute to reducing the existing CWA Section 303(d) impairment in the lower San Joaquin River and associated TMDL actions for reducing boron loading. These same effects on boron at the Banks and Jones pumping plants would be expected in the LLT, because the primary effect of climate change on sea level rise and boron concentrations is expected in the western Delta.

Maintenance of SWP and CVP facilities under Alternative 5A would not be expected to create new sources of boron or contribute towards a substantial change in existing sources of boron in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 5A would result in relatively small increases in long-term average boron concentrations in the Delta, not measurably increase boron levels in the lower San Joaquin River, and reduce boron levels in water exported to the SWP/CVP export service areas. However, the predicted changes would not be expected to cause exceedances of applicable objectives or further measurable water quality degradation, and thus would not constitute an adverse effect on water quality.

CEQA Conclusion: Based on the above assessment, any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in boron levels upstream of the Delta. Small increases in boron levels predicted for interior Delta locations in response to a shift in the Delta source water percentages would not be expected to cause exceedances of objectives, or substantial degradation of these water bodies. Alternative 5A maintenance also would not result in any substantial increases in boron concentrations in the affected environment. Boron concentrations would be reduced in water exported from the Delta to the CVP/SWP Export Service Areas, thus reflecting a potential improvement to boron loading in the lower San Joaquin River.

Boron is not a bioaccumulative constituent, thus any increased concentrations under Alternative 5A would not result in adverse boron bioaccumulation effects to aquatic life or humans. Relative to Existing Conditions, Alternative 5A would not result in substantially increased boron concentrations such that frequency of exceedances of municipal and agricultural water supply objectives would increase. The levels of boron degradation that may occur under Alternative 5A would not be of sufficient magnitude to cause substantially increased risk for adverse effects to municipal or agricultural beneficial uses within the affected environment. Long-term average boron concentrations would decrease in Delta water exports to the SWP and CVP service area, which may contribute to reducing the existing CWA Section 303(d) impairment of agricultural beneficial uses in the lower San Joaquin River. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-4: Effects on Boron Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 5A present no new direct sources of boron to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. Habitat restoration activities in the Delta, while involving increased land and water interaction within these habitats, would not be anticipated to contribute boron which is primarily associated with source water inflows to the Delta (i.e., San Joaquin River, agricultural drainage, and Bay source water). Moreover, some habitat restoration would occur on lands within the Delta currently used for irrigated agriculture, thus replacing agricultural land uses with restored habitats. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated boron concentrations, which would be considered an improvement compared to the No Action Alternative (ELT and LLT). Consequently, as they pertain to boron, implementation of the environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 for Alternative 5A would not present new or substantially changed sources of boron to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. As such, their implementation would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or other criteria would be exceeded in water bodies of the affected environment located upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas or substantially degrade the quality of these water bodies, with regard to boron. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-5: Effects on Bromide Concentrations Resulting from Facilities Operations and Maintenance Upstream of the Delta

Upstream of the Delta

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), under Alternative 5A in the ELT there would be no expected change to the sources of bromide in the Sacramento River and east-side tributary watersheds. Thus, changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of bromide in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial bromide increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River, which is the beneficial use most sensitive to elevated bromide concentrations. Consequently, Alternative 5A in the ELT would not be expected to adversely affect the MUN beneficial use, or any other beneficial uses, of the Sacramento River, the San Joaquin River, the eastside tributaries, or their associated reservoirs upstream of the Delta due to changes in bromide concentrations.

Effects of Alternative 5A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect bromide sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-6. See Chapter 8, Section 8.3.1.3, *Plan Area* in Appendix A of the RDEIR/SDEIS for more information regarding the modeling methodology.

Estimates of bromide concentrations at Delta assessment locations were generated using a mass balance approach, and using relationships between EC and chloride and between chloride and bromide and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area* in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in bromide at Delta assessment locations based on both approaches.

Based on the mass balance modeling approach for bromide, relative to Existing Conditions, Alternative 5A long-term average bromide concentrations would increase in the S. Fork Mokelumne River at Staten Island, and decrease at all other assessment locations (Table Br-3 in Appendix B of this RDEIR/SDEIS). Average bromide concentrations at Staten Island would increase from 50 μg/L under Existing Conditions to 59 μg/L (18% increase) for the modeled 16-year hydrologic period (1976–1991). However, multiple interior and western Delta assessment locations would have an increased frequency of exceedance of 50 μg/L, which is the CALFED Drinking Water Program goal for bromide as a long-term average applied to drinking water intakes (Table Br-3 in Appendix B of this RDEIR/SDEIS). These locations are the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The greatest increase in frequency of exceedance of the CALFED Drinking Water Program long-term goal of 50 μg/L would occur in the S. Fork Mokelumne River (19% increase) and Sacramento River at Emmaton (3% increase). The increase in frequency of exceedance of the 50 μg/L threshold at the other locations would be 1% or less. Similarly, these locations would have an increased frequency of exceedance of 100 μg/L, which is the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts (Table Br-3 in Appendix B of this RDEIR/SDEIS). The greatest increase in frequency of exceedance of 100 μg/L would occur at Franks Tract (7% increase). The increase in frequency of exceedance of the 100 μg/L threshold at the other locations would be 5% or less.

Changes in long-term average bromide concentrations and changes in threshold exceedance frequencies relative to the No Action Alternative (ELT) are generally of similar magnitude to those previously described relative to Existing Conditions (Table Br-3 in Appendix B of this RDEIR/SDEIS).

Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide were consistent with the discussion above, and assessment of bromide using these modeling results lead to the same conclusions as are presented above for the mass balance approach (Table Br-4 in Appendix B of this RDEIR/SDEIS).

Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT). Also, the magnitude of bromide concentration increases at Mallard Slough and in the San Joaquin River at Antioch during their historical months of use, relative to Existing Conditions and the No Action Alternative (ELT), would be generally similar to those described for Alternative 4 (Tables Br-5 and Br-6 in Appendix B of this RDEIR/SDEIS), and the frequency of exceedance of bromide thresholds would be similar (Tables Br-3 and Br-4 in Appendix B of this RDEIR/SDEIS). As described for Alternative 4, the use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. Opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The effects of Alternative 5A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion.

SWP/CVP Export Service Areas

Under Alternative 5A, long-term average bromide concentrations at the Banks and Jones pumping plants, based on the mass balance modeling approach, would decrease. Long-term average bromide concentrations for the modeled 16-year hydrologic period at the pumping plants would decrease by as much as 27% relative to Existing Conditions and 21% relative to the No Action Alternative (ELT) (Table Br-3 in Appendix B of this RDEIR/SDEIS). As a result, less frequent exceedances of the 50 μg/L and 100 μg/L assessment thresholds would occur and an overall improvement in SWP/CVP Export Service Areas water quality would occur respective to bromide. Commensurate with the decrease in exported bromide, an improvement in lower San Joaquin River bromide would also occur since bromide in the lower San Joaquin River is principally related to irrigation water deliveries from the Delta. Results of the modeling approach which used relationships between EC and chloride and between chloride and bromide are consistent with the mass balance results, and assessment of bromide using these modeling results leads to the same conclusions (Table Br-4 in Appendix B of this RDEIR/SDEIS).

The effects of Alternative 5A in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to that described above, because the sea level rise that could occur in the LLT would not result in substantial bromide contributions to the water exported at Banks and Jones pumping plants.

Maintenance of SWP and CVP facilities under Alternative 5A would not be expected to create new sources of bromide or contribute towards a substantial change in existing sources of bromide in the affected environment. Maintenance activities would not be expected to cause any substantial change in bromide such that MUN beneficial uses, or any other beneficial use, would be adversely affected anywhere in the affected environment.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 5A, relative to the No Action Alternative (ELT and LLT) would result in an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island; there would be decreases in long-term average bromide concentrations at the other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island would be less than the concentration believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts. Thus, this increased bromide concentration is not expected to result in adverse affects to MUN beneficial uses, or any other beneficial use, at these locations. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: While greater water demands under Alternative 5A would alter the magnitude and timing of reservoir releases north and east of the Delta, these activities would have negligible, if any, effect on the sources of bromide, and ultimately the concentration of bromide in the Sacramento River, the San Joaquin River, the eastside tributaries, and the various reservoirs of the related watersheds, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS).

Under Alternative 5A there would be an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of disinfection byproducts in treated drinking water at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. However, long-term average bromide concentrations would increase only in the S. Fork Mokelumne River at Staten Island and decrease at all other assessment locations. The long-term bromide concentration in the S. Fork Mokelumne River at Staten Island (59 μg/L) would be less than the 100 μg/L believed to be sufficient to meet currently established drinking water criteria for disinfection byproducts. Further, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), the use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and thus has historically been opportunistic and opportunity to use these intakes would remain. Thus, these increased bromide concentrations would not be expected to adversely affect MUN beneficial uses, or any other beneficial use, at these locations.

The assessment of effects on bromide in the SWP/CVP Export Service Areas is based on assessment of changes in bromide concentrations at Banks and Jones pumping plants. Long-term average bromide concentrations at the Banks and Jones pumping plants are predicted to decrease by as much as 27% relative to Existing Conditions and there would be less frequent exceedance of bromide concentration thresholds.

Based on the above, Alternative 5A would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide. Alternative

5A would not result in any substantial change in long-term average bromide concentration or exceed 50 and 100 µg/L assessment threshold concentrations by frequency, magnitude, and geographic extent that would result in adverse effects on any beneficial uses within affected water bodies. Bromide is not a bioaccumulative constituent and thus concentrations under this alternative would not result in bromide bioaccumulating in aquatic organisms. Increases in exceedances of the 100 µg/L assessment threshold concentration would be 7% or less at all locations assessed, which is considered to be less than substantial long-term degradation of water quality. The levels of bromide degradation that may occur under the Alternative 5A would not be of sufficient magnitude to cause substantially increased risk for adverse effects on any beneficial uses of water bodies within the affected environment. Bromide is not CWA Section 303(d) listed and thus the minor increases in long-term average bromide concentrations would not affect existing beneficial use impairment because no such use impairment currently exists for bromide. Based on these findings, this impact is less than significant. No mitigation is required.

Impact WQ-6: Effects on Bromide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new sources of bromide to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Some habitat restoration activities would occur on lands in the Delta formerly used for irrigated agriculture. Such replacement or substitution of land use activity would not be expected to result in new or increased sources of bromide to the Delta. Therefore, as they pertain to bromide, implementation of these environmental commitments would not be expected to adversely affect MUN beneficial use, or any other beneficial uses, of the affected environment.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable bromide concentration changes.

In summary, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 5A relative to the No Action Alternative (ELT and LLT), would have negligible, if any, effects on bromide concentrations. Therefore, the effects on bromide from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

***CEQA Conclusion*:** Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 5A would not present new or substantially changed sources of bromide to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution would not be expected to substantially increase or present new sources of bromide. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, effects on bromide concentrations throughout the affected environment, would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria because none exist for bromide, and would not cause changes in bromide concentrations that would result in significant impacts on any beneficial uses within affected water bodies. Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of significant impacts on beneficial uses, would not cause greater bioaccumulation of bromide, and would not further impair any beneficial uses due to bromide concentrations because no uses are currently impaired due to bromide levels. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-7: Effects on Chloride Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 5A on chloride concentrations in reservoirs and rivers upstream of the Delta would be the similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Chloride loading in these watersheds would remain unchanged and resultant changes in flows from altered system-wide operations would have negligible, if any, effects on the concentration of chloride in the rivers and reservoirs of these watersheds. There would be no expected change to the sources of chloride in the Sacramento River and east-side tributary watersheds, and changes in the magnitude and timing of reservoir releases north and east of the Delta would have negligible, if any, effect on the sources, and ultimately the concentration of chloride in the Sacramento River, the eastside tributaries, and the various reservoirs of the related watersheds. The modeled annual average lower San Joaquin River flow at Vernalis would decrease slightly (1%) compared to Existing Conditions and would remain virtually the same as the No Action Alternative (ELT), and thus flow changes would not result in substantial chloride increases. Moreover, there are no existing municipal intakes on the lower San Joaquin River. Consequently, Alternative 5A in the ELT would not be expected to cause exceedances of chloride objectives/criteria or substantially degrade water quality with respect to chloride, and thus would not adversely affect any beneficial uses of the Sacramento River, the eastside tributaries, associated reservoirs upstream of the Delta, or the San Joaquin River.

Effects of Alternative 5A in reservoirs and rivers upstream of the Delta in the LLT relative to Existing Conditions and the No Action Alternative (LLT) would be expected to be similar, because the climate change and sea level rise that would occur in the LLT would not affect chloride sources in these areas.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-8. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Estimates of chloride concentrations at Delta assessment locations were generated using a mass balance approach and EC-chloride relationships and DSM2 EC output. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding these modeling approaches. The assessment below identifies changes in chloride at Delta assessment locations based on both approaches.

Modeling of chloride using both the mass balance approach and EC-chloride relationship predicts that Alternative 5A in the ELT would result in similar or reduced long-term average chloride concentrations, relative to Existing Conditions, for the 16-year period modeled at all assessment locations except for the S. Fork Mokelumne River at Staten Island. The increase in long-term average chloride concentration at Staten Island would be 3 mg/L (17%) based on the mass balance modeling and 1 mg/L (6%) based on the EC-chloride relationship (Tables Cl-20 and Cl-21 in Appendix B of this RDEIR/SDEIS). This differs from Alternative 4, under which there would be increased long-term average chloride concentrations also at the North Bay Aqueduct at Barker Slough. The change in long-term average chloride concentrations relative to the No Action Alternative (ELT) would be similar to those relative to Existing Conditions.

The following outlines the modeled chloride changes relative to the applicable objectives and beneficial uses of Delta waters.

Municipal Beneficial Uses Relative to Existing Conditions

Estimates of chloride concentrations generated using EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses on a basis of the percent of years the chloride objective is exceeded for the modeled 16-year period. The objective is exceeded if chloride concentrations exceed 150 mg/L for a specified number of days in a given water year at Antioch and Contra Costa Pumping Plant #1. The modeled frequency of objective exceedance would decrease at the Contra Costa Pumping Plant #1 from 6.7% of years under Existing Conditions to 0% of years under Alternative 5A in the ELT (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Evaluation of the 250 mg/L Bay-Delta WQCP objective for chloride utilized results from both the mass balance approach and EC-chloride relationship. The basis for the evaluation was the predicted number of days the objective would be exceeded for the modeled 16-year period.

Based on the mass balance approach, there would be a decreased frequency of exceedance of the 250 mg/L objective under Alternative 5A, relative to Existing Conditions, at all locations except in the Sacramento River at Mallard Island, San Joaquin River at Antioch, and the Sacramento River at Emmaton. In the Sacramento River at Mallard Island, the frequency of objective exceedance would increase from 85% under Existing Conditions to 86% under Alternative 5A for the entire period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). In the San Joaquin River at Antioch, there would be an increase in chloride objective exceedance for the entire period modeled, from 66% under Existing Conditions to 68% under Alternative 5A. In the Sacramento River at Emmaton, there would be an increase in chloride objective exceedance during the drought period modeled, from 55% to 57%. The mass balance results also indicate reduced assimilative capacity with respect to the 250 mg/L objective during certain months and at certain locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in March and April of up to 20% for the 16-year period modeled and 56% for the drought period modeled (Table Cl-22 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced, in February through April by up to 7%, and in January of the drought period modeled by 77%.

When utilizing the EC-chloride relationship to model chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity would be similar to that discussed when utilizing the mass balance modeling approach (Tables Cl-3 and Cl-23 in Appendix B of this RDEIR/SDEIS). However, the EC-chloride relationships generally predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

Based on the long-term average water quality degradation in the western Delta, the potential exists for substantial adverse effects under Alternative 5A in the ELT on the municipal and industrial beneficial uses through reduced opportunity for diversion of water with acceptable chloride levels.

CWA Section 303(d) Listed Water Bodies–Relative to Existing Conditions

Tom Paine Slough in the southern Delta is on the state's CWA Section 303(d) list for chloride with respect to the secondary MCL of 250 mg/L. Monthly average chloride concentrations at the Old River at Tracy Road for the 16-year period modeled, which represents the nearest DSM2-modeled location to Tom Paine Slough, would be generally similar under Alternative 5A in the ELT relative to Existing Conditions, and thus, would not be further degraded on a long-term basis (Figure Cl-5 in Appendix B of this RDEIR/SDEIS).

Suisun Marsh also is on the state's CWA Section 303(d) list for chloride in association with the Bay-Delta WQCP objectives for maximum allowable salinity during the months of October through May, which establish appropriate seasonal salinity conditions for fish and wildlife beneficial uses. With respect to Suisun Marsh, the monthly average chloride concentrations for the 16-year period modeled would generally increase under Alternative 5A in the ELT relative to Existing Conditions in March through May at the Sacramento River at Mallard Island (Figure Cl-6 in Appendix B of this RDEIR/SDEIS) and at Collinsville (Figure Cl-7 in Appendix B of this RDEIR/SDEIS), and increase substantially in October through May at Montezuma Slough at Beldon's Landing (i.e., over a doubling of concentration in December through February) (Figure Cl-8 in Appendix B of this RDEIR/SDEIS). However, modeling of Alternative 5A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results for Suisun Marsh, but EC levels were still somewhat higher than EC levels under Existing Conditions for several locations and months. Although chloride was not specifically modeled in these sensitivity analyses, it is expected that chloride concentrations would be nearly proportional to EC levels in Suisun Marsh. Additionally, although these analyses were only conducted at the LLT, they are expected to generally also apply to the ELT. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions (see Appendix 8H Attachment 1 in Appendix A of the RDEIR/SDEIS for more information on these sensitivity analyses). Since Alternative 5A in the ELT includes operation of the gates, and includes very little tidal restoration area, it is anticipated that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 5A in the ELT would be very similar to Existing Conditions. For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

Municipal Beneficial Uses Relative to No Action Alternative (ELT)

Similar to the assessment conducted for Existing Conditions, estimates of chloride concentrations generated from EC-chloride relationships were used to evaluate the 150 mg/L Bay-Delta WQCP objective for municipal and industrial beneficial uses. For Alternative 5A in the ELT, the modeled frequency of objective exceedance would not change at the Contra Costa Pumping Plant #1--the No

Action Alternative (ELT) and Alternative 5A in the ELT all would have 0% exceedance (Table Cl-1 in Appendix B of this RDEIR/SDEIS).

Based on the mass balance approach, the frequency of exceedance of the 250 mg/L objective under Alternative 5A in the ELT would be the same, or would decrease, at all locations relative to the No Action Alternative (ELT), except in the Old River at Rock Slough and Contra Costa Pumping Plant #1 during the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). The frequency of objective exceedance would increase from 32% to 33% at Rock Slough and from 28% to 30% at Contra Costa Pumping Plant #1. The mass balance results indicate reduced assimilative capacity with respect to the 250 mg/L objective for certain months and locations. In the San Joaquin River at Antioch, there would be a reduction in assimilative capacity in April of 4% for the entire period modeled and 20% for the drought period modeled (Table Cl-22 in Appendix B of this RDEIR/SDEIS). Assimilative capacity at the Contra Costa Pumping Plant #1 also would be reduced in October, January, and April by up to 2% for the entire period modeled. During the drought period modeled, there would be reductions of assimilative capacity of 45% in January and 100% in September (Table Cl-22 in Appendix B of this RDEIR/SDEIS).

When utilizing the EC-chloride relationship to model monthly average chloride concentrations for the 16-year period, trends in frequency of exceedance and use of assimilative capacity would be similar to that discussed for the mass balance modeling approach (Tables Cl-3 and Cl-23 in Appendix B of this RDEIR/SDEIS). However, utilizing the EC-chloride relationships generally predicted changes of lesser magnitude, where predictions of change utilizing the mass balance approach were generally of greater magnitude, and thus more conservative. As discussed in Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS, in cases of such disagreement, the approach that yielded the more conservative predictions was used as the basis for determining adverse impacts.

Figure Cl-18 shows chloride concentrations in April during the five-year drought period (1987–1991) at Antioch, where Table Cl-22 indicated 22% use of assimilative capacity. The figure shows that during two of the five years, chloride concentrations increased relative to the No Action Alternative (ELT) and decreased in the other three years. The absolute differences estimated are fairly small and may be within modeling uncertainty. Figures Cl-19 and Cl-20 show a box and whisker plot and exceedance plot for April at Antioch for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that while the median chloride concentration is slightly increased relative to the No Action Alternative (ELT), the maximum value decreased, while the 25th percentile and 75th percentile values remained about the same. Based on this analysis, long-term degradation is not expected at Antioch in April during drought years.

Figure Cl-21 shows chloride levels in September at Contra Costa Pumping Plant #1 during the drought period (1987–1991), where Table Cl-22 indicated 100% use of assimilative capacity. In general, changes in chloride concentrations relative to the No Action Alternative (ELT) are fairly small, and may be within modeling uncertainty. Figures Cl-22 and Cl-23 show a box and whisker plot and exceedance plot for September at Contra Costa Pumping Plant #1 for all dry and critical water years modeled (not just the 1987–1991 drought period). These graphs show that the median chloride concentration is slightly decreased relative to the No Action Alternative (ELT), and chloride concentrations are generally similar to the No Action Alternative (ELT) throughout the range seen. The 100% use of assimilative capacity was shown because long term averages were just below the criterion, so a very small increase in chloride (that is probably within the modeling uncertainty) resulted in a very high estimate of use of assimilative capacity. Similar results are shown in Figure

Cl-24, Cl-25, and Cl-26 for October at Contra Costa Pumping Plant #1. Median concentrations decreased slightly, and the exceedance plot shows generally similar concentrations throughout the range seen. Figure Cl-24 shows that while some years see increased concentrations (e.g., 1978, 1989), other years see decreased concentrations (e.g., 1980, 1982). Based on this analysis, long-term degradation is not expected at Contra Costa Pumping Plant #1 in September during drought years, or October on a long-term average basis.

Furthermore, sensitivity analyses conducted of Alternative 4 Scenario H3 without restoration areas indicated lower chloride levels in the western Delta than with the restoration areas. It is thus likely that modeling of Alternative 5A that does not include restoration areas would show lower levels of chloride at Antioch in April, and at Contra Costa Pumping Plant #1 in September and October than is shown herein using the Alternative 5 (ELT) modeling.

Based on the low level of water quality degradation estimated for the western Delta, and the lack of exceedance of water quality objectives, Alternative 5A is not expected to have substantial adverse effects on municipal and industrial beneficial uses in the western Delta.

CWA Section 303(d) Listed Water Bodies–Relative to No Action Alternative (ELT)

With respect to the state's CWA Section 303(d) listing for chloride, Alternative 5A would generally result in similar changes to those discussed for the comparison to Existing Conditions. Monthly average chloride concentrations at Tom Paine Slough would not be further degraded on a long-term basis, based on changes that would occur in Old River at Tracy Road (Figure Cl-5 in Appendix B of this RDEIR/SDEIS). Modeling indicated that monthly average chloride concentrations at source water channel locations for the Suisun Marsh would increase substantially in some months during October through May relative to the No Action Alternative (ELT) (Figures Cl-6, Cl-7, and Cl-8 in Appendix B of this RDEIR/SDEIS), but the results of sensitivity analyses performed indicate that chloride increases in Suisun Marsh predicted via the modeling would not occur, and that chloride in Suisun Marsh under Alternative 5A in the ELT would be very similar to the No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, chloride concentrations under Alternative 5A could be less than under the No Action Alternative (ELT). For these reasons, any changes in chloride in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

The effects of Alternative 5A in the LLT in the Delta region, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be similar to effects in the ELT. With greater climate change and sea level rise, additional outflow may be required at certain times to prevent increases in chloride in the west Delta. Small increases in chloride concentrations may occur in some areas, but it is not expected that these increases would cause exceedance of Bay-Delta WQCP objectives of cause substantial long-term degradation that would impact municipal and industrial beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 5A in the ELT, long-term average chloride concentrations at the Banks and Jones pumping plants, based on the mass balance analysis of modeling results for the 16-year period, would decrease relative to Existing Conditions. Chloride concentrations would be reduced by 26% at Banks pumping plant (Table Cl-20 in Appendix B of this RDEIR/SDEIS). At Jones pumping plant, chloride concentrations would be reduced 21% (Table Cl-20 in Appendix B of this RDEIR/SDEIS). The frequency of exceedances of applicable water quality objectives would be the same or decrease relative to Existing Conditions, except for at Jones pumping plant for the drought period modeled (Table Cl-2 in Appendix B of this RDEIR/SDEIS). The frequency of objective exceedance at the Jones pumping plant would increase from 0% to 2%. The chloride concentration changes relative to the No Action Alternative (ELT) would be similar. Consequently, water exported into the SWP/CVP Export Service Areas would generally be of similar or better quality with regard to chloride relative to Existing Conditions and the No Action Alternative (ELT). Results of the modeling approach which utilized a EC-chloride relationship are consistent these results, and assessment of chloride using these modeling output results in the same conclusions as for the mass balance approach (Tables Cl-3 and Cl-21 in Appendix B of this RDEIR/SDEIS).

Commensurate with the reduced chloride concentrations in water exported to the SWP/CVP Export Service Area, reduced chloride loading in the lower San Joaquin River would be anticipated which would likely alleviate chloride concentrations at Vernalis.

The effects of Alternative in the LLT in the SWP/CVP Export Service Areas, relative to Existing Conditions and the No Action Alternative (LLT), would be expected to be very similar to effects in the ELT.

Maintenance of SWP and CVP facilities would not be expected to create new sources of chloride or contribute towards a substantial change in existing sources of chloride in the affected environment. Maintenance activities would not be expected to cause any substantial change in chloride such that any long-term water quality degradation would occur, thus, beneficial uses would not be adversely affected anywhere in the affected environment.

NEPA Effects: In summary, relative to the No Action Alternative (ELT and LLT), Alternative 5A would not result in substantially increased chloride concentrations in the Delta on a long-term average that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use, or any other beneficial use. Based on these findings, this effect is determined to not be adverse.

CEQA Conclusion: Chloride is not a constituent of concern in the Sacramento River watershed upstream of the Delta, thus river flow rate and reservoir storage reductions that would occur under Alternative 5A relative to Existing Conditions, would not be expected to result in a substantial adverse change in chloride levels. Additionally, relative to Existing Conditions, Alternative 5A would not result in reductions in river flow rates (i.e., less dilution) or increased chloride loading such that there would be any substantial increase in chloride concentrations upstream of the Delta in the San Joaquin River watershed.

Relative to Existing Conditions, Alternative 5A would result in substantially increased chloride concentrations in the Delta on a long-term average that would result in adverse effects on the municipal and industrial water supply beneficial use. Additional exceedance of the 150 mg/L and 250 mg/L objectives is not expected, and substantial long-term degradation is not expected that would result in adverse effects on the municipal and industrial water supply beneficial use.

Chloride concentrations would be reduced under Alternative 5A in water exported from the Delta to the SWP/CVP Export Service Areas thus reflecting a potential improvement to chloride loading in the lower San Joaquin River.

Chloride is not a bioaccumulative constituent, thus any increased concentrations under the Alternative 5A would not result in substantial chloride bioaccumulation impacts on aquatic life or humans. Alternative 5A maintenance would not result in any substantial changes in chloride concentration upstream of the Delta or in the SWP/CVP Export Service Areas.

Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-8: Effects on Chloride Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 5A would present no new direct sources of chloride to the affected environment, including areas Upstream of the Delta, within the Plan Area, and the SWP/CVP Export Service Areas. Consequently, as they pertain to chloride, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. The potential reduction in irrigated lands within the Delta may result in reduced discharges of agricultural field drainage with elevated chloride concentrations, which would be considered an improvement relative to the No Action Alternative (ELT and LLT). Therefore, the effects on chloride from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

***CEQA Conclusion*:** Implementation of the Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 5A would not present new or substantially changed sources of chloride to the affected environment upstream of the Delta, within Delta, or in the SWP/CVP Export Service Areas. Replacement of irrigated agricultural land uses in the Delta with habitat restoration may result in some reduction in discharge of agricultural field drainage with elevated chloride concentrations, thus resulting in improved water quality conditions. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-9: Effects on Dissolved Oxygen Resulting from Facilities Operations and Maintenance

As described in detail for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS), DO levels are primarily affected by water temperature, flow velocity, turbulence, amounts of oxygen demanding substances present (e.g., ammonia, organics), and rates of photosynthesis (which is influenced by nutrient levels), respiration, and decomposition. Water temperature and salinity affect the maximum DO saturation level (i.e., the highest amount of oxygen the water can dissolve). Flow velocity affects the turbulence and re-aeration of the water (i.e., the rate at which oxygen from the atmosphere can be dissolved in water). High nutrient content can support aquatic plant and algae growth, which in turn generates oxygen through photosynthesis and consumes oxygen through respiration and decomposition.

As described for Alternative 4, amounts of oxygen demanding substances present (e.g., ammonia, organics) in the reservoirs and rivers upstream of the Delta, rates of photosynthesis (which is influenced by nutrient levels/loading), and respiration and decomposition of aquatic life is not expected to change sufficiently under Alternative 5A to substantially alter DO levels relative to Existing Conditions or the No Action Alternative (ELT and LLT). Further, the rivers upstream of the Delta are well oxygenated and experience periods of supersaturation (i.e., when DO level exceeds the saturation concentration). Because these are large, turbulent rivers, any reduced DO saturation level that would be caused by an increase in temperature under Alternative 5A would not be expected to cause DO levels to be outside of the range seen historically. Flow changes that would occur under Alternative 5A would not be expected to have substantial effects on river DO levels; likely, the changes would be immeasurable. This is because sufficient turbulence and interaction of river water with the atmosphere would continue to occur to maintain water saturation levels (due to these factors) at levels similar to that of Existing Conditions and the No Action Alternative (ELT and LLT).

Also as described for Alternative 4, salinity changes would generally have relatively minor effects on Delta DO levels. Further, the relative degree of tidal exchange of flows and turbulence, which contributes to exposure of Delta waters to the atmosphere for reaeration, would not be expected to substantially change relative to Existing Conditions or the No Action Alternative (ELT and LLT), such that these factors would reduce Delta DO levels below objectives or levels that protect beneficial uses. Similarly, increased temperature under Alternative 5A would generally have relatively minor effects on Delta DO levels, relative to Existing Conditions.

Similar to Alternative 4, flows in the San Joaquin River at Stockton were evaluated, and are shown in Figure DO-1 in Appendix B of this RDEIR/SDEIS. The Figure shows that while flows do would change somewhat, they are would generally be within the range of flows seen under Existing Conditions and the No Action Alternative. Reports indicate that the aeration facility performs adequately under the range of flows from 250–1,000 cfs (ICF International 2010). Based on the above, the expected changes in flows in the San Joaquin River at Stockton are not expected to substantially move the point of minimum DO, and therefore the aeration facility will would likely still be located appropriately to keep DO levels above Basin Plan objectives.

Overall, assuming continued operation of the aerators, the alternative is not expected to have a substantial impact adverse effect on DO in the Deep Water Ship Channel. It is expected that DO levels in the Deep Water Ship Channel, which is CWA Section 303(d) listed as impaired due to low DO, would remain similar to those under Existing Conditions and the No Action Alternative (ELT and LLT) or improve as TMDL-required studies are completed and actions are implemented to improve DO levels. DO levels in other Clean Water Act Section 303(d)-listed waterways would not be expected to change relative to Existing Conditions or the No Action Alternative (ELT and LLT), as the circulation of flows, tidal flow exchange, and re-aeration would continue to occur.

In the SWP/CVP Export Service Areas, the primary factor that would affect DO in the conveyance channels and ultimately the receiving reservoirs would be changes in the levels of nutrients and oxygen-demanding substances and DO levels in the exported water. As described above and for Alternative 4, exported water could potentially be warmer and have higher salinity relative to Existing Conditions and the No Action Alternative (ELT and LLT). Nevertheless, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions or the No Action Alternative (ELT and LLT) due to water quality regulations, canal turbulence, exposure of the water to the atmosphere, and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

NEPA Effects: Because DO levels are not expected to change substantially relative to the No Action Alternative (ELT and LLT), the effects on DO from implementing Alternative 5A are determined to not be adverse.

CEQA Conclusion: The effects of Alternative 5A on DO levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). Reservoir storage reductions that would occur under Alternative 5A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DO levels in the reservoirs, because oxygen sources (surface water aeration, aerated inflows, vertical mixing) would remain. Similarly, river flow rate reductions would not be expected to result in a substantial adverse change in DO levels in the rivers upstream of the Delta, given that mean monthly flows would remain within the ranges historically seen under Existing Conditions and the affected river are large and turbulent. Any reduced DO saturation level that may be caused by increased water temperature would not be expected to cause DO levels to be outside of the range seen historically. Finally, amounts of oxygen demanding substances and salinity would not be expected to change sufficiently to affect DO levels.

It is expected there would be no substantial change in Delta DO levels in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to DO. DO levels would be affected by nutrient loading, which the state regulates the discharges of, and this loading would not be expected to lower DO levels relative to Existing Conditions based on historical DO levels. Further, the anticipated changes in salinity would have relatively minor effects on DO levels, and tidal exchange, which contribute to the reaeration of Delta waters would not be expected to change substantially.

There is not expected to be substantial, if even measurable, changes in DO levels in the SWP/CVP Export Service Areas waters, relative to Existing Conditions, because the biochemical oxygen demand of the exported water would not be expected to substantially differ from that under Existing Conditions (due to water quality regulations), canal turbulence and exposure of the water to the atmosphere and the algal communities that exist within the canals that would establish an equilibrium for DO levels within the canals. The same would occur in downstream reservoirs.

Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels are expected, long-term water quality degradation would not be expected to occur, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and DO-related impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-10: Effects on Dissolved Oxygen Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Environmental Commitments 3, 4, 6–11 would involve habitat restoration actions. The increased habitat provided by these environmental commitments could contribute to an increased biochemical or sediment demand, through contribution of organic carbon and plants decaying. However, the areal extent of new habitat would be small relative to the existing and No Action Alternative habitat areas, and similar habitat existing in the Delta is not identified as contributing to adverse DO conditions. The remaining environmental commitments would not be expected to affect DO levels because they are actions that do not affect the presence of oxygen-demanding substances. Therefore, the effects on DO from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

***CEQA Conclusion*:** It is expected that DO levels in the Upstream of the Delta Region, in the Plan Area, or in the SWP/CVP Export Service Areas following implementation of Environmental Commitments 3–12, 15, and 16 under Alternative 5A would not be substantially different from existing DO conditions, because these would contribute to a minimal, localized change in oxygen-demanding substances associated with habitat restoration, if at all. Therefore, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would result in significant impacts on any beneficial uses within affected water bodies. Because no substantial changes in DO levels would be expected, long-term water quality degradation would not be expected, and, thus, beneficial uses would not be adversely affected. Various Delta waterways are CWA Section 303(d)-listed for low DO, but because no substantial decreases in DO levels would be expected, greater degradation and impairment of these areas would not be expected. Based on these findings, this impact would be less than significant. No mitigation is required.

Impact WQ-11: Effects on Electrical Conductivity Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 5A on EC levels in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). The extent of new urban growth would be less in the ELT, thus discharges of EC-elevating parameters in runoff and wastewater discharges to water bodies upstream of the Delta would be expected to be less than in the LLT. However, the state is regulating point source discharges of EC-related parameters and implementing a program to further decrease loading of EC-related parameters to tributaries. Based on these considerations, and those described in Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS, EC levels (highs, lows, typical conditions) in the Sacramento River and its tributaries, the eastside tributaries, or their associated reservoirs upstream of the Delta would not be expected to be outside the ranges occurring under Existing Conditions.

For the San Joaquin River, increases in EC levels under Alternative 5A could occur, but would be slightly less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because the effects of climate change and increase water demands on flows, which could effect dilution of high EC discharges, would be less in the ELT. The implementation of the adopted TMDL for the San Joaquin River at Vernalis and the ongoing development of the TMDL for the San Joaquin River upstream of Vernalis are expected to contribute to improved EC levels. Based on these considerations, substantial changes in EC levels in the San Joaquin River relative to Existing Conditions would not be expected to be of sufficient magnitude and geographic extent that would result in adverse effects on any beneficial uses, or substantially degrade the quality of these water bodies, with regard to EC.

Delta

As mentioned at the beginning of Section 4.5.4, the analysis of EC under Alternative 5A is based on modeling conducted for Alternative 5 in the ELT, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. Also, the modeling was originally performed assuming the Emmaton compliance point shifted to Threemile Slough. However, Yolo Bypass Improvements are not a component of Alternative 5A and the amount of tidal habitat restoration (i.e., Environmental Commitment 4) would be significantly less than that represented in the modeling Alternative 5A. Also, Alternative 5A does not include a change in compliance point from Emmaton to Threemile Slough. Furthermore, there are several factors related to the modeling approach that may result in modeling artifacts that show objective exceedance, when in reality no such exceedance would occur. The result of all of these factors is that the quantitative modeling results presented in this assessment is not entirely predictive of actual effects under Alternative 5A, and the results should be interpreted with caution. In order to understand the significance of all of these factors on the results, sensitivity analyses and further other analyses were performed to evaluate the impact of maintaining the compliance point at Emmaton, the impact of having substantially less restoration than included in the modeling that was analyzed, and whether exceedances were indeed modeling artifacts or were potential alternative-related effects that may actually occur. For more information on these sensitivity analyses, refer to Chapter 8, Section 8.3.1.7, Electrical Conductivity, and Appendix 8H Attachment 1, both in Appendix A of the RDEIR/SDEIS.

In this assessment, the modeling results are described and then in most cases are qualified in light of findings from the sensitivity analyses. Conclusions thus represent assessment of the combination of the modeling results and sensitivity analysis findings.

The modeling of EC under Alternative 5A included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes (i.e., water conveyance facilities). Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-12. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Relative to Existing Conditions and the No Action Alternative (ELT), initial review of modeling results indicated that Alternative 5A would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, and San Joaquin River at Jersey Point, San Andreas Landing, and Prisoners Point (Table EC-9 in Appendix B of this RDEIR/SDEIS). Additionally, the modeling results indicated potentially large increases in EC in Suisun Marsh. However, to understand and interpret these results, considerations must be made regarding uncertainty in the modeling, differing assumptions between the modeling and the alternative, and sensitivity analyses. These objectives and locations are addressed in the context of these considerations in detail below. At all other locations, the level of exceedance and EC in the modeling results was approximately equivalent or lower than under Existing Conditions and the No Action Alternative (ELT).

Sacramento River at Emmaton

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 5A than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of dry and critical water years. However, sensitivity analyses have shown that the level of effect would be less than presented in the modeling. Remaining increases in exceedance of the objective and degradation are expected to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Delta Cross Channel operation. Further discussion is provided below.

Modeling results indicated that the percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 13% under the No Action Alternative (ELT), to 17% and the percent of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative (ELT), to 28%. Although these results are for modeling that was originally performed for Alternative 5 at the ELT assuming the Emmaton compliance point shifted to Threemile Slough, Alternative 5A does not include a change in compliance point from Emmaton to Threemile Slough. Sensitivity analyses were performed that modeled Alternative 4 scenario H3 at the LLT with Emmaton as the compliance point. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H, Attachment 1 in Appendix A of the RDEIR/SDEIS). Assuming the compliance location at Emmaton instead of Threemile Slough in the CALSIM II modeling decreased exceedances at Emmaton from 28% to 15% under Alternative 4, operations scenario H3 at the LLT (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses), which would still be greater than Existing Conditions, but is very close to the No Action Alternative (ELT). Table 2 of Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS indicates that most of these exceedances are a result of modeling artifacts, but some exceedances are due to deadpool conditions that occurred in 1977, 1981, and 1990 under Alternative 4 scenario H3 at the LLT and not under Existing Conditions. As discussed in Chapter 5, *Water Supply*, Section 5.3.1, *Methods for Analysis*, in the Draft EIR/EIS, under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions. However, these results indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects to agricultural beneficial uses.

This is evidenced in the modeling results, which indicated that long-term monthly average EC levels at Emmaton would increase 3–12% for the entire period modeled (1976–1991) and 3–29% during the drought period modeled (1987–1991), relative to the No Action Alternative (ELT) (Table EC-17 in Appendix B of this RDEIR/SDEIS). The largest increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. During these periods, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would be considered not adverse.

San Joaquin River at San Andreas Landing

Alternative 5A is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions and the No Action Alternative (ELT). Modeling results estimated that the percent of days the San Andreas Landing EC objective would be exceeded would increase by <1% relative to Existing Conditions, and the percent of days out of compliance would increase from 1% under Existing Conditions to 2% (Table EC-9 in Appendix B of this RDEIR/SDEIS). San Andreas Landing average EC would increase by <1% for the entire period modeled and 7% during the drought period modeled, relative to Existing Conditions (Table EC-17 in Appendix B of this RDEIR/SDEIS). Results relative to the No Action Alternative (ELT) were similar (Table EC-17 in Appendix B of this RDEIR/SDEIS). However, sensitivity analyses performed for Alternative 4 scenario H3 at the LLT indicate that many of these exceedances are likely modeling artifacts, and the small number of remaining exceedances would be small in magnitude, lasting only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, Section 8.3.1.1, *Models Used and Their Linkages*, of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT, because the factors affecting salinity findings in the sensitivity analysis (e.g., modeling assumptions, physical hydrodynamic mechanisms) are similar between the ELT and LLT (see Appendix 8H Attachment 1, in Appendix A of the RDEIR/SDEIS).

San Joaquin River at Prisoners Point

Modeling results indicated that the EC objective that applies between the San Joaquin River at Jersey Point and Prisoners Point would be exceeded at Prisoners Point more often under Alternative 5A than under Existing Conditions and the No Action Alternative (ELT). However, modeling results without restoration areas would be expected to show a lesser effect, and remaining exceedances are expected to be able to be addressed via real-time operations, including real time management of the north Delta and south Delta intakes, as well as Head of Old River Barrier management. Further discussion is provided below.

Modeling results estimated that the percent of days the Prisoners Point EC objective would be exceeded would increase from 6% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 7% and the percent of days out of compliance with the EC objective would increase from 10% under Existing Conditions, or 1% under the No Action Alternative (ELT), to 10% (Table EC-9 in Appendix B of this RDEIR/SDEIS). The magnitude of the exceedances is estimated to be very small—the objective is 440 μmhos/cm, and the EC during times of exceedance was generally between 440 and 550 μmhos/cm. The exceedances generally occurred in drier water years, when flows are lower. During these times, the EC in the San Joaquin River at Vernalis is greater than in the Sacramento River entering the Delta, and is high enough on its own to cause an exceedance.

There are two main drivers of the increase in exceedances under the alternative: an increase in San Joaquin River flow at Prisoners Point during April and May under the alternative, relative to Existing Conditions and the No Action Alternative (ELT), and a reduction in the amount of Sacramento River water moving past Prisoners Point under the alternative. The result is increased San Joaquin River water at Prisoners Point, and a reduction in the dilution that the Sacramento River provides the higher EC San Joaquin River. The increase in San Joaquin River flow at Prisoners Point is due to a reduction in pumping from the south Delta under the alternative, as well as due to the presence of the Head of Old River Barrier, which increases flow in the San Joaquin River downstream of Old River by preventing flow from entering Old River. The reduction in Sacramento River water influence is due to less pumping at the south Delta pumping plants (i.e., greater pumping draws more Sacramento River water through the Delta).

Sensitivity analyses conducted for Alternative 4 scenario H3 at the LLT indicated that removing all tidal restoration areas (such as is largely the case in Alternative 5A at the ELT) would reduce the number of exceedances by about 9 percentage points, but there would still be more exceedances than under Existing Conditions or the No Action Alternative. Sensitivity analyses also indicated that if the Head of Old River Barrier was open in April and May, exceedances would be reduced by about 5 percentage points. Both of these analyses also showed lower EC during April and May, including during times when modeling showed the objective to be exceeded. These sensitivity analyses were only run at the LLT, but it is expected that the findings can generally be extended to the ELT. Results of the sensitivity analyses indicate that the exceedances are partially a function of the restoration that was assumed in the Alternative 2D modeling, but partly due also to operations of the alternative itself, perhaps due to Head of Old River Barrier assumptions and south Delta export differences (see Appendix 8H, Attachment 1, in Appendix A of the RDEIR/SDEIS for more discussion of these sensitivity analyses). Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS contains a more detailed assessment of the likelihood of these exceedances estimated via modeling for Alternatives 1–9 impacting aquatic life beneficial uses. Specifically, Appendix 8H, Attachment 2, in Appendix A of the RDEIR/SDEIS discusses whether these exceedances might have indirect effects on striped bass spawning in the Delta, and concludes that the high level of uncertainty precludes making a definitive determination for those alternatives. However, based on the sensitivity analyses conducted, modeling of Alternative 5A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 5 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

San Joaquin River at Jersey Point

Modeling results indicated that the EC objective that applies between the San Joaquin River at Jersey Point and Prisoners Point also would be exceeded at Jersey Point more often under Alternative 5A than under Existing Conditions and the No Action Alternative (ELT). At Jersey Point, modeling results estimated that the percent of days the EC objective would be exceeded would increase from 0% under Existing Conditions, or 3% under the No Action Alternative (ELT), to 4% and the percent of days out of compliance with the EC objective would increase from 0% under Existing Conditions, or 3% under the No Action Alternative (ELT), to 5% (Table EC-9 in Appendix B of this RDEIR/SDEIS). The incremental increase in the frequency of objective exceedance relative to the No Action Alternative (ELT), which reflects only the effects due to the alternative, and not effects of climate change, sea level rise and water demands, would be 1%. This small incremental increase is within the model uncertainty and, thus, the alternative is not expected to contribute to exceedances during real-time operation of the alternative. Therefore, the incremental increase in objective exceedance shown in the modeling results is not expected to adversely affect aquatic life beneficial uses.

Suisun Marsh

For Suisun Marsh October–May is the period when Bay-Delta WQCP EC objectives for protection of fish and wildlife apply. Modeling results indicate that average EC for the entire period modeled would increase in the Sacramento River at Collinsville during the months of March through May relative to Existing Conditions, by 0.2 mS/cm (Table EC-11 in Appendix B of this RDEIR/SDEIS). In Montezuma Slough at National Steel, average EC levels would increase in December through March by 0.1–0.5 mS/cm (Table EC-12 in Appendix B of this RDEIR/SDEIS). The most substantial EC increase would occur in Montezuma Slough near Beldon Landing, with long-term average EC levels increasing by 1.4–5.8 mS/cm, depending on the month, at least doubling during some months the long-term average EC relative to Existing Conditions (Table EC-13 in Appendix B of this RDEIR/SDEIS). Sunrise Duck Club and Volanti Slough also would have long-term average EC increases during October–May ranging 1.4–3.7 mS/cm (Tables EC-14 and EC-15 in Appendix B of this RDEIR/SDEIS). Modeled long-term average EC increases in Suisun Marsh under Alternative 4A relative to the No Action Alternative (ELT) are similar to the increases relative to Existing Conditions.

However, modeling used for the assessment of Alternative 5A assumed no operation of the Montezuma Slough Salinity Control Gates, but the project description assumes continued operation of the Salinity Control Gates, consistent with assumptions included in the No Action Alternative. A sensitivity analysis modeling run conducted for Alternative 4 scenario H3 at the LLT with the gates operational consistent with the No Action Alternative resulted in substantially lower EC levels than indicated in the original Alternative 4 modeling results discussed above, but EC levels were still somewhat higher than EC levels under Existing Conditions and the No Action Alternative for several locations and months. Another modeling run with the gates operational and restoration areas removed resulted in EC levels nearly equivalent to Existing Conditions and the No Action Alternative (see Appendix 8H, Attachment 1, of the Draft EIR/EIS for more information on these sensitivity analyses). Since Alternative 5A at the ELT includes operation of the gates, and includes very little tidal restoration areas, it is anticipated that EC increases in Suisun Marsh predicted via the modeling would not occur, and that EC in Suisun Marsh under Alternative 5A would be very similar to Existing Conditions and No Action Alternative (ELT). Depending on where tidal restoration areas assumed to be included in the No Action Alternative are located, EC under Alternative 5A could be less than under the No Action Alternative (ELT). For these reasons, any changes in EC in Suisun Marsh are expected to have no adverse effect on marsh beneficial uses.

SWP/CVP Export Service Areas

Under Alternative 5A, at the Banks pumping plant, the frequency of exceedance of the EC objective would be 1% for the entire period modeled and 2% for the drought period modeled (Table EC-10 in Appendix B of this RDEIR/SDEIS). Relative to Existing Conditions, average EC levels under Alternative 5A would decrease 17% for the entire period modeled and 13% during the drought period modeled. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 13% for the entire period modeled and 11% during the drought period modeled (Table EC-17 in Appendix B of this RDEIR/SDEIS).

At the Jones pumping plant, the frequency of exceedance of the EC objective would be 2% for the entire period modeled and drought period modeled. Relative to Existing Conditions, average EC levels under Alternative 5A would decrease 14% for the entire period modeled and 13% during the drought period modeled. Relative to the No Action Alternative (ELT), average EC levels would similarly decrease, by 10% for the entire period modeled and drought period modeled (Table EC-17 in Appendix B of this RDEIR/SDEIS).

Commensurate with the EC decrease in exported waters, an improvement in lower San Joaquin River average EC levels would be expected since EC in the lower San Joaquin River is, in part, related to irrigation water deliveries from the Delta. While the magnitude of this expected lower San Joaquin River improvement in EC is difficult to predict, the relative decrease in overall loading of EC-elevating constituents to the Export Service Areas would likely alleviate or lessen any expected increase in EC at Vernalis related to decreased annual average San Joaquin River flows.

The export area of the Delta is listed on the state's CWA Section 303(d) list as impaired due to elevated EC Alternative 5A would result in lower average EC levels relative to Existing Conditions and the No Action Alternative (ELT) and, thus, would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters.

NEPA Effects: In summary, based on the results of the modeling and sensitivity analyses conducted, it is unlikely that there would be increased frequency of exceedance of agricultural EC objectives in the western, interior, or southern Delta. However, modeling results indicate that there could be increased long-term and drought period average EC levels during the summer months that would occur in the western Delta (i.e., in the Sacramento River at Emmaton) under Alternative 5A relative to the No Action Alternative (ELT), that could contribute to adverse effects on the agricultural beneficial uses. In addition, the increased frequency of exceedance of the San Joaquin River at Prisoners Point EC objective could contribute to adverse effects on fish and wildlife beneficial uses (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 5A, relative to the No Action Alternative (ELT), and thus it is not expected that they would contribute to additional beneficial use impairment. The increases in EC in the Sacramento River at Emmaton, particularly during summer months of dry and critical water years, and the additional exceedances of water quality objectives in the San Joaquin River at Prisoners Point constitute an adverse effect on water quality. Mitigation Measure WQ-11 would be available to reduce these effects.

CEQA Conclusion: River flow rate and reservoir storage reductions that would occur under Alternative 5A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in EC levels in the reservoirs and rivers upstream of the Delta, given that: changes in the quality of watershed runoff and reservoir inflows would not be expected to occur in the future; the state's regulation of point-source discharge effects on Delta salinity-elevating parameters and the expected further regulation as salt management plans are developed; the salt-related TMDLs adopted and being developed for the San Joaquin River; and the expected improvement in lower San Joaquin River average EC levels commensurate with the lower EC of the irrigation water deliveries from the Delta.

Relative to Existing Conditions, Alternative 5A would not result in any substantial increases in long-term average EC levels in the SWP/CVP Export Service Areas, and exceedance of the Bay-Delta WQCP EC objective would be infrequent. Average EC levels for the entire period modeled would decrease at both the Banks and Jones pumping plants and, thus, this alternative would not contribute to additional beneficial use impairment related to elevated EC in the SWP/CVP Export Service Areas waters. Rather, this alternative would improve long-term EC levels in the SWP/CVP Export Service Areas, relative to Existing Conditions.

Further, relative to Existing Conditions, Alternative 5A would not result in substantial increases in long-term average EC in Suisun Marsh. Thus, EC levels in Suisun Marsh are not expected to further degrade existing EC levels and thus would not contribute additionally to adverse effects on the fish and wildlife beneficial uses. Because EC is not bioaccumulative, any changes in long-term average EC levels would not directly cause bioaccumulative problems in fish and wildlife. Suisun Marsh is CWA Section 303(d) listed as impaired due to elevated EC, but EC levels are not expected to change substantially under Alternative 5A, relative to Existing Conditions, and thus it is not expected that they would contribute to additional beneficial use impairment.

In the Plan Area, Alternative 5A is not expected to result in an increase in the frequency with which Bay-Delta WQCP EC objectives are exceeded, except for at the San Joaquin River at Jersey Point (fish and wildlife objective: 4% increase) and Prisoners Point (fish and wildlife objective; 1% increase). These increased frequencies are due to the combined effects of operations of the alternative along with climate change, sea level rise and increased water demands. A comparison to the No Action Alternative (ELT) results reveals that the alternative would not contribute to additional exceedance at Jersey Point beyond the modeling uncertainty and, thus, there would likely be no adverse effects to aquatic life at Jersey Point. However, there would be a discernible increased frequency of exceedance of the fish and wildlife objective at Prisoners Point that could contribute to adverse effects on aquatic life (specifically, indirect adverse effects on striped bass spawning), though there is a high degree of uncertainty associated with this impact. However, modeling of Alternative 5A that did not contain restoration areas would likely show a lesser level of effects than presented herein (using the Alternative 5 ELT modeling), both in terms of frequency and magnitude of exceedance. Additionally, by adaptively managing the Head of Old River Barrier and the fraction of south Delta versus north Delta diversions, EC levels at Prisoners Point would likely be decreased to a level that would not adversely affect aquatic life beneficial uses.

Average EC levels at Emmaton would increase by 7% during the drought period modeled. The largest monthly average increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. The increases in drought period average EC levels could cause substantial water quality degradation that would potentially contribute to adverse effects on the agricultural beneficial uses in the western Delta. The comparison to Existing Conditions reflects changes in EC due to both Alternative 5A operations and climate change/sea level rise. The adverse effects expected to occur at Emmaton would be due in part to the effects of climate change/sea level rise, and in part due to Alternative 5A operations. This is evidenced by the significant effects expected in the No Action Alternative (ELT) at Emmaton relative to Existing Conditions, as well as the fact that a lesser level of adverse effects is expected at Emmaton under Alternative 5A relative to the No Action Alternative (ELT). During summer of dry and critical water years, additional flow in the Sacramento River at Emmaton would reduce or eliminate increases in EC. It is expected that for May–September of dry and critical water years, less pumping from the north Delta intakes and greater reliance on south Delta intakes would allow for enough flow in the Sacramento River at Emmaton to reduce water quality degradation to levels closer to the No Action Alternative that would not be expected to adversely affect beneficial uses. Because EC is not bioaccumulative, the increases in long-term average EC levels would not directly cause bioaccumulative problems in aquatic life or humans. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse.

Based on these findings, this impact in the Plan Area is considered to be significant. Implementation of Mitigation Measure WQ-11 would be expected to reduce these effects to a less than significant level.

Mitigation Measure WQ-11: Avoid, Minimize, or Offset, as Feasible, Reduced Water Quality Conditions

Please see Mitigation Measure WQ-11 in Section 4.3.4 of the RDEIR/SDEIS.

Impact WQ-12: Effects on Electrical Conductivity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16.

NEPA Effects: The implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would present no new direct sources of EC to the affected environment, including areas upstream of the Delta, within the Delta region, and in the SWP/CVP Export Service Areas. As they pertain to EC, implementation of these environmental commitments would not be expected to adversely affect any of the beneficial uses of the affected environment. Moreover, some habitat restoration activities would occur on lands within the Delta currently used for irrigated agriculture. Such replacement or substitution of land use activity is not expected to result in new or increased sources of EC to the Delta and, in fact, could decrease EC through elimination of high EC agricultural runoff.

Environmental Commitment 4 would result in some tidal habitat restoration, however, the areal extent would be small relative to the existing and No Action Alternative tidal area and, thus not expected to appreciably affect the magnitude of daily tidal water exchange at the restoration areas or alter other hydrodynamic conditions in adjacent Delta channels that would result in measurable EC changes.

In summary, implementation of the environmental commitments would not be expected to adversely affect EC levels in the affected environment and thus would not adversely affect beneficial uses or substantially degrade water quality with regard to EC within the affected environment. Therefore, the effects on EC from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 under Alternative 4A would not present new or substantially changed sources of EC to the affected environment. Some environmental commitments may replace or substitute for existing irrigated agriculture in the Delta. This replacement or substitution is not expected to substantially increase or present new sources of EC, and could actually decrease EC loads to Delta waters. Thus, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would have negligible, if any, adverse effects on EC levels throughout the affected environment and would not cause exceedance of applicable state or federal numeric or narrative water quality objectives/criteria that would result in adverse effects on any beneficial uses within affected water bodies. Further, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause significant long-term water quality degradation such that there would be greater risk of adverse effects on beneficial uses. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-13: Effects on Mercury Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of the Alternative 5A on mercury levels in surface waters upstream of the Delta relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). This is because factors which affect mercury concentrations in surface waters upstream of the Delta are similar under Alternatives 4 and 5A. The changes in flow in the Sacramento River under Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT) would not be of the magnitude of storm flows, in which substantial sediment-associated mercury is mobilized.

Therefore, mercury loading should not be substantially different due to changes in flow. In addition, even though it may be flow-affected, total mercury concentrations remain well below criteria at upstream locations. Any negligible changes in mercury concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to mercury. Both waterborne methylmercury concentrations and largemouth bass fillet mercury concentrations are expected to remain above guidance levels at upstream of Delta locations, but would not change substantially because the anticipated changes in flow are not expected to substantially change mercury loading relative to Existing Conditions or the No Action Alternative (ELT).

The upstream of Delta areas in the north will benefit from the implementation of the Cache Creek, Sulfur Creek, Harley Gulch, and Clear Lake Mercury. TMDLs and the American River methylmercury TMDL. These projects will target specific sources of mercury and methylation upstream of the Delta and could result in net improvement to Delta mercury loading in the future. The implementation of these projects could help to ensure that upstream of Delta environments will not be substantially degraded for water quality with respect to mercury or methylmercury.

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-14. See Chapter 8, Section 8.3.1.3, *Plan Area,* in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

The effects of Alternative 5A on waterborne concentrations of mercury (Table Hg-1 in Appendix B of this RDEIR/SDEIS) and methylmercury (Table Hg-2 in Appendix B of this RDEIR/SDEIS), and fish tissue mercury concentrations for largemouth bass fillet (Tables Hg-13 and Hg-14 in Appendix B of this RDEIR/SDEIS) were evaluated for nine Delta locations.

Similar to Alternative 4, increases in long-term average mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) would be very small, 0.1 ng/L or less. Also, use of assimilative capacity for mercury relative to the 25 ng/L ecological threshold under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT), would be very low, about 1% or less for all Delta locations (Table Hg-16 in Appendix B of this RDEIR/SDEIS). These concentration changes and small changes in assimilative capacity for mercury are not expected to result in adverse (or positive) effects to beneficial uses.

Changes in methylmercury concentrations in water also are expected to be very small. The greatest annual average methylmercury concentration under Alternative 5A would be 0.169 ng/L for the San Joaquin River at Buckley Cove, for the drought period modeled, which would be slightly higher than

Existing Conditions (0.161 ng/L) and the No Action Alternative (ELT) (0.168 ng/L) (Table Hg-2 in Appendix B of this RDEIR/SDEIS). All methylmercury concentrations in water were estimated to exceed the TMDL guidance objective of 0.06 ng/L under Existing Conditions and, therefore, no assimilative capacity exists.

Fish tissue estimates for largemouth bass fillet show small or no increases in mercury concentrations relative to Existing Conditions and the No Action Alternative (ELT) based on long-term annual average concentrations for mercury at the Delta locations. Concentrations expected for Alternative 5A, with Equation 1, show increases of 5 percent or less, relative to Existing Conditions and the No Action Alternative (ELT), in all years (Table Hg-13 in Appendix B of this RDEIR/SDEIS). With Equation 2, increases relative to Existing Conditions and the No Action Alternative (ELT) are estimated to be <1 percent. Because the increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a complete discussion of the uncertainty associated with the fish tissue estimates.

Briefly, the bioaccumulation models contain multiple sources of uncertainty associated with their development. These are related to: analytical variability; temporal and/or seasonal variability in Delta source water concentrations of merthylmercury; interconversion of mercury species (i.e., the non-conservative nature of methylmercury as a modeled constituent); and limited sample size (both in number of fish and time span over which the measurements were made), among others. Although there is considerable uncertainty in the models used, the results serve as a reasonable approximations of a very complex process. Considering the uncertainty, small (i.e., < 20–25%) increases or decreases in modeled fish tissue mercury concentrations at a low number of Delta locations (i.e., 2–3) should be interpreted to be within the uncertainty of the overall approach, and not predictive of actual adverse effects. Larger increases, or increases evident throughout the Delta, can be interpreted as more reliable indicators of potential adverse effects.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

SWP/CVP Export Service Areas

The analysis of mercury and methylmercury in the SWP/CVP Export Service Areas was based on concentrations estimated at the Banks and Jones pumping plants. Both waterborne total and methylmercury concentrations for Alternative 5A, at the Jones and Banks pumping plants were lower than Existing Conditions and the No Action Alternative (ELT) (Tables Hg-1 and Hg-2 in Appendix B of this RDEIR/SDEIS). Therefore, mercury shows an increased assimilative capacity at these locations (Table Hg-16 in Appendix B of this RDEIR/SDEIS).

The largest improvements in largemouth bass tissue mercury concentrations and Exceedance Quotients ([EQs]; modeled tissue divided by TMDL guidance concentration) for Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT) at any location within the Delta are expected for the Banks and Jones pumping plants export pump locations. Concentrations expected for Alternative 5A at the export pump locations with Equation 2 in all years show decreases relative to Existing Conditions (14% to 16%) and relative to the No Action Alternative (ELT) (15% to 18%) (Table Hg-14 in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on mercury are expected to be similar to those described above.

NEPA Effects: Based on the above discussion, Alternative 5A would not cause concentrations of mercury and methylmercury in water and fish tissue in the affected environment to be substantially different from the No Action Alternative (ELT and LLT) and, thus, would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to the No Action Alternative (ELT and LLT), Alternative 5A would not be expected to increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, the effects of Alternative 5A on mercury in the affected environment are considered to be not adverse.

CEQA Conclusion: Under Alternative 5A, greater water demands and climate change would alter the magnitude and timing of reservoir releases and river flows upstream of the Delta in the Sacramento River watershed and east-side tributaries, relative to Existing Conditions. Concentrations of mercury and methylmercury upstream of the Delta would not be substantially different relative to Existing Conditions due to the lack of important relationships between mercury/methylmercury concentrations and flow for the major rivers.

Methylmercury concentrations exceed criteria at all locations in the Delta and no assimilative capacity exists. However, monthly average waterborne concentrations of total and methylmercury, over the period of record, under Alternative 5A would be very similar to Existing Conditions. Similarly, estimates of fish tissue mercury concentrations show small differences would occur among sites for Alternative 5A as compared to Existing Conditions for Delta sites.

Assessment of effects of mercury in the SWP/CVP Export Service Areas were based on effects on mercury concentrations and fish tissue mercury concentrations at the Banks and Jones pumping plants. The Banks and Jones pumping plants are expected to show increased assimilative capacity for waterborne mercury and decreased fish tissue concentrations of mercury for Alternative 5A, all scenarios, as compared to Existing Conditions.

As such, Alternative 5A is expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, Alternative 5A would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-14: Effects on Mercury Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** The potential types of effects on mercury resulting from implementation of the environmental commitments under Alternative 5A would be generally similar to those described under Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of the RDEIR/SDEIS). However, the magnitude of effects on mercury and methylmercury at locations upstream of the Delta, in the Delta, and the SWP/CVP Export Service Areas related to habitat restoration would be considerably lower than described for Alternative 4. This is because the amount of habitat restoration to be implemented under Alternative 5A would be very low compared to the total proposed restoration area that would be implemented under Alternative 4. The small amount of habitat restoration to be implemented under Alternative 5A may occur on lands in the Delta formerly used for irrigated agriculture. Habitat restoration proposed under Alternative 5A has the potential to increase water residence times and increase accumulation of organic sediments that are known to enhance methylmercury bioaccumulation in biota in the vicinity of the restored habitat areas. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, the uncertainties related to site-specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta in the vicinity of the restored areas. Therefore, the effect of Environmental Commitments 3, 4, 6–12, 15, and 16 on mercury and methylmercury is considered to be adverse.

***CEQA Conclusion*:** There would be no substantial, long-term increase in mercury or methylmercury concentrations or loads in the rivers and reservoirs upstream of the Delta or the waters exported to the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 relative to Existing Conditions. However, in the Delta, due to the small amount of tidal restoration areas proposed, relative to Existing Conditions, uptake of mercury from water and/or methylation of inorganic mercury may increase in localized areas as part of the creation of new, marshy, shallow, or organic-rich restoration areas. Although not quantifiable, on a local level, increases in methylmercury concentrations may be measurable. Methylmercury is CWA Section 303(d)-listed within the affected environment, and therefore any potential measurable increase in methylmercury concentrations would make existing mercury-related impairment measurably worse. Because mercury is bioaccumulative, increases in water-borne mercury or methylmercury that could occur in some areas could bioaccumulate to somewhat greater levels in aquatic organisms and would, in turn, pose health risks to fish, wildlife, or humans. Design of restoration sites would be guided by Environmental Commitment 12, which requires development of site-specific mercury management plans as restoration actions are implemented. The effectiveness of minimization and mitigation actions implemented according to the mercury management plans is not known at this time, although the potential to reduce methylmercury concentrations exists based on current research. Although Environmental Commitment 12 would be implemented with the goal to reduce this potential effect, the uncertainties related to site specific restoration conditions and the potential for increases in methylmercury concentrations in the Delta result in this potential impact being considered significant. No mitigation measures would be available until specific restoration actions are proposed. Therefore, this impact is considered significant and unavoidable.

Impact WQ-15: Effects on Nitrate Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

As described for Alternative 4 (in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), nitrate levels in the major rivers (Sacramento, Feather, American) are low, generally due to ample dilution available in the reservoirs and rivers relative to the magnitude of the point and non-point source discharges, and there is no correlation between historical water year average nitrate concentrations and water year average flow in the Sacramento River at Freeport. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions or the No Action Alternative (ELT), are expected to have negligible, if any, effects on average reservoir and river nitrate-N concentrations in the Sacramento River watershed upstream of the Delta.

In the San Joaquin River watershed, nitrate concentrations are higher than in the Sacramento River watershed, owing to use of nitrate based fertilizers throughout the lower watershed. The correlation between historical water year average nitrate concentrations and water year average flow in the San Joaquin River at Vernalis is a weak inverse relationship—that is, generally higher flows result in lower nitrate concentrations, while low flows result in higher nitrate concentrations (linear regression r^2=0.49; Figure 2 in Appendix 8J, *Nitrate*, of the Draft EIR/EIS). Under Alternative 5A, long-term average flows at Vernalis would decrease an estimated 1% relative to Existing Conditions and would remain virtually the same relative to the No Action Alternative (ELT). Given the relatively small decreases in flows and the weak correlation between nitrate and flows in the San Joaquin River, it is expected that nitrate concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under the No Action Alternative (ELT and LLT).

In the LLT, the primary difference will be changes in flow regime due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any negligible changes in nitrate concentrations that may occur under Alternative 5A in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies, with regard to nitrate.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Effects of environmental commitments not attributable to hydrodynamics are discussed within

Impact WQ-16. See section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Mass balance calculations indicate that under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives (Table N-8 in Appendix B of this RDEIR/SDEIS). Although changes at specific Delta locations and for specific months may be substantial on a relative basis (Table N-10 in Appendix B of this RDEIR/SDEIS), the absolute concentration of nitrate in Delta waters would remain low (<1.4 mg/L-N) in relation to the drinking water MCL of 10 mg/L-N, as well as all other thresholds (see *Nitrate* within Chapter 8, Section 8.3.17, *Constituent-Specific Considerations Used in the Assessment*, in Appendix A of the RDEIR/SDEIS). Long-term average nitrate concentrations are anticipated to remain below 0.5 mg/L-N at all 11 Delta assessment locations except the San Joaquin River at Buckley Cove, where long-term average concentrations would be somewhat above 1 mg/L-N. Nevertheless, at this location, long-term average nitrate concentration would be similar under Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT). Overall, the difference in long-term average nitrate concentrations at various locations throughout the Delta under Alternative 5A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L). As was similarly concluded for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), no additional exceedances of the MCL are anticipated at any location under Alternative 5A, regardless of operations scenario (Table N-8 in Appendix B of this RDEIR/SDEIS).

Use of assimilative capacity relative to the drinking water MCL of 10 mg/L-N under Alternative 5A would be low or negligible (i.e., <3%) in comparison to both Existing Conditions and the No Action Alternative (ELT), for all locations and months, for all modeled years (1976–1991), and for the drought period (1987–1991) (Table N-12 in Appendix B of this RDEIR/SDEIS). Changes in use of assimilative capacity relative to existing conditions and the No Action Alternative (ELT) under Alternative 5A would be approximately the same as described for Alternative 4.

As described for Alternative 4, actual nitrate concentrations would likely be higher than the modeling results indicate in certain locations under Alternative 5A. This is the mass balance modeling does not account for contributions from the SRWTP, which would be implementing nitrification/partial denitrification, or Delta wastewater treatment plant dischargers that practice nitrification, but not denitrification. However, for the reasons described for Alternative 4, any increases in nitrate concentrations that may occur at certain locations within the Delta under Alternative 5A would not be of frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the water quality at these locations, with regard to nitrate.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

SWP/CVP Export Service Areas

Assessment of effects of Alternative 5A on nitrate in the SWP/CVP. Export Service Areas is based on effects on nitrate at the Banks and Jones pumping plants.

Results of the mass balance calculations indicate that relative to Existing Conditions and the No Action Alternative (ELT), nitrate concentrations at Banks and Jones pumping plants under Alternative 5A are anticipated to decrease on a long-term average annual basis (Table N-8 in Appendix B of this RDEIR/SDEIS). During the late summer, particularly in the drought period assessed, concentrations are expected to increase substantially on a relative basis (i.e., up to 110%), but the absolute value of these changes (i.e., in mg/L-N) would be small. Additionally, given the many factors that contribute to potential algal blooms in the SWP and CVP canals within the Export Service Areas, and the lack of studies that have shown a direct relationship between nutrient concentrations in the canals and reservoirs and problematic algal blooms in these water bodies, there is no basis to conclude that these small (i.e., generally <0.2 mg/L-N), seasonal increases in nitrate concentrations would increase the potential for problem algal blooms in the SWP/CVP Export Service Areas. Overall, the difference in long-term average nitrate concentrations at Banks and Jones pumping plants under Alternative 5A compared to Alternative 4 would be negligible (i.e., <0.1 mg/L) (Table N-10 in Appendix B of this RDEIR/SDEIS). As was similarly concluded for Alternative 4, no additional exceedances of the MCL are anticipated under Alternative 5A (Table N-8 in Appendix B of this RDEIR/SDEIS). On a monthly average basis and on a long-term annual average basis, for all modeled years and for the drought period only, use of assimilative capacity available under Existing Conditions and the No Action Alternative (ELT), relative to the 10 mg/L-N MCL, would be negligible (<2.4%) for both Banks and Jones pumping plants (Table N-12 in Appendix B of this RDEIR/SDEIS). Use of assimilative capacity relative to Existing Conditions and the No Action Alternative (ELT) for Alternative 5A would be slightly less than expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on nitrate are expected to be similar to those described above.

Any increases in nitrate concentrations that may occur in water exported via Banks and Jones pumping plants are not expected to result in adverse effects to beneficial uses or substantially degrade the quality of exported water, with regard to nitrate.

NEPA Effects: Modified reservoir operations and subsequent changes in river flows under Alternative 5a, relative to the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed. In the Delta, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any Delta location, and use of assimilative capacity available under the No Action Alternative, relative to the drinking water MCL of 10 mg/L-N, would be low. Long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to differ negligibly relative to the No Action Alternative (ELT and LLT) and no additional exceedances of the 10 mg/L-N MCL are anticipated. Therefore, the effects on nitrate from implementing water conveyance facilities are considered to be not adverse.

CEQA Conclusion: Nitrate concentrations are generally low in the reservoirs and rivers of the watersheds, owing to substantial dilution available for point sources and the lack of substantial nonpoint sources of nitrate upstream of the SRWTP in the Sacramento River watershed, and in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers).Although higher in the San Joaquin River watershed, nitrate concentrations are not well-correlated with flow rates. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions, are expected to have negligible, if any, effects on reservoir and river nitrate concentrations upstream of Freeport in the Sacramento River watershed and upstream of the Delta in the San Joaquin River watershed.

In the Delta, results of the mass balance calculations indicate that under Alternative 5A, relative to Existing Conditions, nitrate concentrations throughout the Delta are anticipated to remain low (<1.4 mg/L-N) relative to adopted objectives. No additional exceedances of the 10 mg/L-N MCL are anticipated at any location, and use of assimilative capacity available under Existing Conditions, relative to the drinking water MCL of 10 mg/L-N, would be low or negligible (i.e., <2%) for virtually all locations and months.

Assessment of effects of nitrate in the SWP/CVP Export Service Areas is based on effects on nitrate concentrations at the Banks and Jones pumping plants. Results of the mass balance calculations indicate that under Alternative 5A, relative to Existing Conditions, long-term average nitrate concentrations at Banks and Jones pumping plants are anticipated to change negligibly. No additional exceedances of the 10 mg/L-N MCL are anticipated, and use of assimilative capacity available under Existing Conditions, relative to the MCL would be negligible (i.e., <2.2%) for both Banks and Jones pumping plants for all months.

Based on the above, there would be no substantial, long-term increase in nitrate concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the SWP/CVP Export Service Areas under Alternative 5A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any increases that may occur in some areas and months would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, increases that may occur in some areas and months would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-16: Effects on Nitrate Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Some habitat restoration activities included in Environmental Commitments 3, 4, and 6–11 would occur on lands within the Delta formerly used for agriculture. As discussed for Impact WQ-2, increased biota that may result in those areas may increase ammonia, which in turn may be converted to nitrate by established microbial communities. However, the areal extent of the new habitat implemented for the Environmental Commitments would be less than the existing and No Action Alternative habitat areas, and similar habitat exists currently in the Delta and is not identified as contributing to adverse nitrate conditions. Thus, these land use changes would not be expected to substantially increase nitrate concentrations in the Delta. Implementation of Environmental Commitments 12, 15, and 16 do not include actions that would affect nitrate sources or loading. Based on these findings, the effects on nitrate from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

***CEQA Conclusion*:** Land use changes that would occur from the environmental commitments are not expected to substantially increase nitrate concentrations, because the amount of area to be converted would be small relative to existing habitat, and existing habitats are not known for contributing to adverse nitrate conditions. Thus, it is expected that implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because nitrate concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Nitrate is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing nitrate-related impairment measurably worse because no such impairments currently exist. Because nitrate is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-17: Effects on Dissolved Organic Carbon Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 5A on DOC concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 because factors affecting DOC concentrations in these water bodies would be similar. Moreover, long-term average flow and DOC levels in the Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated. Thus changes in system operations and resulting reservoir storage levels and river flows under Alternative 5A would not be expected to cause substantial long-term changes in DOC concentrations in the water bodies upstream of the Delta. Any changes in DOC levels in water bodies upstream of the Delta under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be of sufficient frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies.

Delta

Effects of water conveyance facilities on long-term average DOC concentrations under Alternative 5A in the Delta would be similar to the effects discussed for Alternative 4. To the extent that habitat restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration under Alternative 5A because very little would occur relative to Alternative 4. Other effects of environmental commitments not attributable to hydrodynamics are discussed in Impact WQ-18. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Under Alternative 5A, the geographic extent of effects pertaining to long-term average DOC concentrations in the Delta would be less extensive, and the magnitude of predicted long-term change and relative frequency of concentration threshold exceedances would be lower than described for Alternative 4. The effects of Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT) are discussed together because the direction and magnitude of predicted change are similar. Relative to the Existing Conditions and No Action Alternative (ELT), Alternative 5A would result in small increases in long-term average DOC concentrations for both the modeled 16-year period (1976–1991) and drought period (1987–1991) at several interior Delta locations (increases up to 0.2 mg/L at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1) (Table DOC-2 in Appendix B of this RDEIR/SDEIS). The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at the Contra Costa Pumping Plant #1 associated with the 3 mg/L threshold (i.e., increase from 52% under Existing Conditions to 59% under Alternative 5A for the modeled 16-year period). The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower.

While Alternative 5A would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. As discussed for Alternative 4, substantial changes in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 5A are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Relative to Existing Conditions and the No Action Alternative (ELT and LLT), Alternative 5A would lead to predicted improvements in long-term average DOC concentrations at Barker Slough, as well as Banks and Jones pumping plants (discussed below).

SWP/CVP Export Service Areas

Under the Alternative 5A, long-term average DOC concentrations would decrease at Barker Slough and at the Banks and Jones pumping plants relative to Existing Conditions (as much as 0.2 mg/L), and the reductions would be similar compared to No Action Alternative (ELT) (Table DOC-2 in Appendix B of this RDEIR/SDEIS). Decreases in long-term average DOC would result in generally lower exceedance frequencies for concentration thresholds, although the frequency of exceedances of the 3 mg/L threshold during the modeled drought period would increase at the Banks and Jones pumping plants (i.e., increase at Banks pumping plant from 57% under Existing Conditions to 80% under Alternative 5A). Comparisons to the No Action Alternative (ELT) yield similar trends, but with slightly smaller magnitude drought period changes.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above.

Maintenance of SWP and CVP facilities under Alternative 5A would not be expected to create new sources of DOC or contribute towards a substantial change in existing sources of DOC in the affected area.

NEPA Effects: In summary, the operations and maintenance activities under Alternative 5A, relative to the No Action Alternative (ELT and LLT), would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. The long-term average DOC concentrations at the Barker Slough and Banks and Jones pumping plants are predicted to decrease (by up to 0.2 mg/L), while long-term average DOC concentrations for some Delta interior locations are predicted to increase by as much as 0.2 mg/L. However, the increase in long-term average DOC concentration that could occur within the Delta interior would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters. Based on these findings, the effect of operations and maintenance activities on DOC under Alternative 5A is determined to be not adverse.

CEQA Conclusion: For the same reasons described for Alternative 4, the operations and maintenance activities under Alternative 5A, relative to the Existing Conditions, would not cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in DOC levels upstream of the Delta. Moreover, long-term average flow and DOC at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in DOC concentrations upstream of the Delta.

Relative to Existing Conditions, the Alternative 5A would result in relatively small increases (i.e., ≤0.2 mg/L) in long-term average DOC concentrations at some interior Delta locations. The predicted increases under the operational scenarios modeled would not substantially increase the frequency with which long-term average DOC concentrations exceeds 2, 3, or 4 mg/L. While the operational scenarios would lead to slightly higher long-term average DOC concentrations at the interior Delta locations and some municipal water intakes, the predicted changes would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

Relative to Existing Conditions, Alternative 5A would result in reduced long-term average DOC concentrations at the Banks and Jones pumping plants and Barker Slough. However, Alternative 5A would result in slightly greater frequency of exceedance of the 3 mg/L DOC concentration threshold during the modeled drought period. Nevertheless, an overall improvement in DOC-related water quality would be predicted in the SWP/CVP Export Service Areas.

Based on the above, the operations and maintenance activities of Alternative 5A would not result in any substantial change in long-term average DOC concentration. The increases in long-term average DOC concentration that could occur within the Delta would not be of sufficient magnitude to adversely affect the MUN beneficial use, or any other beneficial uses, of Delta waters or waters of the SWP/CVP Service Area. Because DOC is not bioaccumulative, the increases in long-term average DOC concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to

DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-18: Effects on Dissolved Organic Carbon Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Relative to existing habitat and that to be developed under the No Action Alternative (ELT and LLT), the area of new habitat restoration implemented for the environmental commitments would be very small. Implementation of non-habitat restoration environmental commitments would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, any increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Based on these findings, the effect of the environmental commitments on DOC is determined to be not adverse.

CEQA Conclusion: Implementation of habitat restoration environmental commitments is not expected to cause a substantial long-term change in DOC concentrations in the water bodies upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas, relative to the Existing Conditions, because the land area proposed for restoration would be relatively small compared to existing land area and sources of DOC. Implementation of other environmental commitments also would not be expected to have substantial, if even measurable, effect on DOC concentrations upstream of the Delta, within the Delta, and in the SWP/CVP Export Service Areas, because they would present no major sources of DOC to the affected environment. Consequently, increases in average DOC levels in the affected environment are not expected to be of sufficient frequency, magnitude and geographic extent that would adversely affect the MUN beneficial use, or any other beneficial uses, of the affected environment, nor would potential increases substantially degrade water quality with regard to DOC. Furthermore, DOC is not bioaccumulative, therefore changes in DOC concentrations would not cause bioaccumulative problems in aquatic life or humans. Finally, DOC is not causing beneficial use impairments and thus is not CWA Section 303(d) listed for any water body within the affected environment. Because long-term average DOC concentrations are not expected to increase substantially, no long-term water quality degradation with respect to DOC is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-19: Effects on Pathogens Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 5A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described for Alternative 4, pathogen concentrations in the Sacramento and San Joaquin Rivers have a minimal relationship to flow rate in these rivers. Further, urban runoff contributions during the dry season would be expected to be a relatively small fraction of the rivers' total flow rates. During wet weather events, when urban runoff contributions would be higher, the flows in the rivers also would be higher. Given the small magnitude of urban runoff contributions relative to the magnitude of river flows and that pathogen concentrations in the rivers have a minimal relationship to river flow rate, river flow rate and reservoir storage reductions that would occur under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in pathogen concentrations in the reservoirs and rivers upstream of the Delta.

The effects of Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be changes in the relative percentage of water throughout the Delta being comprised of various source waters (i.e., water from the Sacramento River, San Joaquin River, Bay water, eastside tributaries, and agricultural return flow), due to potential changes in inflows particularly from the Sacramento River watershed. However, as described for Alternative 4, it is expected there would be no substantial change in Delta pathogen concentrations in response to a shift in the Delta source water percentages under this alternative or substantial degradation of these water bodies, with regard to pathogens, because it is expected that pathogen sources in close proximity to Delta sites would have a greater influence on pathogen levels at the site, rather than the primary source(s) of water to the site. In-Delta potential pathogen sources, including water-based recreation, tidal habitat, wildlife, and livestock-related uses, would continue under this alternative. As such, there is not expected to be substantial, if even measurable, changes in pathogen concentrations in the SWP/CVP Export Service Area waters.

As such, Alternative 5A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or U.S. EPA-recommended pathogen criteria would be exceeded in water bodies of the affected environment located upstream of the Delta or substantially degrade the quality of these water bodies, with regard to pathogens.

NEPA Effects: Because pathogen levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on pathogens from implementing Alternative 5A are determined to not be adverse.

CEQA Conclusion: The effects of Alternative 5A on pathogen levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas, relative to Existing Conditions, would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because the factors that would affect pathogen levels in the surface waters of these areas would be similar. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-20: Effects on Pathogens Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Environmental Commitments 3, 4, and 6–11 would involve habitat restoration actions. This could result in localized increases in wildlife-related coliforms relative to the No Action Alternative (ELT and LLT). The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. The remaining environmental commitments would not be expected to affect pathogen levels, because they are actions that do not affect the presence of pathogen sources. Based on these findings, the effects on pathogens from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to not be adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, and 6–11 could result in localized increases in wildlife-related coliforms relative to Existing Conditions. The Delta currently supports similar habitat types and, with the exception of the CWA Section 303(d) listing for the Stockton Deep Water Ship Channel, is not recognized as exhibiting pathogen concentrations that rise to the level of adversely affecting beneficial uses. As such, the potential increase in wildlife-related coliform concentrations due to tidal habitat creation is not expected to adversely affect beneficial uses. Therefore, the environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pathogen concentrations are not expected to increase substantially, no long-term water quality degradation for pathogens is expected to occur and, thus, no adverse effects on beneficial uses would occur. The San Joaquin River in the Stockton Deep Water Ship Channel is CWA Section 303(d) listed for pathogens. Because no measurable increase in Deep Water Ship Channel pathogen concentrations are expected to occur on a long-term basis, further degradation and impairment of this area is not expected to occur. Finally, pathogens are not bioaccumulative constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-21: Effects on Pesticide Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 5A on pesticide levels in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT), would be similar to those expected to occur under Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because under Alternative 5A, the primary factor that would influence pesticide concentrations in surface waters upstream of the Delta—the effect of timing and magnitude of reservoir releases on dilution capacity—is expected to change by a similar degree. As shown in Tables P-1 through P-4 in Appendix B of this RDEIR/SDEIS, changes in average winter and summer flow rates, relative to Existing Conditions and the No Action Alternative (ELT), are expected to be similar to or less than changes in flow rates expected under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis (shown in Tables 1–4 in Appendix 8L, *Pesticides*, of the Draft EIR/EIS). Similarly, the primary factor that would influence pesticide concentrations in surface waters of the Delta and in the SWP/CVP Export Service Areas (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As shown for Alternative 5A (Figures B.4-89 through B.4-110 in Appendix B of this RDEIR/SDEIS), the percent change in monthly average source water fractions would be similar to changes expected under Alternative 4 (Figures 133–175 in Appendix 8D, *Source Water Fingerprinting Results*, of the Draft EIR/EIS).

It was concluded for Alternative 4, and thus for Alternative 5A based on similar flow changes, that the potential average summer flow reductions would not be of sufficient magnitude to substantially increase in-river pesticide concentrations or alter the long-term risk of pesticide-related effects on aquatic life beneficial uses upstream of the Delta. Greater long-term average flow reductions, and corresponding reductions in dilution/assimilative capacity, would be necessary before long-term risk of pesticide related effects on aquatic life beneficial uses would be adversely altered. Similarly, the modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 5A would not be of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses of the Delta. Based on the general observation that San Joaquin River, in comparison to the Sacramento River, is a greater contributor of organophosphate insecticides in terms of greater frequency of incidence and presence at concentrations exceeding water quality benchmarks, modeled increases in Sacramento River fraction at Banks and Jones would generally represent an improvement in export water quality respective to pesticides.

The flow changes in the LLT would be expected in the ranges of that described above for Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT), and that described for Alternative 4 relative to the No Action Alternative (LLT) in Chapter 8, Section 8.3.3.9, in Appendix A of this RDEIR/SDEIS. Thus, similar to above and Alternative 4, the flow changes that would occur in the LLT under Alternative 5A, relative to Existing Conditions and the No Action Alternative (LLT), would not be expected to result in changes in dilution of pesticides of sufficient magnitude to substantially alter the long-term risk of pesticide-related toxicity to aquatic life, nor adversely affect other beneficial uses upstream of the Delta, in the Delta, or the SWP/CVP Export Service Areas.

NEPA Effects: In summary, the changes in long-term average flows on the Sacramento, Feather, American, and San Joaquin Rivers under Alternative 5A relative to the No Action Alternative (ELT and LLT) would be of insufficient magnitude to substantially increase the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in these water bodies upstream of the Delta. Similarly, changes in source water fractions to the Delta would be of insufficient magnitude to substantially alter the long-term risk of pesticide-related water quality degradation and related toxicity to aquatic life in the Delta or CVP/SWP Export Service Areas. Therefore, the effects on pesticides from the water conveyance facilities are determined not to be adverse.

***CEQA Conclusion*:** Based on the discussion above, the effects of Alternative 5A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to or slightly less than those described for the Alternative 4. The considered operational scenarios of Alternative 5A would not result in any substantial change in long-term average pesticide concentration or result in substantial increase in the anticipated frequency with which long-term average pesticide concentrations would exceed aquatic life toxicity thresholds or other beneficial use effect thresholds upstream of the Delta, at the 11 assessment locations analyzed for the Delta, or the SWP/CVP service area. Numerous pesticides are currently used throughout the affected environment, and while some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence for their presence in waters affected by SWP and CVP operations (i.e., diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative, and thus changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, while there are numerous CWA Section 303(d) listings throughout the affected environment that name pesticides as the cause for beneficial use impairment, the modeled changes in upstream river flows and Delta source water fractions under Scenarios H3–H4 would not be expected to make any of these beneficial use impairments measurably worse. Because long-term average pesticide concentrations are not expected to increase substantially, no long-term water quality degradation with respect to pesticides is expected to occur and, thus, no adverse effects on beneficial uses would occur. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-22: Effects on Pesticide Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on pesticides from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of pesticides, and the potential short-term loading from former agricultural lands would be expected to degrade and dissipate rapidly, such that pesticide levels would differ little from Existing Conditions. Therefore, implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in pesticide concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas. As such, these environmental commitments are not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because pesticide concentrations are not expected to increase substantially, no long-term water quality degradation for pesticides is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term pesticide concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Environmental Commitments 3, 4, 6–12, 15, 16 do not include the use of pesticides known to be bioaccumulative in animals or humans, nor do the environmental commitments propose the use of any pesticide currently named in a CWA Section 303(d) listing of the affected environment. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-23: Effects on Phosphorus Concentrations Resulting from Facilities Operations and Maintenance

The effects of Alternative 5A on phosphorus concentrations in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas would be similar to those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because factors which affect phosphorus concentrations in surface waters of these areas are the same under Alternative 4 and Alternative 5A. As described for Alternative 4, phosphorus loading to waters upstream of the Delta is not anticipated to change, and because changes in flows do not necessarily result in changes in concentrations or loading of phosphorus to these water bodies, substantial changes in phosphorus concentration are not anticipated under Alternative 5A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), upstream of the Delta. Phosphorus concentrations may increase during January through March at locations in the Delta where the source fraction of San Joaquin River water increases, due to the higher concentration of phosphorus in the San Joaquin River during these months compared to Sacramento River water or San Francisco Bay water. However, based on the DSM2 fingerprinting results (Figures B.4-1 through B.4-66 in Appendix B of this RDEIR/SDEIS), together with source water concentrations (in Figure 8-56 in

Appendix A of the RDEIR/SDEIS), the magnitude of increases during these months is expected to be negligible to low (i.e., <0.02 mg/L) at all Delta locations relative to Existing Conditions and the No Action Alternative (ELT and LLT). Thus, phosphorus concentrations in the Delta and waters exported from Banks and Jones pumping plants to the SWP/CVP Export Service Areas are expected to be similar to Existing Conditions and the No Action Alternative (ELT and LLT).

NEPA Effects: In summary, operation of the water conveyance facilities would have little to no effect on phosphorus concentrations in water bodies upstream of the Delta, in the Plan Area, and the waters exported to the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT). Thus, effects of the water conveyance facilities on phosphorus are considered to be not adverse.

CEQA Conclusion**:** The effects of Alternative 5A on phosphorus levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions would be similar to those described for the Alternative 4. There would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Plan Area, or the waters exported to the CVP and SWP service areas under Alternative 5A relative to Existing Conditions. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because phosphorus concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and thus any minor increases that may occur in some areas would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, minor increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-24: Effects on Phosphorus Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects**:** Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, relative to the No Action Alternative (ELT and LLT), the effects on phosphorus from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: Environmental Commitments 3, 4, 6–12, 15, and 16 do not involve actions that would contribute long-term additional loading of phosphorus. Therefore, there would be no substantial, long-term increase in phosphorus concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the waters exported to the SWP/CVP Export Service Areas due to implementation of these environmental commitments relative to Existing Conditions. Because phosphorus concentrations are not expected to increase substantially due to these environmental commitments, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Phosphorus is not CWA Section 303(d) listed within the affected environment and, thus, the environmental commitments would not make any existing phosphorus-related impairment measurably worse because no such impairments currently exist. Because phosphorus is not bioaccumulative, any increases that may occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-25: Effects on Selenium Concentrations Resulting from Facilities Operations and Maintenance

Upstream of the Delta

The effects of Alternative 5A on selenium concentrations in reservoirs and rivers upstream of the Delta would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), because factors affecting selenium concentrations in these water bodies would be similar. Substantial point sources of selenium do not exist upstream in the Sacramento River watershed, in the watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), or upstream of the Delta in the San Joaquin River watershed. Nonpoint sources of selenium within the watersheds of the Sacramento River and the eastern tributaries also are relatively low, resulting in generally low selenium concentrations in the reservoirs and rivers of those watersheds. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions or the No Action Alternative (ELT and LLT), are expected to have negligible, if any, effects on reservoir and river selenium concentrations upstream of Freeport in the Sacramento River watershed or in the eastern tributaries upstream of the Delta. Similarly, it is expected that selenium concentrations in the San Joaquin River would be minimally affected, if at all, by anticipated changes in flow rates under Alternative 5A, given the relatively small decreases in flows and the considerable variability in the relationship between selenium concentrations and flows in the San Joaquin River. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Delta

Modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. To the extent that restoration actions alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance. Other effects of environmental commitments not attributable to hydrodynamics are discussed within Impact WQ-26. See Chapter 8, Section 8.3.1.3, *Plan Area*, in Appendix A of the RDEIR/SDEIS for more information regarding the hydrodynamic modeling methodology.

Alternative 5A would result in small changes in average selenium concentrations in water relative to Existing Conditions and No Action Alternative (ELT) at all modeled Delta assessment locations (Table Se-1 in Appendix B of this RDEIR/SDEIS). Long-term average concentrations at some interior and western Delta locations would increase by 0.01–0.02 μg/L for the entire period modeled (1976–1991). These small increases in selenium concentrations in water would result in small reductions (1% or less) in available assimilative capacity for selenium, relative to USEPA's draft water quality criterion of 1.3 μg/L (Table Se-8d in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water under Alternative 5A (range 0.09–0.39 μg/L) would be similar to Existing Conditions (range 0.09–0.41 μg/L) and the No Action Alternative (ELT) (range 0.09–0.39

µg/L), and would be below the draft water quality criterion of 1.3 µg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS). These changes would be nearly identical to those under Alternative 4.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 5A would result in small changes (about 1% or less) in estimated selenium concentrations in most biota (whole-body fish, bird eggs [invertebrate diet or fish diet], and fish fillets) throughout the Delta, with little difference among locations (Tables Se-2d and Se-4d in Appendix B of this RDEIR/SDEIS). Level of Concern Exceedance Quotients (i.e., modeled tissue divided by Level of Concern benchmarks) for selenium concentrations in those biota for all years and for drought years are less than 1.0, indicating low probability of adverse effects. Similarly, Advisory Tissue Level Exceedance Quotients for selenium concentrations in fish fillets for all years and drought years are less than 1.0. Estimated selenium concentrations in sturgeon for the San Joaquin River at Antioch are predicted to increase by 7 percent relative to Existing Conditions and to the No Action Alternative (ELT) in all years (from about 4.7 to about 5.1 mg/kg dry weight [dw]), and those for sturgeon in the Sacramento River at Mallard Island are predicted to increase by about 5 percent in all years (from about 4.4 to 4.6 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Selenium concentrations in sturgeon during drought years are expected to increase by about 3 to 5 percent at those locations (from about 6.9 to 7.1 mg/kg dw) (Tables Se-5 and Se-6 in Appendix B of this RDEIR/SDEIS). Detection of small changes in whole-body sturgeon such as those estimated for the western Delta would require very large sample sizes because of the inherent variability in fish tissue selenium concentrations. Low Toxicity Threshold Exceedance Quotients for selenium concentrations in sturgeon in the western Delta would exceed 1.0 for drought years at both locations (as they do for Existing Conditions and the No Action Alternative (ELT)); for all years the Exceedance Quotient would be 1.0 or less (Table Se-7 in Appendix B of this RDEIR/SDEIS). The High Toxicity Threshold Quotient would be less than 1.0 at both locations for all years and drought years (Table Se-7 in Appendix B of this RDEIR/SDEIS).

The disparity between larger estimated changes for sturgeon and smaller changes for other biota is attributable largely to differences in modeling approaches, as described in Appendix 8M, *Selenium*, in Appendix A of the RDEIR/SDEIS. The model for most biota was calibrated to encompass the varying concentration-dependent uptake from waterborne selenium concentrations (expressed as the K_d, which is the ratio of selenium concentrations in particulates [as the lowest level of the food chain] relative to the waterborne concentration) that was exhibited in data for largemouth bass in 2000, 2005, and 2007 at various locations across the Delta. In contrast, the modeling for sturgeon could not be similarly calibrated at the two western Delta locations and used literature-derived uptake factors and trophic transfer factors for the estuary from Presser and Luoma (2013). As noted in the Appendix 8M, there was a significant negative log-log relationship of K_d to waterborne selenium concentration that reflected the greater bioaccumulation rates for bass at low waterborne selenium than at higher concentrations. There was no difference in bass selenium concentrations in the Sacramento River at Rio Vista in comparison to the San Joaquin River at Vernalis in 2000, 2005, and 2007 [Foe 2010], despite a nearly 10-fold difference in waterborne selenium. Thus, there is more confidence in the site-specific modeling based on the Delta-wide model that was calibrated for bass data than in the estimates for sturgeon based on "fixed" K_ds for all years and for drought years without regard to waterborne selenium concentration at the two locations in different time periods.

Residence time of water in the Delta is expected to increase relative to Existing Conditions primarily as a result of habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur under the No Action Alternative (ELT) separate from Alternative 5A. Although estimates of the residence time increases are not available for Alternative 5A, estimates for Alternative 5 at the Late Long Term (presented in Table 8-60a in Section 8.3.1.7 of

Appendix A in the *Microcystis* subsection) which contained 65,000 acres of tidal restoration are available, and is expected that residence time increases under Alternative 5A would be substantially less than identified for Alternative 5 in the table.

If increases in fish tissue or bird egg selenium were to occur as a result of increased residence time, the increases would likely be of concern only where fish tissues or bird eggs are already elevated in selenium to near or above thresholds of concern. That is, where biota concentrations are currently low and not approaching thresholds of concern (which, as discussed above, is the case throughout the Delta, except for sturgeon in the western Delta), changes in residence time alone would not be expected to cause them to then approach or exceed thresholds of concern. Thus, the most likely area in which biota tissues would be at levels high enough that additional bioaccumulation due to increased residence time from restoration areas would be a concern is the western Delta and Suisun Bay for sturgeon. Based on the expected minor increases in residence time in the western Delta and Suisun Bay, any increases are not expected to be of sufficient magnitude to substantially affect selenium bioaccumulation.

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 5A would result in essentially no change in selenium concentrations throughout the Delta for most biota (about 1% or less), although larger increases in selenium concentrations are predicted for sturgeon in the western Delta. Concentrations of selenium in sturgeon would exceed only the lower benchmark during the drought period, indicating a low potential for effects. The modeling of bioaccumulation for sturgeon is less calibrated to site-specific conditions than that for other biota, which was calibrated on a robust dataset for modeling of bioaccumulation in largemouth bass as a representative species for the Delta. Overall, Alternative 5A would not be expected to substantially increase the frequency with which applicable water quality criterion, or toxicity and level of concern benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon relative to the low benchmark and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium. These changes would be similar to those described for Alternative 4.

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

SWP/CVP Export Service Areas

Alternative 5A would result in small (0.03 μg/L) decreases in long-term average selenium concentrations in water at the Banks and Jones pumping plants, relative to Existing Conditions and the No Action Alternative (ELT), for the entire period modeled (Table Se-1 in Appendix B of this RDEIR/SDEIS). These decreases in long-term average selenium concentrations in water would result in increases in available assimilative capacity for selenium at these pumping plants, relative to the USEPA's draft water quality criterion of 1.3 μg/L (Table Se-8d in Appendix B of this RDEIR/SDEIS). The long-term average selenium concentrations in water for Alternative 5A (range 0.18–0.25 μg/L) would be well below the draft water quality criterion of 1.3 μg/L (Table Se-1 in Appendix B of this RDEIR/SDEIS).

Relative to Existing Conditions and the No Action Alternative (ELT), Alternative 5A would result in small changes (about 1% or less) in estimated selenium concentrations in biota (whole-body fish, bird eggs [invertebrate diet], bird eggs [fish diet], and fish fillets) (Table Se-4d in Appendix B of this

RDEIR/SDEIS). Concentrations in biota would not exceed any selenium toxicity or level of concern benchmarks for Alternative 5A (Table Se-4d in Appendix B of this RDEIR/SDEIS).

In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on selenium are expected to be similar to those described above.

NEPA Effects: Relative to the No Action Alternative (ELT and LLT), Alternative 5A would result in essentially negligible changes in selenium concentrations in water upstream of the Delta. Similarly, there would be negligible changes in selenium water and most biota concentrations in the Delta, with no exceedances of benchmarks for biological effects. For sturgeon in the Delta, there would be only a small increase of threshold exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark. At the Banks and Jones pumping plants, Alternative 5A would cause no increases in the frequency with which applicable benchmarks would be exceeded and would slightly improve the quality of water in selenium concentrations. Therefore, the effects on selenium (both as waterborne and as bioaccumulated in biota) from Alternative 5A are considered to be not adverse.

CEQA Conclusion**:** There are no substantial point sources of selenium in watersheds upstream of the Delta, and no substantial nonpoint sources of selenium in the watersheds of the Sacramento River and the eastern tributaries. Nonpoint sources in the San Joaquin Valley that contribute selenium to the Delta will be controlled through a TMDL developed by the Central Valley Water Board (2001) for the lower San Joaquin River, established limits for the Grassland Bypass Project, and Basin Plan objectives (Central Valley Water Board [2010 d and State Water Board [2010b, 2010c]) that are expected to result in decreasing discharges of selenium from the San Joaquin River to the Delta. Consequently, any modified reservoir operations and subsequent changes in river flows under Alternative 5A, relative to Existing Conditions, are expected to cause negligible changes in selenium concentrations in water. Any negligible changes in selenium concentrations that may occur in the water bodies of the affected environment located upstream of the Delta would not be of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of these water bodies as related to selenium.

Relative to Existing Conditions, modeling estimates indicate Alternative 5A would result in essentially no change in selenium concentrations in water or most biota throughout the Delta, with no exceedances of benchmarks for biological effects. The Low Toxicity Threshold Exceedance Quotient for selenium concentrations in sturgeon for all years in the San Joaquin River at Antioch would increase slightly, from 0.94 for Existing Conditions to 1.0 for Alternative 5A. Concentrations of selenium in sturgeon would exceed only the lower benchmark during the drought period, indicating a low potential for effects. Overall, Alternative 5A would not be expected to substantially increase the frequency with which applicable benchmarks would be exceeded in the Delta (there being only a small increase for sturgeon exceedance relative to the low benchmark for sturgeon and no exceedance of the high benchmark) or substantially degrade the quality of water in the Delta, with regard to selenium.

Assessment of effects of selenium in the SWP/CVP Export Service Areas is based on effects on selenium concentrations at the Banks and Jones pumping plants. Relative to Existing Conditions, Alternative 5A would cause no increases in the frequency with which applicable benchmarks would be exceeded, and would slightly improve the quality of water in selenium concentrations at the Banks and Jones pumping plants.

Based on the above, selenium concentrations that would occur in water under Alternative 5A would not cause additional exceedances of applicable state or federal numeric or narrative water quality objectives/criteria, or other relevant water quality effects thresholds identified for this assessment, by frequency, magnitude, and geographic extent that would result in adverse effects to one or more beneficial uses within affected water bodies. In comparison to Existing Conditions, water quality conditions under Alternative 5A would not increase levels of selenium by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of selenium in aquatic organisms, thereby substantially increasing the health risks to wildlife (including fish) or humans consuming those organisms. Water quality conditions under this alternative with respect to selenium would not cause long-term degradation of water quality in the affected environment, and therefore would not result in use of available assimilative capacity such that exceedances of water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. This alternative would not further degrade water quality by measurable levels, on a long-term basis, for selenium and, thus, cause the CWA Section 303(d)-listed impairment of beneficial use to be made discernibly worse. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-26: Effects on Selenium Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to the No Action Alternative (ELT and LLT), under which more restoration would occur. Therefore, the effects on selenium from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

***CEQA Conclusion*:** Environmental Commitments 3, 4, 6–12, 15, and 16 would not increase selenium loading, and the amount of restoration that would occur would be minimal relative to the area of the Delta and implemented such that any localized changes in residence time are unlikely to measurably change selenium concentrations in water or biota relative to Existing Conditions. Therefore, it is expected that with implementation of these environmental commitments there would be no substantial, long-term increase in selenium concentrations in water in the rivers and reservoirs upstream of the Delta, water in the Delta, or the waters exported to the SWP/CVP Export Service Areas, relative to Existing Conditions. As such, these environmental commitments would not contribute to additional exceedances of applicable water quality objectives/criteria. Given the factors discussed in the assessment above and for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), any increases in bioaccumulation rates from waterborne selenium that could occur in some areas as a result of increased water residence times would not be of sufficient magnitude and geographic extent that any portion of the Delta would be expected to have measurably higher body burdens of selenium in aquatic organisms, and therefore would not substantially increase risk for adverse effects to beneficial uses. Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause long-term degradation of water quality resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely. Also, these environmental commitments would not result in substantially increased risk for adverse effects to any beneficial uses. Furthermore, although the Delta is a CWA Section 303(d)-listed water body for selenium, given the discussion in the assessment above, it is unlikely that restoration areas would result in measurable increases in selenium in fish tissues or bird eggs such that the beneficial use impairment would be made discernibly worse.

Because it is unlikely that substantial increases in selenium in fish tissues or bird eggs would occur such that effects on aquatic life beneficial uses would be anticipated, and because of the avoidance and minimization measures that are designed to further minimize and evaluate the risk of such increases (see Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP for more detail on AMM27) as well as the Selenium Management environmental commitment (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS this impact is considered less than significant. No mitigation is required.

Impact WQ-27: Effects on Trace Metal Concentrations Resulting from Facilities Operations and Maintenance

The effects of operation of the water conveyance facilities under Alternative 5A on trace metal concentrations in surface waters upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT) would be similar to those effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS).

Given the poor association of dissolved trace metal concentrations with flow, river flow rate and reservoir storage reductions that would occur under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not be expected to result in a substantial adverse change in trace metal concentrations in the reservoirs and rivers upstream of the Delta.

In the Delta, for metals of primarily aquatic life concern (copper, cadmium, chromium, lead, nickel, silver, and zinc), average and 95th percentile trace metal concentrations of the primary source waters to the Delta are very similar, and very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria, including those that are hardness-based (see Tables 8-51 and 8-52 in Appendix A of this RDEIR/SDEIS). No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average and 95th percentile source water concentrations for copper, cadmium, chromium, led, nickel, silver, and zinc do not exceed their respective criteria, more frequent exceedances of criteria in the Delta would not occur. For metals of primarily human health and drinking water concern (arsenic, iron, manganese), average and 95th percentile concentrations are also very similar (see Tables 8–10 in Appendix 8N,*Trace Metals*, of the Draft EIR/EIS) and average concentrations are below human health criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that the average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be expected to occur.

Because Alternative 5A would not result in substantial increases in trace metal concentrations in the water exported from the Delta or diverted from the Sacramento River through the proposed conveyance facilities, there is not expected to be substantial changes in trace metal concentrations in the SWP/CVP Export Service Areas, relative to Existing Conditions or the No Action Alternative (ELT and LLT).

As such, Alternative 5A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals.

NEPA Effects: Alternative 5A would not be expected to substantially increase the frequency with which applicable Basin Plan objectives or CTR criteria would be exceeded in the water bodies of the affected environment or substantially degrade the quality of these water bodies, with regard to trace metals, relative to the No Action Alternative (ELT and LLT)., Therefore, the effects on trace metals from implementing Alternative 5A are determined to not be adverse.

CEQA Conclusion: While Alternative 5A would alter the magnitude and timing of reservoir releases north, south and east of the Delta, this would have no substantial effect on the various watershed sources of trace metals. Moreover, long-term average flow and trace metals at Sacramento River at Hood and San Joaquin River at Vernalis are poorly correlated; therefore, changes in river flows would not be expected to cause a substantial long-term change in trace metal concentrations upstream of the Delta.

Average and 95th percentile trace metal concentrations are very similar across the primary source waters to the Delta. Given this similarity, very large changes in source water fraction would be necessary to effect a relatively small change in trace metal concentration at a particular Delta location. Moreover, average and 95th percentile trace metal concentrations for these primary source waters are all below their respective water quality criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and given that trace metals do not already exceed water quality criteria, more frequent exceedances of criteria in the Delta would not be expected to occur under Alternative 5A.

Because Alternative 5A is not expected to result in substantial changes in trace metal concentrations in Delta waters, which includes Banks and Jones pumping plants, effects on trace metal concentrations in the SWP/CVP Export Service Area are expected to be negligible.

As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur in water bodies of the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-28: Effects on Trace Metal Concentrations Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Because Environmental Commitments 3, 4, 6–12, 15, and 16 present no new sources of trace metals to the affected environment, the effects on trace metal concentrations from implementing these environmental commitments are determined to be not adverse.

CEQA Conclusion: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not cause substantial long-term increase in trace metal concentrations in the rivers and reservoirs upstream of the Delta, in the Delta Region, or the SWP/CVP Export Service Areas, because they present no new sources of trace metals to the affected environment. As such, this alternative is not expected to cause additional exceedance of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because trace metal concentrations are not expected to increase substantially, no long-term water quality degradation for trace metals is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term trace metal concentrations that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. The trace metals discussed in this assessment are not considered bioaccumulative, and thus would not directly cause bioaccumulative problems in aquatic life or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-29: Effects on TSS and Turbidity Resulting from Facilities Operations and Maintenance

As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS), the operation of the water conveyance facilities under Alternative 5A is expected to have a minimal effect on TSS and turbidity levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT and LLT). This is because the factors that would affect TSS and turbidity levels in the surface waters of these areas would be the same. TSS concentrations and turbidity levels in rivers upstream of the Delta are affected primarily by: 1) TSS concentrations and turbidity levels of the water released from the upstream reservoirs, 2) erosion occurring within the river channel beds, which is affected by river flow velocity and bank protection, 3) TSS concentrations and turbidity levels of tributary inflows, point-source inputs, and nonpoint runoff as influenced by surrounding land uses; and 4) phytoplankton, zooplankton and other biological material in the water. Within the Delta, TSS concentrations and turbidity levels in Delta waters are affected by TSS concentrations and turbidity levels of inflows (and associated sediment load), as well as fluctuation in flows within the channels due to the tides, with sediments depositing as flow velocities and turbulence are low at periods of slack tide, and sediments becoming suspended when flow velocities and turbulence increase when tides are near the maximum. TSS and turbidity variations can also be attributed to phytoplankton, zooplankton and other biological material in the water. These factors would be similar under Alternative 5A and Alternative 4, are expected to be minimally different from Existing Conditions and the No Action Alternative (ELT and LLT). Because Alternative 5A is expected to have minimal effect on TSS concentrations and turbidity levels in Delta waters, including water exported at the south Delta pumps, relative to Existing Conditions or the No Action Alternative (ELT and LLT), Alternative 5A also is expected to have minimal effect on TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters.

NEPA Effects: Because TSS concentrations and turbidity levels are expected to be minimally affected relative to the No Action Alternative (ELT and LLT), the effects on TSS and turbidity from implementing Alternative 5A are determined to not be adverse.

CEQA Conclusion: As described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS) changes in river flow rate and reservoir storage that would occur under Alternative 5A, relative to Existing Conditions, would not be expected to result in a substantial adverse change in TSS concentrations and turbidity levels in the reservoirs and rivers upstream of the Delta, given that suspended sediment concentrations are more affected by season than flow. Within the Delta, geomorphic changes associated with sediment transport and deposition are usually gradual, occurring over years, and high storm event inflows would not be substantially affected. Thus, it is expected that the TSS concentrations and turbidity levels in the affected channels would not be substantially different from the levels under Existing Conditions. There is not expected to be substantial, if even measurable, changes in TSS concentrations and turbidity levels in the SWP/CVP Export Service Areas waters under Alternative 5A, relative to Existing Conditions, because this alternative is not expected to result in substantial changes in TSS concentrations and turbidity levels at the south Delta export pumps, relative to Existing Conditions. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels are not expected to be substantially different, long-term water quality degradation is not expected, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-30: Effects on TSS and Turbidity Resulting from Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16

***NEPA Effects*:** Localized, temporary changes in TSS and turbidity could occur associated with the restoration actions of Environmental Commitments 3, 4, 6–12, 15, and 16. However, these changes would be gradual and not expected to substantially differ from No Action Alternative (ELT and LLT) conditions. Therefore, the effects on TSS and turbidity from implementing these environmental commitments are determined to be not adverse.

***CEQA Conclusion*:** It is expected that the TSS concentrations and turbidity levels Upstream of the Delta, in the Plan Area, and the SWP/CVP Export Service Areas due to implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would not be substantially different relative to Existing Conditions, except within localized areas of the Delta modified through creation of habitat and open water. Therefore, this alternative is not expected to cause additional exceedance of applicable water quality objectives where such objectives are not exceeded under Existing Conditions. Because TSS concentrations and turbidity levels Upstream of the Delta, in the greater Plan Area, and in the SWP/CVP Export Service Areas are not expected to be substantially different, long-term water quality degradation is not expected relative to TSS and turbidity, and, thus, beneficial uses are not expected to be adversely affected. Finally, TSS and turbidity are neither bioaccumulative nor CWA Section 303(d) listed constituents. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

Impact WQ-31: Water Quality Effects Resulting from Construction-Related Activities for the Water Conveyance Facilities and Environmental Commitments

The potential construction-related water quality effects that would occur under Alternative 5A would similar to the effects described for Alternative 4A (see Section 4.3.4 of the RDEIR/SDEIS). This is because the type, size, and number of construction activities for water conveyance facilities and environmental commitments that would occur under Alternative 5A would be similar to Alternative 4A. The construction-related activities for the water conveyance facilities under Alternative 5A would be similar to those described for Alternative 4A. However, there would be less construction activity due to the fewer intakes constructed and the area of in-water habitat restoration activities implemented under Alternative 5A would be less.

NEPA Effects: The types and magnitude of potential construction-related water quality effects associated with implementation of Alternative 2D would be very similar to the effects discussed for Alternative 4A. Nevertheless, the construction of water supply facilities and environmental commitments, with the implementation of the BMPs specified in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS and other agency permitted construction requirements, would result in the potential water quality effects being largely avoided and minimized. The specific environmental commitments that would be implemented under Alternative 5A would be similar to those described for Alternative 4A. Consequently, relative to the No Action Alternative (ELT), Alternative 5A would not be expected to cause exceedance of applicable water quality objectives/criteria or substantial water quality degradation with respect to constituents of concern, and thus would not adversely affect any beneficial uses upstream of the Delta, in the Delta, or in the SWP/CVP Export Service Areas. Therefore, with implementation of environmental commitments presented in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS, the potential construction-related water quality effects are considered to be not adverse.

CEQA Conclusion: Because environmental commitments would be implemented under Alternative 5A for construction-related activities along with agency-issued permits that also contain construction requirements to protect water quality, the construction-related effects, relative to Existing Conditions, would not be expected to cause or contribute to substantial alteration of existing drainage patterns which would result in substantial erosion or siltation on- or off-site, substantial increased frequency of exceedances of water quality objectives/criteria, or substantially degrade water quality with respect to the constituents of concern on a long-term average basis, and thus would not adversely affect any beneficial uses in water bodies upstream of the Delta, within the Delta, or in the SWP/CVP Export Service Areas. Moreover, because the construction-related activities would be temporary and intermittent in nature, the construction would involve negligible discharges, if any, of bioaccumulative or CWA Section 303(d) listed constituents to water bodies of the affected environment. As such, construction activities would not contribute measurably to bioaccumulation of contaminants in organisms or humans or cause CWA Section 303(d) impairments to be discernibly worse. Based on these findings, this impact is determined to be less than significant. No mitigation is required.

Impact WQ-32: Effects on *Microcystis* Bloom Formation Resulting from Facilities Operations and Maintenance

Upstream of the Delta

Adverse effects from *Microcystis* upstream of the Delta have only been documented in lakes such as Clear Lake, where eutrophic levels of nutrients give cyanobacteria a competitive advantage over other phytoplankton during the bloom season. Large reservoirs upstream of the Delta are typically characterized by low nutrient concentrations, where other phytoplankton outcompete cyanobacteria, including *Microcystis*. In the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta under Existing Conditions, bloom development is limited by high water velocity and low residence times. These conditions are not expected to change under Alternative 5A or the No Action Alternative (ELT and LLT). Consequently, any modified reservoir operations under Alternative 5A are not expected to promote *Microcystis* production upstream of the Delta, relative to Existing Conditions and the No Action Alternative (ELT and LLT).

Delta

Modeling that adequately accounted for the effects of water conveyance facilities operations and maintenance and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the six Delta sub-areas was not available for Alternative 5A, so the hydrodynamic effects of this alternative on *Microcystis* were determined qualitatively. For the assessment of Alternative 4, modeling scenarios included assumptions regarding how certain habitat restoration activities of the project alternative would affect Delta hydrodynamics, so the impacts due solely to operations and maintenance of the water conveyance facilities under Alternative 4 could not be determined. Because the assessment for Alternative 5A is qualitative, the effects discussed for the Delta under water conveyance facilities are related solely to operations and maintenance, not the hydrodynamic effects of restoration actions, which are discussed in Impact WQ-33.

The effects of Alternative 5A on *Microcystis* levels, and thus microcystin concentrations in the Delta, relative to Existing Conditions, would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

Under Alternative 5A, a portion of the Sacramento River water which would be conveyed through the Delta to the south Delta intakes under Existing Conditions would be replaced at various locations throughout the Delta by other source water due to diversion of Sacramento River water at the north Delta intake under Alternative 5A. The change in flow paths of water through the Delta that would occur under Alternative 5A could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 5A would result in a net increase in water residence times at various locations throughout the Delta relative to Existing Conditions. In contrast to Alternative 5A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta at the LLT relative to Existing Conditions.

Besides the effects of operations and maintenance described above, substantial increases in water residence times due to factors unrelated to the project alternative, including habitat restoration (8,000 acres of tidal habitat and enhancements to the Yolo Bypass), sea level rise and climate change, are expected to occur in the Delta relative to Existing Conditions. Although there is uncertainty regarding the degree to which operations and maintenance of the project alternative would affect water residence times in the Delta, it is likely that such effects would be small in comparison to the combined effects of restoration activities, sea level rise and climate change. Slight increases in ambient water temperatures (1.3–2.5°F), due to climate change in the ELT, are expected to occur in the Delta under Alternative 5A, relative to Existing Conditions. However, due to the combination of the effects of restoration activities unrelated to the project alternative, climate change, and sea level rise on increased residence times, as well as the effects of climate change on increased ambient water temperatures, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur, relative to Existing Conditions.

The magnitude by which water temperatures and residence times would increase due to these factors would be less under Alternative 5A than under Alternative 4.

The effects of Alternative 5A on *Microcystis* levels, and thus microcystin concentrations in the Delta relative to the No Action Alternative (ELT and LLT) would be less than those described for Alternative 4 in Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS for the reasons discussed below.

As described relative to Existing Conditions, operations and maintenance of Alternative 5A could alter source water flow paths through the Delta, which could result in localized increases in residence time in various Delta sub-regions, and decreases in residence time in other areas. In general, there is substantial uncertainty regarding the extent that operations and maintenance of Alternative 5A would result in a net increase in water residence times at various locations throughout the Delta relative to the No Action Alternative (ELT and LLT). The previously discussed influence of factors unrelated to implementation of the project alternative, including habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass), climate change and sea level rise, on increased water residence times, as well as the influence of climate change on increased ambient water temperatures in the Delta, would occur under both Alternative 5A and No Action Alternative (ELT and LLT). In summary, operations and maintenance of Alternative 5A is not expected to increase water residence times or ambient water temperatures throughout the Delta, and thus result in adverse effects on *Microcystis*, relative to No Action Alternative (ELT and LLT).

SWP/CVP Export Service Area

The effects of Alternative 5A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas relative to Existing Conditions would be less than those described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). As described above for the Delta, source waters to the south Delta intakes could be adversely affected relative to Existing Conditions by *Microcystis* both from an increase in Delta water temperatures associated with climate change, and from an increase in water residence times. The impacts from increased Delta water residence times would be primarily related to habitat restoration (8,000 acres of tidal habitat restoration and enhancements to the Yolo Bypass) that is assumed to occur separate from Alternative 5A. The combined effect of these factors on *Microcystis* in source waters to the south Delta intakes would likely be much greater than the influence of operations and maintenance of Alternative 5A, the effects of which are uncertain. In contrast to Alternative 5A, the combination of the habitat restoration and operations and maintenance assumptions included in the hydrodynamic modeling of Alternative 4 resulted in a substantial increase in water residence times, and thus a potential increase in *Microcystis* abundance, at numerous locations throughout the Delta relative to Existing Conditions. Increases in ambient air temperatures due to climate change relative to Existing Conditions are expected under this alternative. Increases in ambient air temperatures are expected to result in warmer ambient water temperatures, and thus conditions more suitable to *Microcystis* growth, in the water bodies of the SWP/CVP Export Service Areas. The incremental increase in long-term average air temperatures would be less at the ELT (2.0°F), compared to the LLT (4.0°F).

The effects of Alternative 5A on *Microcystis* levels, and thus microcystin concentrations, in the SWP/CVP Export Service Areas, relative to the No Action Alternative (ELT and LLT), are expected to be less than effects described for Alternative 4 (see Chapter 8, Section 8.3.3.9, in Appendix A of the RDEIR/SDEIS). This is because effects of *Microcystis* on exports from Banks and Jones pumping plants would be different between Alternative 5A and Alternative 4. Specifically, under Alternative 5A, the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (ELT and LLT), as discussed in the *Delta* section above; while under Alternative 4, this fraction of water is expected to be adversely affected by *Microcystis* blooms, relative to the No Action Alternative (LLT). Additionally, conditions in the SWP/CVP Export Service Areas under Alternative 5A are not expected to become more conducive to *Microcystis* bloom formation, relative to the No Action Alternative (ELT), because neither water residence time nor water temperatures are projected to increase in the SWP/CVP Export Service Areas.

NEPA Effects: For the reasons discussed above, the effects on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas from implementing water conveyance facilities are determined to be not adverse.

CEQA Conclusion: For the reasons described above, the effects of operations and maintenance of water conveyance facilities under Alternative 5A on *Microcystis* in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas, relative to Existing Conditions, would be less than those described for the Alternative 4. As such, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. However, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur under Alternative 5A for reasons unassociated with operations and maintenance of the project alternative, including tidal habitat restoration activities, climate change and sea level rise. While long-term water quality degradation may occur and, thus, impacts on beneficial uses could occur, these impacts are not related to implementation of Alternative 5A. Although there is considerable uncertainty regarding this impact, the effects on *Microcystis* from implementing water conveyance facilities are determined to be less than significant. No mitigation is required.

Impact WQ-33: Effects on *Microcystis* Bloom Formation Resulting from Environmental Commitments

Effects on *Microcystis* from implementation of environmental commitments under Alternative 5A would be the same as those described for Alternative 4A.

NEPA Effects: Based on the discussion for Impact WQ-33 in Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS, the effects on *Microcystis* from implementing Environmental Commitments 3, 4, 6–12, 15, and 16 are determined to be not adverse.

CEQA Conclusions: Based on the discussion for Impact WQ-33 in Section 4.3.4, *Water Quality*, of this RDEIR/SDEIS, Environmental Commitments 3, 4, 6–12, 15, and 16 would not be expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. *Microcystis* and microcystins are not CWA Section 303(d) listed within the affected environment and thus any increases that could occur in some areas would not make any existing *Microcystis* impairment measurably worse because no such impairments currently exist. Because *Microcystis* and microcystins are not bioaccumulative, increases that could occur in some areas would not bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Because *Microcystis* levels are not expected to increase substantially, no long-term water quality degradation from *Microcystis* or microcystins is expected to occur and, thus, no adverse effects to beneficial uses would occur. Furthermore, any negligible changes in long-term *Microcystis* levels that may occur throughout the affected environment would not be expected to make any existing beneficial use impairments measurably worse. Based on these findings, this impact is considered less than significant. No mitigation is required.

Impact WQ-34: Effects on San Francisco Bay Water Quality Resulting from Facilities Operations and Maintenance and Environmental Commitments

The effects analysis presented in the preceding impacts (Impact WQ-1 through WQ-33) concluded that Alternative 5A would have a less-than-significant impact/no adverse effect on the following constituents in the Delta:

- Boron
- Bromide
- Chloride
- Dissolved organic carbon (DOC)
- Dissolved oxygen
- Pathogens
- Pesticides
- Trace metals
- Turbidity and TSS
- *Microcystis*

Elevated concentrations of boron are of concern in drinking and agricultural water supplies. Chloride, DOC, and bromide concentrations also are of concern in drinking water supplies. However, waters in the San Francisco Bay are not designated to support municipal water supply (MUN) and agricultural supply (AGR) beneficial uses. Changes in Delta dissolved oxygen, pathogens, pesticides, trace metals, and turbidity and TSS are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the Delta. Changes in *Microcystis* would be primarily due to factors unassociated with the project alternative. Thus, changes in boron, bromide, chloride, DOC, dissolved oxygen, pathogens, pesticides, trace metals, turbidity and TSS, and *Microcystis* in Delta outflow associated with implementation of Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT) are not anticipated to be of a frequency, magnitude and geographic extent that would adversely affect any beneficial uses or substantially degrade the quality of the of San Francisco Bay, as described for Alternative 4 (see Chapter 8, Section 8.3.3.9 in Appendix A of this RDEIR/SDEIS).

Elevated EC is of concern for its effects on the agricultural beneficial use (AGR) and fish and wildlife beneficial uses. San Francisco Bay does not have an AGR beneficial use designation. As described for

Alternative 4, salinity throughout San Francisco Bay is largely a function of the tides, as well as to some extent the freshwater inflow from upstream. However, the changes in Delta outflow due to Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would be minor compared to tidal flows, and thus no substantial adverse effects on salinity, or fish and wildlife beneficial uses, downstream of the Delta are expected.

Also, as described for Alternative 4, changes in nutrient loading would not be expected to contribute to adverse effects to beneficial uses. Changes in nitrogen (ammonia and nitrate) loading to Suisun and San Pablo Bays under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), would not adversely impact primary productivity in these embayments because light limitation and grazing current limit algal production in these embayments. Nutrient levels and ratios are not considered a direct driver of *Microcystis* and cyanobacteria levels in the North Bay. The only postulated effect of changes in phosphorus loads to Suisun and San Pablo Bays is related to the influence of nutrient stoichiometry on primary productivity. However, there is uncertainty regarding the impact of nutrient ratios on phytoplankton community composition and abundance. As described for Alternative 4, any effect on phytoplankton community composition would likely be small compared to the effects of grazing from introduced clams and zooplankton in the estuary. Therefore, changes in total nitrogen and phosphorus loading that would occur in Delta outflow to San Francisco Bay, relative to Existing Conditions and the No Action Alternative (ELT and LLT), are not expected to result in degradation of water quality with regard to nutrients that would result in adverse effects to beneficial uses.

Similar to Alternative 4, loads of mercury, methylmercury, and selenium from the Delta to San Francisco Bay are estimated to change relatively little due to changes in source water fractions and net Delta outflow that would occur under Alternative 5A, relative to Existing Conditions and the No Action Alternative (ELT and LLT), because changes in Delta outflow would be similar.

NEPA Effects: Based on the discussion above, Alternative 5A, relative to the No Action Alternative (ELT and LLT), would not cause further degradation to water quality with respect to boron, bromide, chloride, dissolved oxygen, DOC, EC, mercury, pathogens, pesticides, selenium, nutrients (ammonia, nitrate, phosphorus), trace metals, turbidity and TSS, or *Microcystis* in the San Francisco Bay. Further, changes in these constituent concentrations in Delta outflow would not be expected to cause changes in Bay concentrations of frequency, magnitude, and geographic extent that would adversely affect any beneficial uses. In summary, effects on the San Francisco Bay from implementation of water conveyance facilities and Environmental Commitments 3, 4, 6–12, 15, and 16 are considered to be not adverse.

CEQA Conclusion: As with Alternative 4, Alternative 5A would not be expected to cause long-term degradation of water quality in San Francisco Bay resulting in sufficient use of available assimilative capacity such that occasionally exceeding water quality objectives/criteria would be likely and would result in substantially increased risk for adverse effects to one or more beneficial uses. Further, this alternative would not be expected to cause additional exceedance of applicable water quality objectives/criteria in the San Francisco Bay by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment. Any changes in boron, bromide, chloride, and DOC in the San Francisco Bay would not adversely affect beneficial uses, because the uses most affected by changes in these parameters, MUN and AGR, are not beneficial uses of the Bay. Further, no substantial changes in dissolved oxygen, pathogens, pesticides, trace metals, turbidity or TSS, and *Microcystis* are anticipated in the Delta due to the implementation of Alternative 5A, relative to Existing Conditions, therefore, no substantial changes to these constituents levels in the Bay are anticipated. Changes in Delta salinity would not contribute to measurable changes in Bay salinity, as the change in Delta outflow would be two to three orders of magnitude lower than (and thus minimal compared to) the Bay's tidal flow and thus, have minimal influence on salinity changes. Changes in nutrient load, relative to Existing Conditions, are expected to have minimal effect on water quality degradation, primary productivity, or phytoplankton community composition. As with Alternative 4, the change in mercury and methylmercury load (which is based on source water and Delta outflow), relative to Existing Conditions, would be within the level of uncertainty in the mass load estimate and not expected to contribute to water quality degradation, make the CWA Section 303(d) mercury impairment measurably worse or cause mercury/methylmercury to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Similarly, based on Alternative 4 estimates, the increase in selenium load would be minimal, and total and dissolved selenium concentrations would be expected to be the same as Existing Conditions, and less than the target associated with white sturgeon whole-body fish tissue levels for the North Bay. Thus, the change in selenium load is not expected to contribute to water quality degradation, or make the CWA Section 303(d) selenium impairment measurably worse or cause selenium to bioaccumulate to greater levels in aquatic organisms that would, in turn, pose substantial health risks to fish, wildlife, or humans. Based on these findings, this impact is considered to be less than significant. No mitigation is required.

4.5.5 Geology and Seismicity

Impact GEO-1: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking of Water Conveyance Features during Construction

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would not substantially change the hazard of loss of property, personal injury, or death during construction. The effects of Alternative 5A would, therefore, be similar to 4 but lesser in magnitude due to fewer structures. See the discussion of Impact GEO-1 under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Seismically induced ground shaking that is estimated to occur and the resultant ground motion anticipated at Alternative 5A construction sites, including the intake locations, the tunnels, the pipelines and the forebays, could cause collapse or other failure of project facilities while under construction. DWR would conform to Cal-OSHA and other state code requirements, such as shoring, bracing, lighting, excavation depth restrictions, required slope angles, and other measures, to protect worker safety. Conformance with these standards and codes is an environmental commitment of the project (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce this risk and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. This impact would be less than significant. No mitigation is required.

Impact GEO-2: Loss of Property, Personal Injury, or Death from Settlement or Collapse Caused by Dewatering during Construction of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, except that it would entail two fewer intakes. These differences would present a lower hazard of settlement or collapse caused by dewatering but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Settlement or failure of excavations during construction could result in loss of property or personal injury. However, DWR would conform to Cal-OSHA and other state code requirements, such as using seepage cutoff walls, shoring, and other measures, to protect worker safety. DWR has made an environmental commitment to use the appropriate code and standard requirements to minimize potential risks (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-3: Loss of Property, Personal Injury, or Death from Ground Settlement during Construction of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, except that it would entail two fewer intakes. These differences would create a lower hazard of ground settlement on the tunnels and but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Ground settlement as a result of geotechnical investigation and the tunneling operation could result in loss of property or personal injury during construction. However, DWR would conform to Cal-OSHA, USACE and other design requirements to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. DWR has made conformance to geotechnical design recommendations and monitoring an environmental commitment and an avoidance and minimization measure (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Hazards to workers and project structures would be controlled at safe levels and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-4: Loss of Property, Personal Injury, or Death from Slope Failure during Construction of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a lower hazard of slope failure at borrow and spoils storage sites but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Settlement/failure of cutslopes of borrow sites and failure of soil/RTM fill slopes could result in loss of property or personal injury during construction. However, because DWR would conform to Cal-OSHA and other state code requirements and conform to applicable geotechnical design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-5: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Construction-Related Ground Motions during Construction of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard of structural failure from construction-related ground motions but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Construction-related ground motions could initiate liquefaction, which could cause failure of structures during construction. However, because DWR would conform with Cal-OSHA and other state code requirements and conform to applicable design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a level that would protect worker safety (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-6: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Rupture of a Known Earthquake Fault during Operation of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard from an earthquake fault rupture but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** There are no active faults capable of surface rupture that extend into the Alternative 5A alignment. Facilities lying directly on or near active blind faults, such as the concrete batch plants and fuel stations near Twin Cities Road and Interstate 5 and at the expanded Clifton Court Forebay, as well as the expanded Forebay itself for Alternative 5A, may have an increased likelihood of loss of property or personal injury at these sites in the event of seismically-induced ground shaking. However, DWR would conform to Cal-OSHA and other state code requirements, such as shoring, bracing, lighting, excavation depth restrictions, required slope angles, and other measures, to protect worker safety as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. Conformance with these standards and codes is an environmental commitment of the project (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conformance with these health and safety requirements and the application of accepted, proven construction engineering practices would reduce this risk and there would be no increased likelihood of loss of property, personal injury or death due to construction of Alternative 5A. This impact would be less than significant. No mitigation is required.

Impact GEO-7: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking during Operation of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard from seismic shaking but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Seismically induced strong ground shaking could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities. The damage could disrupt the water supply through the conveyance system. In an extreme event, an uncontrolled release of water from the damaged conveyance system could cause flooding and inundation of structures. (Please refer to Chapter 6, *Surface Water*, of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, which would be supported by geotechnical investigations required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS), measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. Conformance with these codes and standards is an environmental commitment by DWR to ensure that ground shaking risks are minimized as the water conveyance features are operated (see Appendix 3B, *Environmental*

Commitments, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-8: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction during Operation of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard of structural failure from ground failure but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Seismically induced ground shaking could cause liquefaction. Liquefaction could damage pipelines, tunnels, intake facilities, pumping plant, and other facilities, and thereby disrupt the water supply through the conveyance system. In an extreme event, flooding and inundation of structures could result from an uncontrolled release of water from the damaged conveyance system. (Please refer to Chapter 6, *Surface Water* of the Draft EIR/EIS for a detailed discussion of potential flood impacts.) However, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. Conformance with these design standards is an environmental commitment by DWR to ensure that liquefaction risks are minimized as the water conveyance features are operated (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The hazard would be controlled to a safe level and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 5A. The impact would be less than significant. No mitigation is required.

Impact GEO-9: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability during Operation of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard from landslides and other slope instability but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

***CEQA Conclusion*:** Unstable levee slopes and natural stream banks may fail, either from high pore-water pressure caused by high rainfall and weak soil, or from seismic shaking. Structures constructed on these slopes could be damaged or fail entirely as a result of slope instability. However, through the final design process, measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, a geotechnical engineer would develop slope stability design criteria (such as minimum slope safety factors and allowable slope deformation and settlement) for the various anticipated loading conditions during facility operations. DWR would also ensure that measures to address this hazard would be required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and*

Seismicity, of the Draft EIR/EIS. Conformance with these codes and standards is an environmental commitment by DWR to ensure cut and fill slopes and embankments will be stable as the water conveyance features are operated and there would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 5A (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-10: Loss of Property, Personal Injury, or Death from Seiche or Tsunami during Operation of Water Conveyance Features

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, but would entail two fewer intakes. These differences would present a slightly lower hazard of a seiche or tsunami but would not substantially change the hazard of loss of property, personal injury, or death during construction compared to Alternative 4. The effects of Alternative 5A would, therefore, be similar to those of Alternative 4. See the description and findings under Alternative 4 in Appendix A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Based on recorded tsunami wave heights at the Golden Gate (Contra Costa Transportation Agency 2009) and in the interior of the San Francisco Bay and on tsunami inundation maps prepared by the California Department of Conservation (2009), the height of a tsunami wave reaching the Suisun Marsh and the Delta would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in most parts of the project area is considered low because the seismic hazard and the geometry of the water bodies (i.e., wide and shallow) near conveyance facilities are not favorable for a seiche to occur. However, assuming the West Tracy fault is potentially active, a potential exists for a seiche to occur in the expanded Clifton Court Forebay. The impact would not be significant because the expanded Clifton Court Forebay embankment would be designed and constructed according to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS to contain and withstand the anticipated maximum seiche wave height, as required by DWR's environmental commitments (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). There would be no increased likelihood of loss of property, personal injury or death due to operation of Alternative 5A from seiche or tsunami. The impact would be less than significant. No additional mitigation is required.

Impact GEO-11: Ground Failure Caused by Increased Groundwater Surface Elevations from Unlined Canal Seepage as a Result of Operating the Water Conveyance Facilities

NEPA Effects: Alternative 5A would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no effect caused by canal seepage. There would be no adverse effect.

CEQA Conclusion**:** Alternative 5A would not involve construction of unlined canals; therefore, there would be no increase in groundwater surface elevations and consequently no impact caused by canal seepage. The impact would be less than significant. No mitigation is required.

Impact GEO-12: Loss of Property, Personal Injury, or Death Resulting from Structural Failure Caused by Rupture of a Known Earthquake Fault at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 5A as under Alternative 4A, but would involve a slightly smaller acreage of restoration, as described in Section 4.1.4.3 of this RDEIR/SDEIS. The effect would be similar to that of Alternative 4A. See Impact GEO-12 under Alternative 4A of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: According to the available AP Earthquake Fault Zone Maps, only the Suisun Marsh ROA could be affected by rupture of an earthquake fault. The active Green Valley fault crosses the southwestern corner of the ROA. The active Cordelia fault extends approximately 1 mile into the northwestern corner of the ROA. Rupture of the Cordelia and Green Valley faults could occur at the Suisun Marsh ROA and damage ROA facilities, such as levees and berms. Damage to these features could result in their failure, causing flooding of otherwise protected areas. However, Alternative 5A would not include Environmental Commitments in the Suisun Marsh area.

Additionally, the final design process for habitat restoration and enhancement activities in the ROAs would include measures to address the fault rupture hazard, as required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, such design codes, guidelines, and standards include the Division of Safety of Dams' *Guidelines for Use of the Consequence Hazard Matrix and Selection of Ground Motion Parameters*, DWR's Division of Flood Management *FloodSAFE Urban Levee Design Criteria*, and USACE's *Engineering and Design—Earthquake Design and Evaluation for Civil Works Projects*. Conformance with these design standards is an environmental commitment by the project proponents to ensure that fault rupture risks are minimized as the habitat restoration and enhancement activities are implemented (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, any hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-13: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Strong Seismic Shaking at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 5A as under Alternative 4A but would involve a slightly smaller acreage of restoration, as described in Section 4.1.4.3, *Environmental Commitments*, of this RDEIR/SDEIS. See Impact GEO-13 under Alternative 4A in Section 4.3.5, *Geology and Seismicity*, of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion: Ground shaking could damage levees, berms, and other structures. Among all the ROAs, the Suisun Marsh ROA would be the most subject to ground shaking because of its proximity to active faults. However, Alternative 5A would not include Environmental Commitments in the Suisun Marsh area. Additionally, conformance with design standards is an environmental commitment by the project proponents to ensure that any remaining strong seismic shaking risks are minimized as the conservation activities are operated and there would be no increased likelihood of loss of property, personal injury or death in the ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-14: Loss of Property, Personal Injury, or Death from Structural Failure Resulting from Seismic-Related Ground Failure (Including Liquefaction Beneath Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 5A to those under 4A but would involve a slightly smaller acreage of restoration, as described in Section 4.1.4.3, *Environmental Commitments*, of this RDEIR/SDEIS. See Impact GEO-14 under Alternative 4A in Section 4.3.5, *Geology and Seismicity*, of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Earthquake-induced ground shaking could cause liquefaction, resulting in damage to or failure of levees, berms, and other features constructed at the restoration areas. Failure of levees and other structures could result in flooding of otherwise protected areas. However, through the final design process, measures to address the liquefaction hazard would be required to conform to applicable design codes, guidelines, and standards as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS. As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, such design codes, guidelines, and standards include USACE's *Engineering and Design—Stability Analysis of Concrete Structures* and *Soil Liquefaction during Earthquakes,* by the Earthquake Engineering Research Institute. Conformance with these design standards is an environmental commitment by the project proponents to ensure that liquefaction risks are minimized as the water conservation features are implemented. The hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs. The impact would be less than significant. No mitigation is required.

Impact GEO-15: Loss of Property, Personal Injury, or Death from Landslides and Other Slope Instability at Restoration Opportunity Areas

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 5A to those under 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.4.3, *Environmental Commitments*, of this RDEIR/SDEIS. See Impact GEO-15 under Alternative 4A in Section 4.3.5, *Geology and Seismicity*, of this RDEIR/SDEIS. There would be no adverse effect.

CEQA Conclusion**:** Unstable new and existing levee and embankment slopes could fail as a result of seismic shaking and as a result of high soil-water content during heavy rainfall and cause flooding of otherwise protected areas. However, because project proponents would conform to applicable design guidelines and standards, such as USACE design measures, as laid out in Chapter 9, *Geology and Seismicity*, of the Draft EIR/EIS, the hazard would be controlled to a safe level and would not create an increased likelihood of loss of property, personal injury or death of individuals in the ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). The impact would be less than significant. No mitigation is required.

Impact GEO-16: Loss of Property, Personal Injury, or Death from Seiche or Tsunami at Restoration Opportunity Areas as a Result of Implementing the Environmental Commitments

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6–12, 15, and 16 would be similar under Alternative 5A to those under Alternative 4A but would involve a slightly greater acreage of restoration, as described in Section 4.1.4.3, *Environmental Commitments*. The distance from the ocean and attenuating effect of the San Francisco Bay would likely allow only a low tsunami wave height to reach the Suisun Marsh and the Delta. Conditions for a seiche to occur at the ROAs are not favorable. Therefore, the effect would not be adverse.

***CEQA Conclusion*:** Based on recorded tsunami heights at the Golden Gate Bridge (Contra Costa Transportation Agency 2009) and in the interior of the San Francisco Bay and on tsunami inundation maps prepared by the California Department of Conservation (2009), the height of a tsunami wave reaching the ROAs would be small because of the distance from the ocean and attenuating effect of the San Francisco Bay. Similarly, the potential for a significant seiche to occur in the project area that would cause loss of property, personal injury, or death at the ROAs is considered low because conditions for a seiche to occur at the ROAs are not favorable. The impact would be less than significant. No mitigation is required.

4.5.6 Soils

Impact SOILS-1: Accelerated Erosion Caused by Vegetation Removal and Other Soil Disturbances as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4 but would include two fewer intakes. These differences would result in slightly less accelerated erosion impacts than Alternative 4. The impacts of Alternative 5A would, however, be similar to those of Alternative 4. See the discussion of Impact SOILS-1 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Construction of the proposed water conveyance facility under Alternative 5A could cause substantial accelerated erosion. DWR would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS). Proper implementation of the requisite SWPPP and compliance with the General Permit (as discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would ensure that there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs as a result of construction of the proposed water conveyance facility. Additionally, implementation of the environmental commitment Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material would help reduce wind blowing of excavated soils, particularly peat soils, during transport and placement at spoils storage, disposal, and reuse areas. Therefore, there would not be an adverse effect.

***CEQA Conclusion*:** Vegetation removal and other soil disturbances associated with construction of water conveyance facilities could cause accelerated water and wind erosion of soil. However, DWR would seek coverage under the state General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. As a result of implementation of the requisite SWPPP, and compliance with the General Permit, there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs the effect would be less than significant. No mitigation is required.

Impact SOILS-2: Loss of Topsoil from Excavation, Overcovering and Inundation as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4 but would entail two fewer intakes. These differences would result in slightly less effects on topsoil loss than under Alternative 4. The impacts of Alternative 5A would, however, be similar to those of Alternative 4. See the discussion of Impact SOILS-2 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., forebays, borrow areas, tunnel shafts, levee foundations, intake facilities, pumping plants): overcovering (e.g., levees and embankments, spoil storage, pumping plants); and water inundation (e.g., forebays, sedimentation basins, and solids lagoons). DWR has made an environmental commitment for Disposal Site Preparation which would require that a portion of the temporary sites selected for storage of spoils, RTM and dredged material will be set aside for topsoil storage and the topsoil would be saved for reapplication to disturbed areas, thereby lessening the effect. However, this effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Construction of the water conveyance facilities would involve excavation, overcovering, and inundation of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil despite a commitment for Disposal Site Preparation. The impact on soils in the project area would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts, but not to a less-than-significant level because topsoil would be permanently lost over extensive areas. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4.

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4.

Impact SOILS-3: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on or in Soils Subject to Subsidence as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, except that it would entail two fewer intakes. These differences would result in slightly less effects related to subsidence than under Alternative 4. The impacts of Alternative 5A would, however, be similar to those under Alternative 4. See the discussion of Impact SOILS-3 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. Geotechnical studies (as described in the Geotechnical Exploration Plan—Phase 2 [California Department of Water Resources 2014]) would be conducted at all facilities to identify the types of soil avoidance or soil stabilization measures that should be implemented to ensure that the facilities are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards (Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). These investigations would build upon the geotechnical data reports (California Department of Water Resources 2001a, 2010b, 2011) and the CERs (California Department of Water Resources 2010a, 2010b, 2015), as well as the results of the investigations that will be conducted under the Geotechnical Exploration Plan—Phase 2 (California Department of Water Resources 2014). Conforming to state and federal design standards (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS), including conduct of site-specific geotechnical evaluations, would ensure that appropriate design measures are incorporated into the project and any subsidence that takes place under the project facilities would not jeopardize their integrity. Therefore, there would not be an adverse effect.

***CEQA Conclusion*:** Some of the conveyance facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, as stated in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR would be required to design and construct the facilities according to state and federal design standards and guidelines (e.g., California Building Code, American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures, ASCE-7-10, 2010). Conforming to these codes would reduce the potential hazard of subsidence or settlement to acceptable levels by avoiding construction directly on or otherwise stabilizing the soil material that is prone to subsidence. Because these measures would reduce the potential hazard of subsidence or settlement to meet design standards, the impact would be less than significant. No mitigation is required.

Impact SOILS-4: Risk to Life and Property as a Result of Constructing the Proposed Water Conveyance Facilities in Areas of Expansive, Corrosive, and Compressible Soils

Alternative 5A would include the same physical/structural components as Alternative 4, except it would entail two fewer intakes. These differences would result in slightly fewer effects related to expansive, corrosive, and compressible soils than under Alternative 4 because there would be two fewer structures. The effects under Alternative 5A would, however, be the similar to those of Alternative 4. See discussion of Impact SOILS-4 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: The integrity of the water conveyance facilities, including tunnels, pipelines, intake facilities, pumping plants, access roads and utilities, and other features could be adversely affected because they would be located on expansive, corrosive, and compressible soils. However, all facility design and construction would be executed in conformance with the CBC (described in detail under Alternative 4 in Chapter 10, *Soils*, in Appendix A of this RDEIR/SDEIS) which specifies measures to mitigate effects of expansive soils, corrosive soils, and soils subject to compression and subsidence. By conforming to the CBC and other applicable design standards, potential effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset. There would be no adverse effect.

***CEQA Conclusion*:** Some of the project facilities would be constructed on soils that are subject to expansion, corrosion to concrete and uncoated steel, and compression under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression/settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, because DWR would be required to design and construct the facilities in conformance with state and federal design standards, guidelines, and building codes (e.g., CBC and USACE design standards). Conforming to these codes and standards is an environmental commitment by DWR to ensure that potential adverse effects associated with expansive and corrosive soils and soils subject to compression and subsidence would be offset (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Therefore, this impact would be less than significant. No mitigation is required.

Impact SOILS-5: Accelerated Bank Erosion from Increased Channel Flow Rates as a Result of Operations

Alternative 5A has different operations from those under Alternative 4, but of a lesser magnitude with respect to potential effects on accelerated bank erosion because the flow from the north Delta would be 3,000 cfs rather than 9,000 cfs. The effects under Alternative 5A would, however, be similar to those under Alternative 4. See the discussion of Impact SOILS-5 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: The effect of increased channel flow rates on channel bank scour would not be adverse because, as described in Section 3.6.2, *Conservation Components*, of Appendix A of this RDEIR/SDEIS, as part of the Environmental Commitment 4, major channels could be dredged to create a larger cross-section that would offset increased tidal velocities. The effect would not be adverse because there would be no net increase in river flow rates and therefore no net increase in channel bank scour.

***CEQA Conclusion*:** Changes in operational flow regimes could cause increases in flow rates in channels and sloughs, potentially leading to increases in channel bank scour. However, where such changes are expected to occur (i.e., at the mouths of tidal marsh channels), the project would also entail expansion of the channel cross-section to increase the tidal prism at these locations as described in Section 3.6.2, *Conservation Components*, of Appendix A of this RDEIR/SDEIS. For most of the existing channels that would not be subject to tidal flow restoration, there would be no adverse effect to tidal flow volumes and velocities. The tidal prism would increase by 5–10%, but the intertidal (i.e., MHHW to MLLW) cross-sectional area also would be increased such that the channel flow rates would be reduced by 10–20% compared to Existing Conditions. Consequently, no appreciable increase in scour is anticipated because the overall net flow would be reduced. The impact would be less than significant. No mitigation is required.

Impact SOILS-6: Accelerated Erosion Caused by Clearing, Grubbing, Grading, and Other Disturbances Associated with Implementation of Proposed Environmental Commitments 3, 4, 6-11

Effects on accelerated erosion from implementation of Environmental Commitments under Alternative 5A, as described in Section 4.1.4.3, *Environmental Commitments* in this RDEIR/SDEIS, would be similar in mechanism and magnitude to those described for Alternative 4A. Any differences would be due to differing acreages or locations, but would be slight. See the discussion of Impact SOILS-6 under Alternative 4A in this RDEIR/SDEIS.

NEPA Effects: Implementation of some of the Environmental Commitments under Alternative 2D would involve ground disturbance and construction activities that could lead to accelerated soil erosion rates and consequent loss of topsoil. However, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, the project proponents would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper implementation of the requisite SWPPP, site-specific BMPs, and compliance with the General Permit would ensure that accelerated water and wind erosion as a result of implementing Environmental Commitments would not be an adverse effect.

***CEQA Conclusion*:** Vegetation removal and other soil disturbances associated with construction of restoration areas could cause accelerated water and wind erosion of soil. However, the project proponents would seek coverage under the state General Permit for Construction and Land Disturbance Activities. Permit conditions would include erosion and sediment control BMPs and compliance with water quality standards. As a result of implementation of permit conditions, the impact would be less than significant. No mitigation is required.

Impact SOILS-7: Loss of Topsoil from Excavation, Overcovering and Inundation Associated with Restoration Activities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–11

Effects from implementation of Environmental Commitments under Alternative 5A on loss of topsoil would be similar in mechanism to those described for Alternative 4A. Differences in Environmental Commitments, as described in Section 4.1.4.3 in this RDEIR/SDEIS, would be slight. See the discussion of Impact SOILS-7 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., levee foundations, water control structures); overcovering (e.g., levees, embankments, application of fill material in subsided areas); and water inundation (e.g., aquatic habitat areas) over areas of the Plan Area. Based on ICF's calculations using a geographic information system, implementation of habitat restoration activities at the ROAs would result in excavation, overcovering, or inundation of approximately a thousand acres of topsoil. This effect would be adverse because it would result in a substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

***CEQA Conclusion*:** Significant impacts could occur if there is loss of topsoil from excavation, overcovering, and inundation associated with restoration activities as a result of implementing the proposed Environmental Commitments. Implementation of the Environmental Commitments would involve excavation, overcovering, and inundation (to create aquatic habitat areas) of topsoil over extensive areas, thereby resulting in a substantial loss of topsoil of over 1,000 acres. The impact would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these impacts to a degree, but not to a less-than-significant level. Therefore, this impact is considered significant and unavoidable.

Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance

Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4.

Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a Topsoil Storage and Handling Plan

Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4.

Impact SOILS-8: Property Loss, Personal Injury, or Death from Instability, Failure, and Damage from Construction on Soils Subject to Subsidence as a Result of Implementing the Proposed Environmental Commitments 3, 4, and 6–11

Effects from implementation of Environmental Commitments under Alternative 5A (as described in Section 4.1.4.3 in this RDEIR/SDEIS) related to subsidence would be similar in mechanism to those described for Alternative 4A. See the discussion of Impact SOILS-8 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: This potential effect could be substantial because the facilities could be located on unstable soils that are subject to subsidence. However, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, geotechnical studies would be conducted at all the ROAs to identify the types of soil stabilization that should be implemented to ensure that levees, berms, and other features are constructed to withstand subsidence and settlement and to conform to applicable state and federal standards.

With construction of all levees, berms, and other conservation features designed and constructed to withstand subsidence and settlement and through conformance with applicable state and federal design standards, this effect would not be adverse.

CEQA Conclusion: Some of the restoration area facilities would be constructed on soils that are subject to subsidence. Subsidence occurring after the facility is constructed could result in damage to or failure of the facility. However, as outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project proponents would be required to design and construct the facilities according to state and federal design standards and guidelines (which may involve, for example, replacement of the organic soil), the impact would be less than significant. No mitigation is required.

Impact SOILS-9: Risk to Life and Property from Construction in Areas of Expansive, Corrosive, and Compressible Soils as a Result of Implementing the Proposed Environmental Commitments 3, 4, and 6–11

Effects from implementation of Environmental Commitments under Alternative 5A, as described in Section 4.1.4.3 in this RDEIR/SDEIS, resulting from construction of Environmental Commitments in areas of expansive, corrosive, or compressible soils would be similar in mechanism to those described for Alternative 4A. See the discussion of Impact SOILS-9 under Alternative 4A of this RDEIR/SDEIS.

NEPA Effects: The Environmental Commitments could be located on expansive, corrosive, and compressible soils. ROA specific geotechnical studies and testing would be completed prior to construction within the ROAs. The site-specific studies and tests would identify specific areas where engineering soil properties, including soil compressibility, may require special consideration during construction of specific features within ROAs (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS). Conformity with USACE, CBC, and other design standards for construction on expansive, corrosive and/or compressible soils would prevent adverse effects of such soils.

CEQA Conclusion: Some of the restoration facilities could be constructed on soils that are subject to expansion, corrosive to concrete and uncoated steel, and compress under load. Expansive soils could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could damage in-ground facilities or shorten their service life. Compression or settlement of soils after a facility is constructed could result in damage to or failure of the facility. However, as outlined in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project proponents would be required to design and construct the facilities according to state and federal design standards, guidelines, and building codes (which may involve, for example, soil lime stabilization, cathodic protection of steel, and soil replacement), this impact would be considered less than significant. No mitigation is required.

4.5.7 Fish and Aquatic Resources

4.5.7.1 Alternative 5A—Dual Conveyance with Modified Pipeline/Tunnel Alignment and Intake 2

The principal features of Alternative 5A are described in section 4.1.4. This alternative is similar to Alternative 4A but includes only a single north Delta intake as opposed to three under Alternative 4A. The analysis below includes a comparison between Alternative 5A in the early long term (a scenario termed A5A_ELT when discussing results based on water operations modeling) and the No Action Alternative in the early long term (a scenario termed NAA_ELT, which is the baseline for NEPA purposes), as well as a comparison between A5A_ELT and Existing Conditions (which is the baseline for CEQA purposes, and is at the current time frame as opposed to the early long term). Additionally, the effects of Alternative 5A in the LLT are similar to the effects of the alternative in the ELT, except where noted.

Delta Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-1: Effects of Construction of Water Conveyance Facilities on Delta Smelt

The potential effects of construction of the water conveyance facilities on delta smelt or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-1) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to delta smelt. To reiterate the summary from Alternative 4A, construction of Alternative 5A includes several elements with the potential to cause adverse effects on delta smelt through spills of hazardous materials or underwater noise. However, adverse effects will be effectively avoided and minimized by siting construction in areas that are minimally used by this species, and through the use of in-water work windows, activity-specific timing restrictions, and environmental commitments.

Alternative 5A includes several environmental commitments that will avoid and limit spills, potentially leading to adverse water quality effects on delta smelt. These include *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan;* and *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material* (see Appendix 3B, *Environmental Commitments*). These commitments would guide rapid and effective response in the case of inadvertent spills of hazardous materials. In combination with the species' natural tolerance to elevated turbidity levels, and limited occurrence in the construction areas, these environmental commitments would be expected to protect delta smelt from any adverse water quality effect resulting from project construction.

Delta smelt could be adversely affected by elevated underwater noise associated with impact pile driving and direct exposure to construction-related disturbance. The number of individuals affected is expected to be limited, based on the fact that delta smelt are typically present at low densities in the affected habitats during the in-water work window. The in-water work window will minimize, but perhaps not completely avoid, the potential for injury or mortality. Mitigation Measures AQUA-1a and AQUA 1b would also minimize adverse effects from impact pile driving. Implementation of environmental commitments *Fish Rescue and Salvage Plan* and *Barge Operations Plan* (as described in Appendix 3B, *Environmental Commitments*) would also minimize adverse effects from construction-related disturbance. As a result, while these construction activities could adversely affect individual delta smelt, these effects would not result in adverse population-level effects on delta smelt.

Construction would not be expected to measurably increase predation rates relative to baseline conditions because the locally increased predator habitat and predation from temporary construction structures would not have population-level effects.

Construction of Alternative 5A will result in both temporary and permanent alteration of migration, spawning, and rearing habitats used by delta smelt. However, these effects are not expected to be adverse from a population standpoint, because local water quality conditions (very low electrical conductivity and typically low turbidity) in the proposed north Delta intake reach limits habitat suitability. In addition, changes to Clifton Court Forebay occur in a marginal environment within which delta smelt are trapped once entrained, with little prospect of effective salvage. Moreover, any habitat losses will be offset by restoration of 55 acres of tidal habitat and the beneficial operational effects of Alternative 5A (described below) on the Delta as a whole.

Table pile_driving_alt5A. Estimated Distances and Areas of Waterbodies Subject to Pile Driving Noise Levels Exceeding Interim Injury and Behavioral Thresholds, and Proposed Timing and Duration of Proposed Pile Driving Activities for Facilities or Structures in or Adjacent to Sensitive Rearing and Migration Corridors of the Covered Species (Alternative 5A)

Facility or Structure	Average Width of Water Body (feet)	Distance to Cumulative 187 and 183 dB SEL Injury Threshold[1, 2] (feet)	Potential Impact Area[3] (acres)	Distance to 150 dB RMS Behavioral Threshold[2] (feet)	Year of Construction	Duration of Pile Driving (days)
Intake 1						
Cofferdam	425	2,814	55	13,058	Year 3	42
Foundation		3,280	64	32,800	Year 4	8
SR-160 Bridge		1,522	30	7,065	Year 5	5
Barge Unloading Facilities (6)						
Piers	300–1,350	1,774	24–110	9,607	Year 5	13
Clifton Court Forebay						
Cofferdams	10,500	2,814	364	13,058	Year 8	450
Siphon – N. Inlet		1,774	144	9,607	Year 9	72
Siphon – N. Outlet		1,774	144	9,607	Year 9	72

[1] Distances to injury thresholds are governed by the distance to "effective quiet" (150 dB SEL).

[2] Distance to injury and behavioral thresholds assume an attenuation rate of 4.5 dB per doubling of distance and an unimpeded propagation path; on-land pile driving, vibratory driving or other non-impact driving methods, dewatering of cofferdams, and the presence of major river bends or other channel features can impede sound propagation and limit the extent of underwater sounds exceeding the injury and behavioral thresholds.

[3] Based on the area of open water subject to underwater sound levels exceeding the cumulative SEL thresholds for fish larger than 2 grams (187 dB) and smaller than 2 grams (183 dB); for open channels, this area is calculated by multiplying the average channel width by twice the distance to the injury thresholds, assuming an unimpeded propagation path upstream and downstream of the source piles.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-1, and as discussed above, the effect would not be adverse for delta smelt or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-1, and as discussed above, the impact of the construction of water conveyance facilities on delta smelt and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-2: Effects of Maintenance of Water Conveyance Facilities on Delta Smelt

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-2 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-2 would not be adverse for delta smelt under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-2 for delta smelt under Alternative 4A, the impact of the maintenance of water conveyance facilities on delta smelt or critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-3: Effects of Water Operations on Entrainment of Delta Smelt

Water Exports from SWP/CVP South Delta Facilities

Overall, operational activities under Alternative 5A at the south Delta facilities would result in minimal (<3%) changes in average proportional entrainment of the total delta smelt population compared to NAA_ELT (Table 11-5A-1).

Average larval/juvenile proportional entrainment across all water year types under Alternative 5A would be 0.14 (15% of the larval/juvenile population), which is 0.005 greater than NAA_ELT (a 3% relative increase) (Table 11-5A-1). Average adult proportional entrainment would be 0.07 (7% of the population), which is 0.003 less compared to NAA (a 4% relative decrease) (Table 11-5A-1).

Differences by water year type were slight, with somewhat greater reductions under Alternative 5A in wet years for adults.

Table 11-5A-1. Differences in Proportional Entrainment of Delta Smelt at SWP/CVP South Delta Facilities

	Proportional Entrainment[a] Difference in Proportions (Relative Change in Proportions)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Total Population (December–June)		
Wet	0.005 (5%)	-0.003 (-3%)
Above Normal	0.008 (5%)	-0.002 (-1%)
Below Normal	0.016 (7%)	0.004 (2%)
Dry	0.023 (9%)	0.007 (2%)
Critical	0.003 (1%)	0.005 (2%)
All Years	0.011 (6%)	0.002 (1%)
Juvenile Delta Smelt (March–June)		
Wet	0.011 (30%)	0.003 (6%)
Above Normal	0.012 (15%)	0.002 (3%)
Below Normal	0.019 (14%)	0.006 (4%)
Dry	0.023 (13%)	0.007 (4%)
Critical	0.005 (2%)	0.004 (2%)
All Years	0.014 (12%)	0.005 (3%)
Adult Delta Smelt[b] (December–March)		
Wet	-0.006 (-8%)	-0.006 (-8%)
Above Normal	-0.004 (-5%)	-0.004 (-5%)
Below Normal	-0.003 (-4%)	-0.002 (-2%)
Dry	0.0 (0%)	-0.001 (-1%)
Critical	-0.002 (-2%)	0.001 (1%)
All Years	-0.003 (-4%)	-0.003 (-4%)
	Shading indicates >5% or more increased entrainment.	

Note: Negative values indicate lower entrainment loss under Alternative than under EXISTING CONDITIONS or NAA_ELT.

[a] Proportional entrainment calculated in accordance with USFWS BiOp (U.S. Fish and Wildlife Service 2008a).

[b] Adult proportional entrainment adjusted according to Kimmerer (2011).

Water Exports from SWP/CVP North Delta Intake Facilities

As described for Alternative 1A and for Alternative 5, potential entrainment and impingement risks at the proposed north Delta intake would be limited because delta smelt rarely occur in the vicinity of the proposed intake site. The intake would be screened to exclude fish larger than ~22 mm. Alternative 5A would have only one SWP/CVP north delta intake, compared to five intakes for Alternative 1A and three intakes for Alternative 4A, for example, and therefore potential entrainment and impingement risks would be lower than for these alternatives.

Predation Associated with Entrainment

Pre-screen loss of delta smelt at the south Delta facilities, typically attributed to predation and other unfavorable habitat conditions near the pumps (Castillo et al. 2012), would be changed to a small extent under Alternative 5A, commensurate with proportional entrainment estimates. Predation loss at the proposed north Delta intake would be limited because few delta smelt occur that far upstream.

NEPA Effects: In conclusion, under Alternative 5A, proportional delta smelt entrainment at the south Delta facilities generally would be similar to NAA_ELT. Entrainment and impingement could potentially occur at the proposed north Delta intake, but the risk would be low due to the location, design, and operation of intakes. Furthermore, any potential effects would be reduced by real-time monitoring and adaptive management response by the Real-Time Response Team. Therefore, the effect on delta smelt entrainment would not be adverse according to NEPA analysis.

CEQA Conclusion: As shown in Table 11-5A-1, under Alternative 5A average larval/juvenile delta smelt proportional entrainment and associated pre-screen predation loss at the south Delta facilities would increase 0.014 (1.4% of the juvenile population, a 12% relative increase) compared to Existing Conditions. Average adult proportional entrainment would decrease 0.003 (a 4% relative decrease) compared to Existing Conditions. Potential impacts would be reduced by monitoring and adaptive management by the Real-Time Response Team. This CEQA interpretation of the biological modeling differs from the NEPA analysis, which is likely attributable to different modeling assumptions (as described fully in Section 11.3.3 and Alternative 1A Impact AQUA-3). Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. Note that the analysis for larvae and juveniles includes both OMR flows and X2 as predictors of proportional entrainment; primarily because of sea level rise assumptions, X2 would be further upstream in the ELT even with similar water operations, so that the comparison of the action alternative in the ELT to Existing Conditions is confounded.

Therefore, the impact analysis is better informed by the results from the NEPA analysis presented above, which accounts for sea level rise by considering the NAA in the ELT. When climate change is factored in, average delta smelt proportional entrainment under Alternative 5A is slightly increased for larvae and juveniles (0.005 more, a 3% relative increase) and adults (4% relative decrease) compared to conditions without BDCP (Table 11-5A-1).

Entrainment and impingement would potentially occur at the proposed north Delta intake, but the magnitude of this effect would be low because delta smelt occur infrequently here and the intake would be equipped with state-of-the-art screens to reduce the entrainment risk. Overall, the impact would be less than significant, and no mitigation would be required.

Impact AQUA-4: Effects of Water Operations on Spawning and Egg Incubation Habitat for Delta Smelt

NEPA Effects: The effects of operations under Alternative 5A on abiotic spawning habitat would be the same as described for Alternative 5 (Impact AQUA-4). Flow reductions below the north Delta intake would not degrade available spawning habitat. In-Delta water temperatures, which can affect spawning timing, would not change across Alternatives, because they would be in thermal equilibrium with atmospheric conditions and not strongly influenced by the flow changes. The effect of Alternative 5A operations on spawning would not be adverse, because there would be little change in abiotic spawning conditions for delta smelt.

CEQA Conclusion: As described above, operations under Alternative 5A would not degrade abiotic spawning habitat availability or change spawning temperatures for delta smelt. Consequently, the impact would be less than significant, and no mitigation would be required.

Impact AQUA-5: Effects of Water Operations on Rearing Habitat for Delta Smelt

NEPA Effects: As described for Alternative 4A (Impact AQUA-5 for delta smelt), rearing habitat conditions for juvenile delta smelt were evaluated using the fall abiotic habitat index (Feyrer et al. 2011); further details and limitations of this method are discussed under Alternative 4A. Alternative 5A includes the USFWS BiOp Fall X2 requirements, thus, the abiotic habitat index under Alternative 5A would be similar to the NAA_ELT (Table 11-5A-3).

Table 11-5A-3. Differences in Delta Smelt Fall Abiotic Index (hectares) between Alternative 5A and Existing Conditions/NAA_ELT Scenarios, Averaged by Prior Water Year Type

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
All	1,036 (26%)	-15 (0%)
Wet	2,424 (52%)	-16 (0%)
Above Normal	1,927 (50%)	-18 (0%)
Below Normal	27 (1%)	-12 (0%)
Dry	-37 (-1%)	-26 (-1%)
Critical	3 (0%)	3 (0%)

Note: Negative values indicate lower habitat indices under alternative scenarios. Water year 1922 was omitted because water year classification for prior year was not available.

CEQA Conclusion: Alternative 5A would not result in less rearing habitat area for delta smelt compared to Existing Conditions. The delta smelt fall abiotic habitat index under Alternative 5A would increase 26% relative to Existing Conditions. This increase is a function of Alternative 5A including the BiOp Fall X2 requirements in wet and above normal years (Existing Conditions does not include Fall X2). The NEPA analysis is a better approach for isolating the effect of the Alternative from the effects of sea level rise, climate change, future water demands, and implementation of required actions under the BiOps such as the Fall X2 requirement. When compared to the NAA_ELT and informed by the NEPA analysis, the average delta smelt abiotic habitat index under Alternative 5A would be similar to NAA_ELT (Table 11-5A-3).

The impact of Alternative 5A would be less than significant. No mitigation is required.

Impact AQUA-6: Effects of Water Operations on Migration Conditions for Delta Smelt

More detailed discussion of water temperature and turbidity as migration cues for delta smelt is provided under Alternative 4A. As described above in Impact AQUA-4, in-Delta water temperatures would not change in response to Alternative 5A flows. Although Alternative 5A would result in sediment being removed at the north Delta intakes, Alternative 5A is not expected to affect suspended sediment concentration during the first flush of precipitation that cues delta smelt migration. With regard to suspended sediment concentrations at other times of the year, any effect will be minimized through the reintroduction of sediment collected at the north Delta intakes into tidal natural communities restoration projects (Environmental Commitment 4), consistent with the Environmental Commitment addressing Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material.

NEPA Effects: Alternative 5A may decrease sediment supply to the estuary, with the potential for decreased habitat suitability for delta smelt in some locations, but there would not be an adverse effect during the migration period and water temperature would not be affected by Alternative 5A water operations. Operations of Alternative 5A would not affect turbidity or temperatures during the migration period, and therefore the impact on migration conditions for delta smelt would not be adverse relative to NAA_ELT.

CEQA Conclusion: As described above, operations under Alternative 5A would not substantially alter the turbidity cues associated with winter flush events that may initiate migration, nor would there be appreciable changes in water temperatures. Consequently, the impact on adult delta smelt migration conditions would be less than significant, and no mitigation would be required.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. For Alternative 5A, this action would entail restoration of up to 55 acres of tidal habitat (including transitional uplands). Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-7: Effects of Construction of Restoration Measures on Delta Smelt

Impact AQUA-8: Effects of Contaminants Associated with Restoration Measures on Delta Smelt

Impact AQUA-9: Effects of Restored Habitat Conditions on Delta Smelt

Impact AQUA-10: Effects of Methylmercury Management on Delta Smelt (Environmental Commitment 12)

Impact AQUA-13: Effects of Localized Reduction of Predatory Fish on Delta Smelt (Environmental Commitment 15)

Impact AQUA-14: Effects of Nonphysical Fish Barriers on Delta Smelt (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on delta smelt for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Longfin Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-19: Effects of Construction of Water Conveyance Facilities on Longfin Smelt

The potential effects of construction of the water conveyance facilities on longfin smelt would be similar to those described for Alternative 4A (Impact AQUA-19) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to longfin smelt.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-19, the effect would not be adverse for longfin smelt.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-19, the impact of the construction of water conveyance facilities on longfin smelt would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-20: Effects of Maintenance of Water Conveyance Facilities on Longfin Smelt

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-20 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-20 would not be adverse for longfin smelt under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-20 for longfin smelt under Alternative 4A, the impact of the maintenance of water conveyance facilities on longfin smelt would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-21: Effects of Water Operations on Entrainment of Longfin Smelt

Water Exports from SWP/CVP South Delta Facilities

For larval longfin smelt, entrainment risk was simulated using particle tracking modeling. Average entrainment under Alternative 5A with the wetter starting distribution was 1.8% compared to 1.7% for NAA_ELT, a relative difference of 3% (Table 11-5A-4). Under the drier water years starting distribution, average entrainment loss was 2.4% under Alternative 5A compared to 2.2% for NAA, a 5% increase in relative terms. Overall, larval longfin smelt entrainment at the south Delta intakes would be similar under Alternative 5A compared to baseline conditions (NAA_ELT).

Table 11-5A-4. Percentage of Particles (and Difference) Representing Longfin Smelt Larvae Entrained by the South Delta Facilities under Alternative 5A and Baseline Scenarios

	Percent Particles Entrained			Absolute Difference (and Relative Difference)	
Starting Distribution	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	A5A_ELT vs. EXISTING CONDITIONS	A5A_ELT vs. NAA_ELT
Wetter	1.9	1.7	1.8	-0.13 (-7%)	0.05 (3%)
Drier	2.5	2.2	2.4	-0.17 (-7%)	0.10 (5%)

Entrainment of later life stages under Alternative 5A generally would be similar to slightly lower than under NAA_ELT. Based on the salvage-density method, entrainment for juvenile longfin smelt averaged across all water year types would be reduced slightly by 7% compared to NAA_ELT; adult longfin smelt entrainment would be reduced by 8% compared to NAA_ELT (Table 11-5A-5). For Alternative 5A entrainment would be highest in dry and critical water year types for juvenile longfin smelt and in critical water year types for adult longfin smelt. In critical water year types, juvenile entrainment would be reduced by 13% and adult entrainment would be slightly greater (6%) compared to NAA_ELT.

Table 11-5A-5. Longfin Smelt Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences (Absolute and Percentage) between Model Scenarios for Alternative 5A

		Absolute Difference (Percent Difference)	
Life Stage	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Juvenile (March–June)	Wet	467 (1%)	-3413 (-5%)
	Above Normal	202 (4%)	-74 (-2%)
	Below Normal	7 (0%)	9 (0%)
	Dry	33,728 (6%)	-13,460 (-2%)
	Critical	-92,666 (-16%)	-68,159 (-13%)
	All Years	2,970 (1%)	-19,762 (-7%)
Adult (December–March)	Wet	-10 (-8%)	-16 (-12%)
	Above Normal	8 (1%)	-43 (-6%)
	Below Normal	175 (9%)	83 (4%)
	Dry	-72 (-6%)	-88 (-7%)
	Critical	-730 (-3%)	1,391 (6%)
	All Years	-233 (-6%)	-303 (-8%)
	Shading indicates entrainment increased by 10% or more.		

[a] Estimated annual number of fish lost, based on normalized data.

Water Exports from SWP/CVP North Delta Intake Facilities

The proposed north Delta intake could increase entrainment potential and locally attract piscivorous fish predators, but entrainment and predation losses of longfin smelt at the north Delta would be extremely low because this species is only expected to occur occasionally in very low numbers this far upstream on the Sacramento River.

Predation Associated with Entrainment

Pre-screen loss of longfin smelt at the south Delta facilities, typically attributed to predation, would be similar or slightly lower under Alternative 5A compared to NAA_ELT, commensurate with differences in entrainment (similar to Impact AQUA-3). Predation loss at the proposed north Delta intake would be limited because very few longfin smelt would be expected to occur that far upstream.

NEPA Effects: In conclusion, the effect on entrainment and entrainment-related predation loss of longfin smelt under Alternative 5A would not be adverse, because of similar or slightly lower entrainment and predation loss at the south Delta facilities. Entrainment loss of longfin smelt at the proposed north Delta intake would be rare because longfin smelt are not expected to occur in that area of the Sacramento River.

CEQA Conclusion: The results of the PTM model indicate slightly reduced (7%) longfin smelt larval entrainment at the south Delta facilities under Alternative 5A compared to NAA_ELT (Table 11-5A-4), whereas adult and juvenile entrainment would be similar between Alternative 5A and NAA_ELT (Table 11-5A-5). Entrainment to the north Delta intake would be minimal because longfin smelt are not expected to occur in the vicinity of the intake. Predation loss at the south Delta facilities compared to Existing Conditions would be similar for juveniles and adults, and reduced by 11% for adults. Predation loss at the proposed north Delta intake would be minimal because longfin smelt rarely occur in that vicinity.

The impact on longfin smelt would be less than significant and may provide a benefit to the species because of the reduced entrainment and predation loss for adults.

Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt

As noted for Alternative 4A, background on the general distribution of longfin smelt and the evidence for relationships between longfin smelt abundance with freshwater outflow is provided in detail in the discussion for Alternative 4. The X2–longfin smelt abundance relationship provided by Kimmerer et al. (2009) was used to evaluate the effects of the alternatives on longfin smelt, following the historical observation that lower X2 (farther downstream) correlates with increased recruitment (represented by abundance indices in trawl surveys), although it is not understood if or how this would affect spawning, egg incubation, and/or rearing longfin smelt. Relationships between X2 and longfin smelt abundance developed by Kimmerer et al. (2009) were used to determine how the changes in winter-spring X2 position described above might influence longfin smelt abundance the following fall.

NEPA Effects: Modeling results based on Kimmerer et al. (2009) indicate that relative longfin smelt abundance averaged across all years would be 5% less (based on Fall Midwater Trawl indices) to 6% less (based on Bay Otter Trawl indices) under Alternative 5A, compared to NAA_ELT (Table 11-5A-7). When analyzing individual water year types, longfin smelt abundances under Alternative 5A are 9–13% lower in below normal and dry years compared to NAA_ELT. Inclusion of Mitigation Measures AQUA-22a-c (see below) would lessen the impact, but it would remain adverse.

Table 11-5A-7 Estimated Differences between Scenarios for Longfin Smelt Relative Abundance in the Fall Midwater Trawl or Bay Otter Trawl[a]

	Fall Midwater Trawl Relative Abundance		Bay Otter Trawl Relative Abundance	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
All	-1,433 (-16%)	-407 (-5%)	-5,598 (-18%)	-1,460 (-6%)
Wet	-2,932 (-15%)	-646 (-4%)	-12,325 (-18%)	-2,461 (-4%)
Above Normal	-1,606 (-16%)	-607 (-7%)	-6,003 (-19%)	-2,277 (-8%)
Below Normal	-935 (-21%)	-411 (-10%)	-2,975 (-24%)	-1,336 (-13%)
Dry	-437 (-19%)	-176 (-9%)	-1,237 (-22%)	-489 (-10%)
Critical	-87 (-8%)	-30 (-3%)	-222 (-10%)	-75 (-4%)
	Shading indicates a decrease of 10% or greater in relative abundance.			

[a] Based on the X2-Relative Abundance Regressions of Kimmerer et al. (2009).

CEQA Conclusion: Average Delta outflows averaged across all water years under Alternative 5A during January through April generally are similar (7% or less difference) to Existing Conditions, but are reduced 12–18% in May and June.

Average longfin smelt relative abundance based on Kimmerer et al. (2009) is reduced 8–10% compared to Existing Conditions (Table 11-5A-7), due to reduced spring Delta outflow.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially reduce relative abundance based on Kimmerer et al. (2009). However, and as noted for Alternative 4A and other alternatives, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed above (Section 11.3.3), because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the NEPA analysis, which compares results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, the average longfin smelt abundance, based on Kimmerer et al. (2009), decreased 5-6% under Alternative 5A (Table 11-5A-7). These results represent the increment of change attributable to the alternative, and address the limitations of the comparison the CEQA baseline (Existing Conditions). Implementation of Mitigation

Measures AQUA-22a through 22c would reduce this impact, but not to a less than significant level. This impact is a result of the specific reservoir operations and resulting flows associated with this alternative. Applying mitigation (e.g., changing reservoir operations in order to alter the flows) to the extent necessary to reduce this impact to a less-than-significant level would fundamentally change the alternative, thereby making it a different alternative than that which has been modeled and analyzed. As a result, this impact is significant and unavoidable because there is no feasible flow-based mitigation available.

Mitigation Measure AQUA-22a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Longfin Smelt to Determine Feasibility of Mitigation to Reduce Impacts to Spawning and Rearing Habitat

Please refer to Mitigation Measure AQUA-22a under Impact AQUA-22 of Alternative 1A.

Mitigation Measure AQUA-22b: Conduct Additional Evaluation and Modeling of Impacts on Longfin Smelt Rearing Habitat Following Initial Operations of Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-22b under Impact AQUA-22 of Alternative 1A.

Mitigation Measure AQUA-22c: Consult with USFWS and CDFW to Identify and Implement Feasible Means to Minimize Effects on Longfin Smelt Rearing Habitat Consistent with Water Conveyance Facility Operations

Please refer to Mitigation Measure AQUA-22c under Impact AQUA-22 of Alternative 1A.

Impact AQUA-23: Effects of Water Operations on Rearing Habitat for Longfin Smelt

Discussion provided above, under Impact AQUA-22.

Impact AQUA-24: Effects of Water Operations on Migration Conditions for Longfin Smelt

Discussion provided above, under Impact AQUA-22.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-25: Effects of Construction of Restoration Measures on Longfin Smelt

Impact AQUA-26: Effects of Contaminants Associated with Restoration Measures on Longfin Smelt

Impact AQUA-27: Effects of Restored Habitat Conditions on Longfin Smelt

Impact AQUA-28: Effects of Methylmercury Management on Longfin Smelt (Environmental Commitment 12)

Impact AQUA-31: Effects of Localized Reduction of Predatory Fish on Longfin Smelt (Environmental Commitment 15)

Impact AQUA-32: Effects of Nonphysical Fish Barriers on Longfin Smelt (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on longfin smelt for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Chinook Salmon

Winter-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-37: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

The potential effects of construction of the water conveyance facilities on winter-run Chinook salmon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-37) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to winter-run Chinook salmon. Any habitat losses from construction of Alternative 5A will be offset by restoration of 55 acres of tidal habitat, 4.6 miles of channel margin habitat, and the beneficial operational effects on the Delta as a whole.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-37, and as discussed above, the effect would not be adverse for winter-run Chinook salmon or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-37, and as discussed above, the impact of the construction of water conveyance facilities on winter-run Chinook salmon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-38: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-38 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-38 would not be adverse for winter-run Chinook salmon under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-38 for winter-run Chinook salmon under Alternative 4A, the impact of maintenance of water conveyance facilities on winter-run Chinook salmon or their designated critical habitat would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-39: Effects of Water Operations on Entrainment of Chinook Salmon (Winter-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Alternative 5A would reduce entrainment and associated pre-screen predation losses at the SWP/CVP south Delta facilities compared to NAA_ELT by about 8% averaged across all water year types (Table 11-5A-8). As discussed for Alternative 5, Impact AQUA-39, entrainment reductions would be highest in wet years and would decrease with reduced flows. The greatest relative reductions under Alternative 5A would occur in wet and above normal years with a decrease 11-14% compared to NAA_ELT (Table 11-5A-8).

Table 11-5A-8. Juvenile Winter-Run Chinook Salmon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA vs. A5A_ELT
Wet	-998 (-9%)	-1,721 (-14%)
Above Normal	-596 (-9%)	-746 (-11%)
Below Normal	-228 (-3%)	-414 (-6%)
Dry	-163 (-4%)	-28 (-1%)
Critical	-50 (-4%)	40 (3%)
All Years	-435 (-6%)	-583 (-8%)

[a] Estimated annual number of fish lost, based on normalized data.

Water Exports from SWP/CVP North Delta Intake Facilities

The entrainment and impingement impact of Alternative 5A would be similar in type to Alternative 1A (with five intakes), but the degree of the effect would be less because Alternative 5A has only one intake. The state-of-the-art, positive barrier screen would be designed and built to specifications developed to reduce the risk of entrainment and impingement, and are expected to be effective at excluding all life stages of winter-run Chinook salmon that would occur in the vicinity. Combined with an adaptive management program, this effect is expected to be minimal.

Predation Associated with Entrainment

Pre-screen loss of juvenile winter-run Chinook salmon at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 5A, commensurate with entrainment reductions. Predation at the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River. Application of bioenergetics modeling for ELT water temperature with a median predator density for the single intake proposed under Alternative 5A predicts increased predation loss of about 958 juveniles, or 0.04% of winter-run Chinook salmon juvenile abundance entering the Delta (See Table 11-5A-13 under discussion of predation under Impact AQUA-42). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A. See additional discussion of predation under Impact AQUA-42.

NEPA Effects: In conclusion, Alternative 5A would reduce overall entrainment and entrainment-related predation losses of juvenile winter-run Chinook salmon relative to NAA_ELT. This effect would not be adverse and may provide a benefit to the species because of the reductions in entrainment loss and mortality.

CEQA Conclusion: Entrainment losses of juvenile winter-run Chinook salmon at the south Delta facilities would decrease ~6% under Alternative 5A compared to Existing Conditions (Table 11-5A-8). As described in the NEPA analysis above, there may be additional predation at the north Delta intake. Overall, impacts of water operations on entrainment of juvenile Chinook salmon (winter-run ESU) would be less than significant and may be beneficial. No mitigation would be required.

Impact AQUA-40: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Winter-Run ESU)

In general, Alternative 5A would not reduce the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to NAA_ELT.

Mean flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam were examined during the May through September winter-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation. Flows under A5A_ELT during May through August would generally be similar to flows under NAA_ELT. Flows under A5A_ELT during September would be up to 10% lower than flows under NAA_ELT. These results indicate that there would generally be no flow-related effects of Alternative 5A on spawning and egg incubation habitat except during September, in which there would be transitory negligible-to-small flow reductions.

Shasta Reservoir storage volume at the end of May influences flow rates below the dam during the May through September winter-run spawning and egg incubation period. May Shasta storage volume under A5A_ELT would be similar (<5% difference) to storage under NAA_ELT for all water year types (Table 11-5A-9).

Table 11-5A-9. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-11 (-0.2%)	2 (0.03%)
Above Normal	-53 (-1%)	-27 (-1%)
Below Normal	-91 (-2%)	5 (0.1%)
Dry	-220 (-6%)	-17 (0.5%)
Critical	-241 (-10%)	56 (3%)

Mean monthly water temperatures for each water year type in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no substantial differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and Alternative 5A in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-12. There would be 2 (3%) fewer years with a "red" level of concern under A5A_ELT than under NAA_ELT. This difference would not be biologically meaningful to winter-run Chinook salmon spawners and eggs, as the 2 years constitute a small proportion of the 82 year period used for analysis.

Table 11-5A-10. Maximum Water Temperature Thresholds for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Location	Period	Maximum Water Temperature (°F)	Purpose
Upper Sacramento River			
Bend Bridge	May–Sep	56	Winter- and spring-run spawning and egg incubation
		63	Green sturgeon spawning and egg incubation
Red Bluff	Oct–Apr	56	Spring-, fall-, and late fall–run spawning and egg incubation
Hamilton City	Mar–Jun	61 (optimal), 68 (lethal)	White sturgeon spawning and egg incubation
Feather River			
Robinson Riffle (RM 61.6)	Sep–Apr	56	Spring-run (Sep-Jan) and steelhead (Jan-Apr) spawning and incubation
	May–Aug	63	Spring-run and steelhead rearing
Gridley Bridge	Oct–Apr	56	Fall- and late fall–run spawning and steelhead rearing
	May–Sep	64	Green sturgeon spawning, incubation, and rearing
American River			
Watt Avenue Bridge	May–Oct	65	Juvenile steelhead rearing

Table 11-5A-11. Number of Days per Month when Three Different Water Temperature Exceedances Trigger Different Levels of Concern for Covered Salmonids and Sturgeon Provided by NMFS and Used in the BDCP Effects Analysis

Exceedance above Water Temperature Threshold (°F)	Level of Concern			
	None	Yellow	Orange	Red
1	0–9 days	10–14 days	15–19 days	≥20 days
2	0–4 days	5–9 days	10–14 days	≥15 days
3	0 days	1–4 days	5–9 days	≥10 days

Table 11-5A-12. Differences between Baseline and Alternative 5A Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern[a]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Red	24 (49%)	-2 (-3%)
Orange	-7 (-50%)	1 (14%)
Yellow	-14 (-88%)	1 (50%)
None	-3 (-100%)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] For definitions of levels of concern, see Table 11-5A-11.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-5A-13). Total degree-days (all water year types combined) under A5A_ELT would be up to 7% lower than under NAA_ELT during May through July and up to 8% higher during August and September. The 8% increase corresponds to a 682 degree-day increase, which for all September days over 82 years (2,460 total days), is <0.3% increase per day. This is a negligible increase.

Table 11-5A-13. Differences and Percent Differences between Alternative 5A and Baseline Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
May	Wet	500 (133%)	1 (0.1%)
	Above Normal	161 (76%)	-74 (-17%)
	Below Normal	280 (128%)	-8 (-2%)
	Dry	197 (106%)	-88 (-19%)
	Critical	211 (95%)	-7 (-2%)
	All	1,348 (111%)	-177 (-6%)
June	Wet	353 (92%)	-12 (-2%)
	Above Normal	103 (70%)	-11 (-4%)
	Below Normal	132 (95%)	-8 (-3%)
	Dry	159 (85%)	-50 (-13%)
	Critical	161 (40%)	-83 (-13%)
	All	908 (72%)	-164 (-7%)
July	Wet	164 (32%)	-58 (-8%)
	Above Normal	75 (93%)	-1 (-1%)
	Below Normal	173 (118%)	-11 (-3%)
	Dry	199 (71%)	-58 (-11%)
	Critical	754 (92%)	-30 (-2%)
	All	1,365 (74%)	-158 (-5%)
August	Wet	789 (113%)	-147 (-9%)
	Above Normal	267 (65%)	-19 (-3%)
	Below Normal	472 (178%)	-20 (-3%)
	Dry	1,133 (169%)	325 (22%)
	Critical	1,324 (89%)	48 (2%)
	All	3,985 (113%)	187 (3%)
September	Wet	103 (14%)	94 (13%)
	Above Normal	10 (1%)	130 (22%)
	Below Normal	702 (94%)	249 (21%)
	Dry	1,503 (118%)	254 (10%)
	Critical	983 (47%)	-47 (-2%)
	All	3,304 (59%)	682 (8%)

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be lower than or similar to mortality under NAA_ELT except in below normal water years when it is expected to be 12% higher (Table 11-5A-14). The corresponding increase in the percent of the winter-run population subject to mortality in below normal years (expressed as an absolute difference) would be 0.2%. Therefore, the increase in mortality from NAA_ELT to A5A_ELT during below normal years, although moderately large on a relative scale (i.e., 12%), would be negligible expressed as an absolute difference to the winter-run population (i.e., 0.2%; Table 11-5A-14).

Table 11-5A-14. Difference and Percent Difference in Percent Mortality of Winter-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (81%)	-0.03 (-4%)
Above Normal	0 (90%)	-0.03 (-4%)
Below Normal	1 (54%)	0.2 (12%)
Dry	2 (110%)	0.1 (3%)
Critical	21 (78%)	-2 (-3%)
All	4 (80%)	-0.2 (-2%)

SacEFT predicts that there would be a 17% relative decrease in the percentage of years with good spawning habitat availability, measured as weighted usable area, under A5A_ELT compared to NAA_ELT (Table 11-5A-15). Expressed as an absolute difference, this reduction would be smaller (i.e., 8%). SacEFT predicts that the percentage of years with good (lower) redd scour risk, good egg incubation conditions, or good (lower) redd dewatering risk under A5A_ELT would be similar to the percentage of years under NAA_ELT. These results indicate that there would be a small negative effect of Alternative 5A on spawning habitat.

The biological significance of a reduction in available suitable spawning habitat varies at the population level in response to a number of factors, including adult escapement. For those years when adult escapement is less than the carrying capacity of the spawning habitat, a reduction in area would have little or no population level effect. In years when escapement exceeds carrying capacity of the reduced habitat, competition among spawners for space (e.g., increased redd superimposition) would increase, resulting in reduced reproductive success. The reduction in the frequency of years in which spawning habitat availability is considered to be good by SacEFT could result in reduced reproductive success and abundance of winter-run Chinook salmon if the number of spawners is limited by spawning habitat quantity. However, it is unlikely that spawning habitat is limiting to winter-run Chinook salmon due to their small spawning adult population sizes in recent years relative to historical numbers.

Table 11-5A-15. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Winter-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Spawning WUA	-20 (-34%)	-8 (-17%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-9 (-9%)	0 (0%)
Redd Dewatering Risk	5 (20%)	1 (3%)
Juvenile Rearing WUA	-8 (-16%)	5 (14%)
Juvenile Stranding Risk	-2 (-10%)	-14 (-44%)

WUA = Weighted Usable Area.

NEPA Effects: Considering the range of results presented here for winter-run Chinook salmon spawning and egg incubation, this effect would not be adverse because it does not have the potential to substantially degrade suitable spawning or egg incubation habitat. There are no effects that would cause biologically meaningful effects to the winter-run population. Although SacEFT predicts a 17% reduction in the number of years with "good" spawning habitat availability, this reduction is 8% expressed as an absolute difference. In light of the current small spawning population size of winter-run Chinook salmon, it is unlikely that spawning habitat is currently limiting; therefore, this small reduction would not be biologically relevant to the ESU.

CEQA Conclusion: In general, Alternative 5A would not degrade the quantity and quality of spawning and egg incubation habitat for winter-run Chinook salmon relative to the Existing Conditions.

CALSIM mean flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the May through September winter-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to flows under Existing Conditions during May through August with some exceptions, and would generally be up to 24% lower during September (dry water years). However, the largest increases in mean flow (up to 47% higher) would occur in September of wet and above normal years.

Shasta Reservoir storage volume at the end of May under A5A_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% and 10% in dry and critical water years, respectively (Table 11-5A-9). This indicates that there would be a small to moderate effect of Alternative 5A on flows during the spawning and egg incubation period.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the May through September winter-run spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A throughout the period except in critical years during August at Keswick (7% higher) and in critical years during August and dry years in September at Bend Bridge (6% and 5% higher, respectively).

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. The number of years classified as "red" would increase by 49% under A5A_ELT relative to Existing Conditions (Table 11-5A-12). This would cause a negative effect to winter-run Chinook salmon spawning and egg incubation.

Total degree-days exceeding 56°F at Bend Bridge were summed for all years by month and water year type during May through September (Table 11-5A-13). Total degree-days (all water year types combined) under A5A_ELT would be 59% to 113% higher than that under Existing Conditions depending on month throughout the period. This would cause a negative effect to winter-run Chinook salmon spawning and egg incubation.

The Reclamation egg mortality model predicts that winter-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be 54 to 110% greater on a relative scale and up to 21% greater on expressed as an absolute difference than mortality under Existing Conditions depending on water year type (Table 11-5A-14). These increases would only affect the winter-run population during critical years, in which the absolute percent increase of the winter-run population would be

21%. The absolute percent increase would be no more than 2% for the other four water year types. These results indicate that Alternative 5A would cause increased winter-run Chinook salmon egg mortality in the Sacramento River.

SacEFT predicts that there would be a 34% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A5A_ELT compared to Existing Conditions (Table 11-5A-15). SacEFT predicts that the percentage of years with good (lower) redd scour risk under A5A_ELT would be similar to the percentage of years under Existing Conditions. SacEFT predicts that the percentage of years with good egg incubation conditions under A5A_ELT would be 9% lower than under Existing Conditions. SacEFT predicts that the percentage of years with good (lower) redd dewatering risk under A5A_ELT would be 20% higher than the percentage of years under Existing Conditions. These results indicate that Alternative 5A would cause large reductions in spawning WUA. However, due to the highly suppressed population size of winter-run Chinook salmon relative to historical population sizes, it is unlikely that spawning habitat is currently limiting.

Summary of CEQA Conclusion

Collectively, the modeling results of the Impact AQUA-40 CEQA analysis indicate that the difference between the CEQA baseline and Alternative 5A could be significant because, under the CEQA baseline, the alternative could substantially degrade suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality, contrary to the NEPA conclusion set forth above. Reservoir storage would be lower under Alternative 5A, particularly in critical years (10% lower). The number of years with a red level of concern regarding water temperatures and exceedances of NMFS temperature thresholds would be substantially greater under Alternative 5A. Egg mortality in drier years, during which winter-run Chinook salmon would already be stressed due to reduced flows and increased temperatures, would be up to 110% greater under Alternative 5A compared to the Existing Conditions (Table 11-5A-14). Further, the number of years with "good" spawning habitat would be 34% lower due to Alternative 5A compared to the Existing Conditions (Table 11-2A-15), which represents a substantial reduction in spawning habitat and, therefore, in adult spawner and redd carrying capacity.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, water temperatures, and biological model outputs in the Sacramento River would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-41: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Winter-Run ESU)

In general, Alternative 5A would not affect the quantity and quality of rearing habitat for fry and juvenile winter-run Chinook salmon relative to NAA_ELT.

Sacramento River mean flows between Keswick and upstream of Red Bluff were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can lead to reduced extent and quality of fry and juvenile rearing habitat. Flows under A5A_ELT would generally be lower than flows under NAA_ELT by up to 22% during September and November, and similar to flows under NAA_ELT during August, October and December. The differences in flow between A5A_ELT and NAA_ELT would generally be smaller at Red Bluff than at Keswick. The biological implications of the flow reductions are analyzed below in the SALMOD and SacEFT analyses.

Mean water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under A5A_ELT would be 14% higher on a relative scale (5% expressed as an absolute difference) than the percentage of years under NAA_ELT (Table 11-5A-14). However, the percentage of years with good (low) juvenile stranding risk under A5A_ELT is predicted to be 44% lower on a relative scale (14% expressed as an absolute difference) than under NAA_ELT. These results indicate that the quantity of juvenile rearing habitat in the Sacramento River would be slightly higher under A5A_ELT relative to NAA_ELT, but the quality of this habitat, with respect to stranding risk, would be degraded.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under A5A_ELT would be 4% lower than the habitat-related mortality with NAA_ELT. These results are inconsistent with SacEFT results, which indicate that juvenile stranding risk would increase under A5A_ELT (Table 11-5A-14).

Both SacEFT and SALMOD are considered to be reliable models for winter-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about winter-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile stranding risk may increase under Alternative 5A, when combined with all early life stage effects in SALMOD, the effects of Alternative 5A would be marginally beneficial to winter-run Chinook salmon survival. Further, these results indicate that the August through November flow reductions in the Sacramento River identified above would not have a biological effect on winter-run Chinook salmon rearing.

NEPA Effects: Collectively, these modeling results presented above indicate that the effect of Alternative 5A is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat and substantially interfere with winter-run Chinook salmon rearing. There would be no substantial effects of Alternative 5A on flows or water temperatures. SALMOD and SacEFT predicted contradicting results regarding habitat-related mortality. SacEFT found that juvenile stranding risk is expected to increase. However, the SALMOD model found that Alternative 5A would provide a minor beneficial effect (4% reduction in habitat-related mortality) to early life stages of winter-run Chinook salmon. The SALMOD results include the effects to all early life stages combined and, therefore, are more representative of the overall effects to winter-run Chinook salmon in the upper Sacramento River.

CEQA Conclusion: In general, Alternative 5A would not reduce the quantity and quality of fry and juvenile rearing habitat for winter-run Chinook salmon relative to the Existing Conditions.

Sacramento River mean flows between Keswick and upstream of Red Bluff were examined for the juvenile winter-run Chinook salmon rearing period (August through December) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to flows under Existing Conditions during December, but up to 24% lower than Existing Conditions during August, September, October, and November, except for September of wet and above normal years (to 47% greater).

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the August through December winter-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A throughout the period except in critical years during August at Keswick (7% higher) and in critical years during August and dry years during September at Bend Bridge (6% and 5% higher, respectively).

SacEFT predicts that the percentage of years with good juvenile rearing habitat availability, measured as weighted usable area, under A5A_ELT would be 16% lower on a relative scale (8% lower expressed as an absolute difference) than under Existing Conditions (Table 11-5A-15). In addition, the percentage of years with good (low) juvenile stranding risk under A5A_ELT is predicted to be 10% lower on a relative scale (2% lower expressed as an absolute difference) than under Existing Conditions. This indicates that the quantity and quality, with respect to stranding risk, of juvenile rearing habitat in the Sacramento River would be marginally lower under A5A_ELT relative to Existing Conditions.

SALMOD predicts that winter-run smolt equivalent habitat-related mortality under A5A_ELT would be 5% higher from that under Existing Conditions. This result is consistent with SacEFT results, which indicate that the number of years with good juvenile rearing WUA and with good (low) stranding risk would both decrease under A5A_ELT (Table 11-5A-15). Therefore, Alternative 5A is predicted to have a significant impact on winter-run Chinook salmon rearing.

Summary of CEQA Conclusion

These modeling results indicate that the impact could be significant because it has the potential to substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish. Differences in flows are moderately large during the majority of months and water year types. Water temperatures would be higher than those under NAA_ELT in the Sacramento River during late summer of critical water years, when winter-run Chinook salmon would already be stressed due to reduced flows and increased temperatures. SALMOD and SacEFT both predicted increased habitat-related mortality of rearing juveniles when the alternative was compared to conditions without climate change (Existing Conditions).

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 5A. SacEFT predicts that juvenile stranding risk may increase under Alternative 5A, but when combined with all early life stage effects in SALMOD, the effects of the alternative would be marginally beneficial to winter-run Chinook salmon. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-42: Effects of Water Operations on Migration Conditions for Chinook Salmon (Winter-Run ESU)

In general, Alternative 5A would not degrade migration conditions for winter-run Chinook salmon relative to the NAA.

Upstream of the Delta

Mean flows in the Sacramento River upstream of Red Bluff were examined for the July through November juvenile emigration period. A substantial reduction in flow may reduce the ability of juvenile winter-run Chinook salmon to migrate effectively down the Sacramento River. Mean flows under A5A_ELT would generally be similar to flows under NAA_ELT, except during September and November, in which flows would be up to 17% lower under A5A_ELT. The flow reductions would not be large or frequent enough to have biologically meaningful effects on juvenile emigration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run Chinook salmon juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

Mean flows in the Sacramento River upstream of Red Bluff were examined during the adult winter-run Chinook salmon upstream migration period (December through August). A reduction in flows may reduce the olfactory cues needed by adults to return to natal spawning grounds in the upper Sacramento River, although there is little empirical evidence supporting this. Flows under A5A_ELT would generally be similar to or slightly greater than those under NAA_ELT.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

Overall, Sacramento River migration flows and water temperatures during the winter-run Chinook salmon juvenile and adult migration periods would not differ substantially between Alternative 5A and NAA_ELT.

Through-Delta

Juveniles

During the juvenile winter-run Chinook salmon emigration period (November to early May), mean monthly flows in the Sacramento River below the north Delta intake under A5A_ELT averaged across years would be lower (up to 18.5% lower) compared to NAA_ELT. Flows would be up to 25% lower in November of below normal years.

The north Delta export facilities would replace aquatic habitat and likely attract piscivorous fish around the intake structures. The single new intake would remove or modify habitat along that portion of the migration corridor (3.8 acres aquatic habitat and 2,050 linear feet of shoreline). Bioenergetics modeling of a single intake with a median predator density predicts a predation loss of about 0.04% of the estimated 2.6 million juvenile winter-run entering the Delta (Table 11-5A-13). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A. A conservative assumption of 5% loss per intake (based on data from GCID (Vogel 2008); see additional discussion in Alternative 4A) would result in a loss of 4% of juvenile winter-run Chinook that reach the north Delta (because the modeling indicated that portion of the population would enter the Yolo Bypass based on the assumptions about Fremont Weir notch operations, and therefore would avoid effects of the intake).

Table 11-5A-13. Chinook Salmon Predation Loss at the Proposed North Delta Diversion Intake (One Intake for Alternative 5A)

Striped Bass Numbers		Estimated Number of Juvenile Salmon Consumed				Percentage of Annual Juvenile Production Entering the Delta[1] (%) Consumed			
Per 1,000 Feet of Intake	Total	Winter	Spring	Fall	Late Fall	Winter	Spring	Fall	Late Fall
18 (Low)	20	145	276	5,047	849	0.01	0.01	0.01	0.02
119 (Median)	131	958	1,824	33,369	5,611	0.04	0.04	0.05	0.13
219 (High)	241	1,764	3,357	61,410	10,325	0.07	0.08	0.10	0.24

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (*BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference).

[1] Estimated as 2.6 million juveniles for winter-run, 4.2 million for spring-run, 61.6 million for fall-run, and 4.3 million for late fall-run. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

Through-Delta survival to Chipps Island by emigrating juvenile winter-run Chinook salmon was modeled by the DPM. Average survival under Alternative 5A would be 33% across all years, 26% in drier years, and 45% in wetter years, which is similar to survival under baseline conditions (Table 11-5A-14). As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 5A and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Table 11-5A-14. Through-Delta Survival (%) of Emigrating Juvenile Winter-Run Chinook Salmon under Alternative 5A and Baseline Scenarios; and Differences between Alternative 5A and Baseline Scenarios

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Types	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA vs. A5A_ELT
Wetter Years	46.3	46.3	45.2	-1.1 (-2%)	-1.0 (-2%)
Drier Years	28.0	27.2	26.4	-1.6 (-5%)	-0.9 (-3%)
All Years	34.9	34.4	33.4	-1.4 (-4%)	-0.9 (-3%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

The importance of attraction flows and olfactory cues to adult Chinook salmon migrating upstream through the Delta is described in detail in Impact AQUA-42 for Alternative 1A. During the adult winter-run Chinook salmon migration period in the Delta (December to February), olfactory cues, based on the proportion of Sacramento River flows under A5A_ELT, would be similar (<3% difference) compared to NAA_ELT (Table 11-5A-15).

Table 11-5A-15. Percentage (%) of Flows and Differences at Collinsville that Originated in the Sacramento River and San Joaquin River during the Adult Salmonid Period for Alternative 5A and Baseline Scenarios, and Percent Differences between Alternative 5A and Baseline Scenarios

	Percentage of Flows			Difference in Flows	
Month	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River					
September	60	65	63	2	-2
October	60	64	65	5	0
November	60	64	64	4	0
December	67	67	66	-1	-1
January	76	75	73	-3	-2
February	75	74	71	-4	-3
March	78	77	72	-6	-5
April	77	76	71	-6	-5
May	69	67	64	-5	-3
San Joaquin River					
September	0.3	0.2	0.7	0.4	0.5
October	0.2	0.2	1.6	1.4	1.4
November	0.4	0.8	2.5	2.1	1.7
December	0.9	1.0	2.0	1.1	1.0
January	1.6	1.7	2.1	0.5	0.5
February	1.4	1.5	1.9	0.5	0.4
March	2.6	2.6	3.2	0.6	0.6
April	6.3	6.2	6.9	0.6	0.7

Shading indicates 10% or greater absolute difference.

Source: DSM2-QUAL fingerprinting analysis (monthly time step, October 1976-September 1991). *BDCP Effects Analysis – Appendix 5.C, Section 5C.5.3. Passage, Movement, and Migration Results.*

NEPA Effects: Overall, the effect of Alternative 5A is not adverse, recognizing that there is some uncertainty related to the effects of the single proposed north Delta intake.

Upstream of the Delta, Alternative 5A would not affect migration conditions for winter-run Chinook salmon, as migration flows and water temperatures would not differ substantially between Alternative 5A and NAA_ELT.

Adult attraction flows in the Delta under Alternative 5A would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

Near-field effects of Alternative 5A's proposed north Delta intake related to impingement and predation could result in negative effects on juvenile migrating winter-run Chinook salmon, although there is uncertainty regarding the overall effects. It is expected that the level of near-field impacts would be directly correlated to the number of new intake structures in the river and thus the level of impacts associated with 1 new intake would be considerably lower than those expected from having 5 new intakes in the river (as proposed for Alternative 1A, for example). Estimates within the effects analysis range from very low levels of effects (considerably less than 1% mortality) to larger effects (~ 4% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structure will be implemented as part of the final NDD screen design effort. Alternative 5A also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for winter-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains uncertain.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 5A would be similar to survival estimated for NAA_ELT (or slightly lower, accounting for similar Yolo Bypass entry for A5A_ELT and NAA_ELT, which was not modeled), based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 5A on juvenile winter-run Chinook salmon migration suggests the potential for a small negative effect of the proposed operations on juvenile winter-run Chinook salmon. This effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 5A of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of winter-run Chinook salmon juveniles into the low-survival interior Delta. Overall, there would not be an adverse effect on migration conditions for winter-run Chinook salmon from Alternative 5A.

CEQA Conclusion: In general, Alternative 5A would not affect migration conditions for winter-run Chinook salmon relative to Existing Conditions.

Upstream of the Delta

Mean flows in the Sacramento River upstream of Red Bluff were examined during the July through November juvenile emigration period. Flows under A5A_ELT for juvenile migrants would generally be similar to flows under Existing Conditions during July, and would be up to 22% lower during August through November, except for September of wet and above normal year types, in which the flows would be 26% and 44% higher, respectively (Appendix B, *Supplemental Modeling for New Alternatives*). The flow reductions would not be large or frequent enough to cause biologically meaningful effects on juvenile emigration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the July through November winter-run juvenile emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and

Alternative 5A throughout the period except in critical years during August at Keswick (7% higher) and in critical years during August and dry years during September at Bend Bridge (6% and 5% higher, respectively).

Mean flows under A5A_ELT in the Sacramento River upstream of Red Bluff during December through August would generally be similar to flows under Existing Conditions, except during August, in which flows would be up to 14% lower in critical water years. These reductions in flow would not be large or frequent enough to cause biologically meaningful effects on adult migration conditions.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the December through August winter-run upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A throughout the period except for increases under Alternative 5A in critical years during August at both locations (7% at Keswick and 6% at Bend Bridge).

Through-Delta

During the juvenile winter-run Chinook salmon emigration period (November to early May), mean monthly flows in the Sacramento River below the north Delta intake would be reduced (7% to 15% lower, averaged across all water years) under Alternative 5A compared to Existing Conditions. Potential predation losses across the single intake structure would be less than 5%. Through-Delta survival to Chipps Island by emigrating juvenile winter-run Chinook salmon would be about 1–1.6% lower (2% to 5% relative decrease) under A5A than under Existing Conditions (Table 11-5A-14).

Adults

As described above, during the adult winter-run Chinook salmon migration period in the Delta (December to February), olfactory cues, based on the proportion of Sacramento River flows, would be similar or slightly lower (<5% difference) compared to Existing Conditions (Table 11-5A-15).

Summary of CEQA Conclusion

Collectively, the impact would be less than significant and no mitigation would be necessary. Water temperatures under Alternative 5A in the Sacramento River upstream of the Delta would generally be similar to those under Existing Conditions during both the juvenile and adult winter-run Chinook salmon migration periods. Flows in the Sacramento River upstream of the Delta would be similar during the juvenile and adult migration periods, except some small decreases that would not be frequent or large enough to cause biologically meaningful effects to winter-run Chinook salmon migration conditions. The relatively small difference in through-Delta migration survival between Alternative 5A and Existing Conditions, as well as inclusion of Environmental Commitments (6, 15, and 16) and bypass flow criteria and real-time operations (discussed above in the NEPA Effects), means that migration habitat conditions and movement would not be substantially degraded.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-43: Effects of Construction of Restoration Measures on Chinook Salmon (Winter-Run ESU)

Impact AQUA-44: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Winter-Run ESU)

Impact AQUA-45: Effects of Restored Habitat Conditions on Chinook Salmon (Winter-Run ESU)

Impact AQUA-46: Effects of Methylmercury Management on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 12)

Impact AQUA-49: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 15)

Impact AQUA-50: Effects of Nonphysical Fish Barriers on Chinook Salmon (Winter-Run ESU) (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on winter-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Spring-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-55: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

The potential effects of construction of the water conveyance facilities on spring-run Chinook salmon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-55) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to spring-run Chinook salmon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-55, and as discussed above, the effect would not be adverse for spring-run Chinook salmon or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-55, and as discussed above, the impact of the construction of water conveyance facilities on spring-run Chinook salmon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-56: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Spring-Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-56 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-56 would not be adverse for spring-run Chinook salmon under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-56 for spring-run Chinook salmon under Alternative 4A, the impact of the maintenance of water conveyance facilities on spring-run Chinook salmon or critical habitat would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-57: Effects of Water Operations on Entrainment of Chinook Salmon (Spring-Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Overall entrainment of juvenile spring-run Chinook salmon at the south Delta export facilities, averaged across all water year types, would be similar or slightly lower (4% less) under Alternative 5A compared to NAA_ELT (Table 11-5A-16). As discussed for Alternative 5 (Impact AQUA-57), entrainment is highest in wet years and lowest in below normal water years. Under Alternative 5A, entrainment would be <10% different than NAA_ELT in in all water year types (Table 11-5A-16). Pre-screen losses, typically attributed to predation, would be expected to change commensurate with entrainment at the south Delta facilities.

Water Exports from SWP/CVP North Delta Intake Facilities

Similar to the effects described for winter-run Chinook salmon under Alternative 1A (Impact AQUA-39) above, potential entrainment of juvenile salmonids at the north Delta intake would be greater than baseline, but the effects would be minimal because it would have state-of-the-art screens to exclude juvenile fish, including spring-run Chinook salmon.

Predation Associated with Entrainment

Pre-screen loss of juvenile spring-run Chinook salmon at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 5A, commensurate with entrainment reductions. Predation in the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River. Application of bioenergetics modeling for ELT water temperature with a median predator density for the single intake proposed under Alternative 5A predicts increased predation loss of about 1,824 juveniles, or 0.04% of spring-run Chinook salmon juvenile abundance entering the Delta (See Table 11-5A-13 under discussion of predation under Impact AQUA-42). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A. See additional discussion of predation under Impact AQUA-60.

NEPA Effects: In conclusion, Alternative 5A would reduce overall entrainment and entrainment-related predation losses of juvenile spring-run Chinook salmon relative to NAA_ELT.. This effect would not be adverse.

CEQA Conclusion: Entrainment losses and associated predation of juvenile spring-run Chinook salmon at the South Delta facilities under Alternative 5A would be similar (<5% difference) to Existing Conditions in three water year types (Table 11-5A-16). The greatest increase is expected to occur during dry water years (~16%) with the greatest decrease occurring during critical water years (~11%). On the basis of results from hatchery-reared individuals from other runs (Zeug and Cavallo 2014), the 16% potential increase may represent a relatively small proportion of the population, particularly given that Existing Conditions includes the USFWS and NMFS BiOp requirements constraining south Delta exports. As described in the NEPA analysis above, there may be additional predation at the north Delta intake. Overall, impacts on juvenile spring-run Chinook salmon from entrainment and associated predation would be less than significant and no mitigation would be required.

Table 11-5A-16. Juvenile Spring-Run Chinook Salmon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-4,515 (-5%)	-8,676 (-9%)
Above Normal	261 (1%)	-857 (-3%)
Below Normal	101 (2%)	-210 (-3%)
Dry	2,694 (16%)	1,069 (6%)
Critical	-1,310 (-11%)	-603 (-5%)
All Years	-184 (0%)	-1,654 (-4%)

Shading indicates 10% or greater increased annual entrainment.

[a] Estimated annual number of fish lost, based on normalized data.

Impact AQUA-58: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Spring-Run ESU)

In general, the effects of Alternative 5A on spawning and egg incubation habitat for spring-run Chinook salmon relative to NAA_ELT are not adverse.

Sacramento River

There has been a small, inconsistent spawning population (<400 individuals) in the mainstem Sacramento River primarily upstream of Red Bluff Diversion Dam over the past decade (Azat 2012).

Flows in the Sacramento River between Keswick and upstream of Red Bluff during the spring-run Chinook salmon spawning and incubation period (September through January) under A5A_ELT would generally be similar to or greater than flows under NAA_ELT except in September and November, in which flows would be up to 22% lower than those under NAA_ELT, depending on location and water year type (Appendix B, *Supplemental Modeling for New Alternatives*).

Shasta Reservoir storage volume at the end of September influences flows downstream of the dam during the spring-run spawning and egg incubation period (September through January). Storage under A5A_ELT would be similar to or slightly greater than storage under NAA_ELT in all water year types (Table 11-5A-19).

Table 11-5A-19. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Shasta Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-326 (-10%)	-29 (-1%)
Above Normal	-389 (-12%)	-26 (-1%)
Below Normal	-178 (-6%)	-11 (-0.4%)
Dry	-215 (-9%)	-13 (-1%)
Critical	-136 (-11%)	61 (6%)

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a “level of concern” as defined in Table 11-5A-11. Differences between baselines and A5A_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-12 for Bend Bridge and in Table 11-5A-20 for Red Bluff. At Bend Bridge, there would be 2 (3%) fewer years with a “red” level of concern, 1 (14%) more year with an “orange” level of concern, and 1 (50%) more year with a ‘yellow” level of concern for A5A_ELT relative to NAA_ELT. At Red Bluff, there would be no difference in the number of years with a “red” or “yellow” level of concern and 1 (7%) more year with an “orange” level of concern under A5A_ELT.

Table 11-5A-20. Differences between Baseline and Alternative 5A Scenarios in the Number of Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern, Sacramento River at Red Bluff, October through April

Level of Concern[a]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Red	9 (75%)	0 (0%)
Orange	8 (133%)	1 (7%)
Yellow	13 (100%)	0 (0%)
None	-30 (-59%)	-1 (-5%)

[a] For definitions of levels of concern, see Table 11-5A-11.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April for the 82-year period. At Bend Bridge, total degree-days (all water year types combined) under A5A_ELT would be up to 7% lower than those under NAA_ELT during May through July and up to 8% higher during August and September (Table 11-5A-13). At Red Bluff, total degree-days under A5A_ELT would be similar to those under NAA_ELT during all seven months. (Table 11-5A-21).

Table 11-5A-21. Differences between Alternative 5A and Baseline Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
October	Wet	521 (203%)	99 (15%)
	Above Normal	232 (89%)	35 (8%)
	Below Normal	265 (127%)	7 (1%)
	Dry	388 (79%)	14 (2%)
	Critical	380 (63%)	-35 (-3%)
	All	1,786 (98%)	120 (3%)
November	Wet	11 (1100%)	3 (33%)
	Above Normal	6 (NA)	3 (100%)
	Below Normal	2 (NA)	0 (0%)
	Dry	36 (450%)	-6 (-12%)
	Critical	21 (525%)	3 (14%)
	All	76 (585%)	3 (3%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	3 (33%)	2 (20%)
	Dry	17 (121%)	-3 (-9%)
	Critical	11 (1100%)	0 (0%)
	All	32 (133%)	-1 (-2%)
April	Wet	97 (84%)	0 (0%)
	Above Normal	73 (52%)	1 (0%)
	Below Normal	89 (113%)	-5 (-3%)
	Dry	98 (53%)	-9 (-3%)
	Critical	41 (342%)	-1 (-2%)
	All	398 (75%)	-14 (-1%)

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be similar to mortality under NAA_ELT in wet and critical years, but greater in above normal (10% greater), below normal (24% greater), and dry (12% greater) water years (Table 11-5A-22). These increases, on a relative scale, correspond to increases in mortality expressed as an absolute difference of 2%, 5%, and 5% of the spring-run population, which would have a negligible to small effect on the population. Combining all water year types, there would be no effect of A5A_ELT on egg mortality (2% absolute change).

Table 11-5A-22. Difference and Percent Difference in Percent Mortality of Spring-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	4 (39%)	0.1 (0.5%)
Above Normal	4 (33%)	2 (10%)
Below Normal	14 (121%)	5 (24%)
Dry	26 (133%)	5 (12%)
Critical	17 (23%)	-1 (-1%)
All	13 (56%)	2 (6%)

SacEFT predicts that there would be no (<5%) difference in the percentage of years with good spawning availability, measured as weighted useable area, between A5A_ELT and NAA_ELT (Table 11-5A-23). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under A5A_ELT relative to NAA_ELT (Table 11-5A-23). SacEFT predicts that there would be a 17% decrease (11% decrease expressed as an absolute difference) in the percentage of years with good (lower) egg incubation conditions under A5A_ELT relative to NAA_ELT. SacEFT predicts that there would be a 7% decrease (3% decrease expressed as an absolute difference) in the percentage of years with good (lower) redd dewatering risk under A5A_ELT relative to NAA_ELT. It is not known the degree to which spawning habitat is limiting to the spring-run Chinook salmon population in the Sacramento River, especially given the recent sharp decline in annual escapement estimates.

Table 11-5A-23. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Spring-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Spawning WUA	-13 (-19%)	0 (0%)
Redd Scour Risk	0 (0%)	0 (0%)
Egg Incubation	-32 (-37%)	-11 (-17%)
Redd Dewatering Risk	-11 (-22%)	-3 (-7%)
Juvenile Rearing WUA	7 (32%)	4 (16%)
Juvenile Stranding Risk	1 (5%)	0 (0%)

WUA = Weighted Usable Area.

The results of the SacEFT model and Reclamation egg mortality model are inconsistent with regard to predicted conditions for spring-run salmon eggs. SacEFT predicts that egg incubation habitat would decrease (11% lower expressed as an absolute difference) and the Reclamation egg mortality model predicts that overall egg mortality would have little change (<5% expressed as an absolute difference) under the A5A_ELT relative to NAA_ELT. The SacEFT uses mid-August through early March as the egg incubation period, based on Vogel and Marine (1991), and the reach between ACID Dam and Battle Creek for redd locations. The Reclamation egg mortality model uses the number of days after Julian week 33 (mid-August) that it takes to accumulate 750 temperature units to hatching and another 750 temperature units to emergence. Temperatures units are calculated by subtracting 32°F from daily river temperature and are computed on a daily basis. As a result, egg incubation duration in the egg mortality model is generally mid-August through January, but is dependent on river temperature. The Reclamation model uses the reach between ACID Dam and Jelly's Ferry (approximately 5 river miles downstream of Battle Creek), which includes 95% of Sacramento River spawning locations based on 2001–2004 redd survey data (Reclamation 2008). The SacEFT model has been peer-reviewed, and the Reclamation egg mortality model has been extensively reviewed and used in prior biological assessments and BiOps. Therefore, both results are considered valid and were considered in drawing conclusions about spring-run egg mortality in the Sacramento River

Clear Creek

Flows in Clear Creek were examined during the spring-run Chinook salmon spawning and egg incubation period (September through January). Mean flows under A5A_ELT would be similar to flows under NAA_ELT throughout the period for all water year types (Appendix B, *Supplemental Modeling for New Alternatives*).

The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under A5A_ELT would be the same as that under NAA_ELT in all water year types, except for 33% greater (i.e., worse or more negative) maximum reduction (expressed as an absolute difference) in dry years (Table 11-5A-24).

Water temperatures were not modeled in Clear Creek.

Table 11-5A-24. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-100 (NA)	-33 (-50%)
Critical	-33 (-50%)	0 (0%)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

Feather River

Flows were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) where spring-run Chinook primarily spawn during September through January (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would not differ from NAA_ELT because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006).

Oroville Reservoir storage volume at the end of September influence flows downstream of the dam during the spring-run spawning and egg incubation period. Mean storage volume at the end of September under A5A_ELT would be similar to or up to 13% greater than storage under NAA_ELT, depending on water year type (Table 11-5A-25).

Table 11-5A-25. Difference and Percent Difference in September Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-601 (-21%)	121 (6%)
Above Normal	-542 (-23%)	14 (1%)
Below Normal	-326 (-16%)	-1 (0%)
Dry	-86 (-6%)	151 (13%)
Critical	24 (2%)	107 (12%)

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month over the egg incubation period compared to the flow in September when spawning is assumed to occur. Flows in the low-flow channel during

September through January were identical between A5A_ELT and NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on redd dewatering in the Feather River low-flow channel.

Mean water temperatures were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) during September through January (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during September through January (Table 11-5A-26). The percent of months exceeding the threshold under Alternative 5A would generally be similar to or lower (up to 21% expressed as an absolute difference) than the percent under NAA_ELT during October and similar during the other four months evaluated. The absolute difference is used to compare results for these analyses because, when large relative differences (percent differences) occur between the baseline (NAA_ELT) and A5A_ELT, they are in most cases mathematical artifacts due to the small values of degree-months for the baseline (i.e., dividing by a small number amplifies the relative difference) that would not translate into biologically meaningful effects on spring-run Chinook salmon.

Table 11-5A-26. Differences between Baseline and Alternative 5A Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, September through January

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
September	0 (0%)	-1 (-1%)	5 (5%)	4 (5%)	7 (18%)
October	6 (28%)	14 (183%)	4 (60%)	4 (150%)	0 (0%)
November	7 (300%)	5 (400%)	2 (200%)	2 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
NAA_ELT vs. A5A_ELT					
September	0 (0%)	-1 (-1%)	-1 (-1%)	-1 (-2%)	2 (5%)
October	-21 (-43%)	-2 (-11%)	-7 (-43%)	-5 (-44%)	-6 (-71%)
November	0 (0%)	-2 (-29%)	-1 (-25%)	0 (0%)	-1 (-100%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

The effects of A5A_ELT on water temperature-related spawning and egg incubation conditions for spring-run Chinook salmon in the Feather River low-flow channel were also analyzed by comparing the total degree-months for months that exceed the 56°F NMFS threshold during the September through January spring-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-5A-27). Combining all water year types, there would be an increase of 27 degree-months during September and a reduction of 21 degree-months during October in the number of degree-months exceeding the NMFS threshold under A5A_ELT relative to NAA_ELT. There would be negligible differences in degree months between NAA_ELT and A5A_ELT in the other three months.

Table 11-5A-27. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, September through January

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
September	Wet	9 (8%)	18 (18%)
	Above Normal	21 (49%)	24 (60%)
	Below Normal	14 (23%)	9 (14%)
	Dry	31 (45%)	2 (2%)
	Critical	-7 (-11%)	-18 (-24%)
	All	60 (17%)	27 (7%)
October	Wet	31 (620%)	21 (140%)
	Above Normal	-2 (-20%)	-10 (-56%)
	Below Normal	13 (186%)	-1 (-5%)
	Dry	8 (114%)	-13 (-46%)
	Critical	-6 (-75%)	-19 (-90%)
	All	45 (122%)	-21 (-20%)
November	Wet	9 (NA)	8 (800%)
	Above Normal	-1 (-33%)	-4 (-67%)
	Below Normal	7 (700%)	3 (60%)
	Dry	2 (NA)	-5 (-71%)
	Critical	0 (NA)	-3 (-100%)
	All	17 (425%)	-1 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 5A on spring-run Chinook salmon spawning and egg incubation conditions would not be adverse because the alternative does not substantially reduce the amount of suitable spawning and egg incubation habitat or substantially interfere with spring-run Chinook salmon spawning and egg incubation.

There are no substantial changes to flows, cold water pool storage, or water temperatures that would cause a biologically meaningful negative effect to spring-run Chinook salmon spawners or eggs. The Reclamation Egg Mortality Model also indicates that there would be no biologically meaningful effects. However, one model, SacEFT, shows adverse effects for egg incubation. After extensive investigation of these results, they appear to be a function of high model sensitivity to relatively small changes in estimated upstream conditions, which may or may not accurately predict adverse effects. The new NDD structures allow for spring time deliveries of water south of the Delta that are currently constrained under the NAA. For this reason, additional spring storage criteria may be necessary to ensure Shasta Reservoir operations similar to what was modeled. These discussions will occur in the Section 7 consultation with Reclamation on Shasta Reservoir and system-wide operations, which is outside the scope of this project. Overall, based on the results of all models except the SacEFT, this impact would not be adverse.

CEQA Conclusion: Collectively, the modeling results of the Impact AQUA-58 CEQA analysis show that the difference between the CEQA baseline and Alternative 5A could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 5A would not substantially affect the quantity and quality of spawning and egg incubation habitat for spring-run Chinook salmon relative to the CEQA conclusion.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff were examined during the spring-run Chinook salmon spawning and incubation period (September through January). Mean flows under A5A_ELT during January and December would generally be similar to flows under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during October and November would be up to 18% lower (both months at Keswick). Mean flows under A5A_ELT during September would be up to 24% lower (dry water years at Keswick) and up to 47% higher (above normal water years at Keswick) than flows under Existing Conditions.

Shasta Reservoir mean storage volume at the end of September would be 6% to 12% lower under A5A_ELT relative to Existing Conditions depending on water year type (Table 11-4A-27).

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the September through January spring-run Chinook salmon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At Keswick, mean temperatures under A5A_ELT would be similar (<5% difference) to those under Existing Conditions in all months and water year types during the period. At Bend Bridge, mean water temperatures under A5A_ELT during September of dry water years would be 5% greater than those under Existing Conditions, but would not be different in other water year types or months during the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 56°F identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September at Bend Bridge and October through April at Red Bluff) and year of the 82-year modeling period. The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and Alternative 5A in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-12 for Bend Bridge and in Table 11-5A-20 for Red Bluff. At Bend Bridge, there would be a 49% increase in the number of years with a "red" level of concern under Alternative 5A relative to Existing Conditions. At Red Bluff, there would be 75%, 133%, and 100% increases in the number of years with "red", "orange", and "yellow" levels of concern, respectively, under Alternative 5A relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Bend Bridge during May through September and at Red Bluff during October through April. At Bend Bridge, total degree-days (all water years combined) under Alternative 5A would be 59% to 113% higher than those under Existing Conditions depending on the month (Table 11-5A-13). At Red Bluff, total degree-days under Alternative 5A would be 75% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-5A-21).

The Reclamation egg mortality model predicts that spring-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be 4% to 26% greater (absolute difference) than mortality under Existing Conditions depending on water year type, with a 13% increase in the mortality rate for all water year types combined (Table 11-5A-22).

SacEFT predicts that there would be a 19% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A5A_ELT compared to Existing Conditions (Table 11-5A-23). SacEFT predicts that there would be no difference in the percentage of years with good (lower) redd scour risk under A5A_ELT relative to Existing Conditions. SacEFT predicts that there would be a 37% relative decrease in the percentage of years with good (lower) egg incubation conditions under A5A_ELT compared to Existing Conditions. SacEFT predicts that there would be a 22% relative decrease in the percentage of years with good (lower) redd dewatering risk under A5A_ELT compared to Existing Conditions. These results indicate that spawning and egg incubation conditions for spring-run Chinook salmon would be poor relative to Existing Conditions. However, it is not known whether spawning habitat is limiting to the spring-run Chinook salmon population in the Sacramento River, especially given the recent sharp decline in annual escapement estimates.

Clear Creek

Mean flows in Clear Creek during the spring-run Chinook salmon spawning and egg incubation period (September through January) under A5A_ELT would generally be similar to or greater than flows under Existing Conditions, except during September of critical water years (9% reduction) (Appendix B, *Supplemental Modeling for New Alternatives*).

The potential risk of spring-run Chinook salmon redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest reduction in flows under A5A_ELT would be 33% to 100% greater (i.e., worse or more negative) (expressed as absolute difference) than Existing Conditions in above normal, dry, and critical years, and would be similar to and 53% lower (better) than that under Existing Conditions in wet and below normal water years, respectively (Table 11-5A-24).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River low-flow channel under A5A_ELT are not different from Existing Conditions during the spring-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Flows in October through January (800 cfs) would be equal to or greater than the spawning flows in September (773 cfs) for all model scenarios.

Oroville Reservoir storage volume at the end of September would be 6% to 23% lower under A5A_ELT relative to Existing Conditions, except for critical year types when storage volume would be similar under A5A_ELT and Existing Conditions (Table 11-5A-25).

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. Mean flows in the low-flow channel during October through January were identical between A5A_ELT and Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on redd dewatering in the Feather River low-flow channel.

Water temperatures were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) during September through January (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under A5A_ELT would be similar to (<5% difference) those under Existing Conditions in all months and water year types during the period.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during September through January (Table 11-5A-26). The percent of months exceeding the threshold under Alternative 5A would be similar to or up to 14% higher (expressed as absolute difference) than under Existing Conditions during September through November. There would be no differences in the percent of months exceeding the threshold between Existing Conditions and Alternative 5A during December and January.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during September through January (Table 11-5A-27). Total degree-months (all water years combined) exceeding the threshold under A5A_ELT would be 17 degree-months to 60 degree-months greater than those under Existing Conditions during September through November. There would be no difference in total degree-months between Existing Conditions and A5A_ELT during December and January. The absolute difference is used to compare results for these analyses because, when large relative differences (percent differences) occur between the baseline (NAA_ELT) and A5A_ELT, they are in most cases mathematical artifacts due to the small values of degree-months for NAA_ELT (i.e., dividing by a small number amplifies the relative difference) that would not translate into biologically meaningful effects on spring-run Chinook salmon.

Summary of CEQA Conclusion

Under Alternative 5A (including climate change effects), there are flow and storage reductions, as well as temperature increases in the Sacramento River that would lead to biologically meaningful increases in egg mortality and overall degraded habitat conditions for spawning spring-run and egg incubation, as compared to Existing Conditions. Both the Reclamation Egg Mortality Model and SacEFT also indicate that there would adverse effects on egg incubation and survival and on spawning habitat availability. Flows in the Feather River low-flow channel do not differ between

Alternative 5A and Existing Conditions. However, water temperature analyses in the Feather River low-flow channel using thresholds developed in coordination with NMFS indicate that there would be moderate to large negative effects on temperature conditions during spring-run Chinook salmon spawning and egg incubation.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable spawning habitat and substantially reduce the number of spring-run as a result of egg mortality.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would be similar between NAA_ELT and Alternative 5A. There would be no effects of Alternative 5A on spawning and egg incubation conditions in Clear Creek, and small beneficial or no effects on flows, reservoir storage, and water temperatures in the Feather River. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-59: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Spring-Run ESU)

In general, Alternative 5A would not affect the quantity and quality of rearing habitat for fry and juvenile spring-run Chinook salmon relative to NAA_ELT.

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix B, *Supplemental Modeling for New Alternatives*). Flows between December and March under A5A_ELT would generally be similar to those under NAA_ELT. Flows during November would be up to 22% lower under A5A_ELT than under NAA_ELT.

As reported in Impact AQUA-40, May Shasta storage volume under A5A_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-5A-9).

As reported in Impact AQUA-58, September Shasta storage volume would be similar to storage under NAA_ELT in all water year types (Table 11-5A-19).

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the November through March spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile rearing WUA conditions under A5A_ELT would be 16% higher than that under NAA_ELT, although this would be a 4% difference expressed as an absolute difference (Table 11-5A-23). SacEFT predicts that, there would be no difference between A5A_ELT and NAA_ELT in the percentage of years with good (lower) juvenile stranding risk conditions.

SALMOD predicts that spring-run smolt equivalent habitat-related mortality would be 2% lower under A5A_ELT than NAA_ELT.

Clear Creek

Flows in Clear Creek below Whiskeytown during the November through March spring-run rearing period under A5A_ELT would generally be similar to flows under NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during November through June were reviewed to determine flow-related effects on larval and juvenile spring-run rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout this period under A5A_ELT would not differ from those under NAA_ELT. In the high flow channel, flows under A5A_ELT would be similar to or up to 40% greater than flows under NAA_ELT during November, December and February through June, except for 18% lower flow during February of below normal water years. Flows in January under A5A_ELT would be lower (up to 15% lower) than flows under NAA_ELT.

May Oroville storage under A5A_ELT would be similar to storage under NAA_ELT (Table 11-5A-28).

As reported in Impact AQUA-58, September Oroville storage volume would be similar to or up to 13% higher than under NAA_ELT depending on water year type (Table 11-5A-25).

Table 11-5A-28. Difference and Percent Difference in May Water Storage Volume (thousand acre-feet) in Oroville Reservoir for Model Scenarios

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-20 (-1%)	-1 (-0.03%)
Above Normal	-58 (-2%)	1 (0.04%)
Below Normal	-143 (-4%)	22 (1%)
Dry	-235 (-9%)	114 (5%)
Critical	-141 (-8%)	-2 (-0.1%)

Water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during November through June (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during May through June (Table 11-5A-29). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-5A-10, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months. The percent of months exceeding the threshold under A5A_ELT would generally be similar to or lower (up to 19% lower expressed as an absolute difference) than the percent under NAA_ELT.

Table 11-5A-29. Differences between Alternative 5A and Baseline Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 63°F Threshold, May through August

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
May	2 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
June	5 (9%)	11 (41%)	5 (100%)	1 (NA)	0 (NA)
July	0 (0%)	0 (0%)	0 (0%)	16 (22%)	19 (47%)
August	0 (0%)	5 (6%)	17 (30%)	17 (61%)	14 (138%)
NAA_ELT vs. A5A_ELT					
May	-1 (-33%)	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)
June	-19 (-23%)	-16 (-30%)	-19 (-65%)	-2 (-67%)	0 (NA)
July	0 (0%)	0 (0%)	-1 (-1%)	-10 (-10%)	-16 (-22%)
August	0 (0%)	-6 (-6%)	-5 (-6%)	-9 (-16%)	-6 (-21%)

Total degree-months exceeding 63°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during May through August (Table 11-5A-30). Total degree-months (all water years combined) under A5A_ELT would be similar to or lower than those under NAA_ELT, depending on the month.

Table 11-5A-30. Differences between Alternative 5A and Baseline Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Feather River above Thermalito Afterbay, May through August

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
May	Wet	0 (NA)	0 (NA)
	Above Normal	1 (NA)	0 (0%)
	Below Normal	0 (NA)	0 (NA)
	Dry	1 (NA)	0 (0%)
	Critical	2 (NA)	0 (0%)
	All	4 (NA)	0 (0%)
June	Wet	14 (108%)	-5 (-16%)
	Above Normal	8 (62%)	-1 (-5%)
	Below Normal	10 (77%)	-3 (-12%)
	Dry	16 (84%)	-3 (-8%)
	Critical	9 (150%)	-1 (-6%)
	All	57 (89%)	-13 (-10%)
July	Wet	19 (16%)	-4 (-3%)
	Above Normal	10 (23%)	-1 (-2%)
	Below Normal	13 (22%)	-2 (-3%)
	Dry	17 (24%)	-1 (-1%)
	Critical	14 (25%)	1 (1%)
	All	73 (21%)	-7 (-2%)
August	Wet	21 (25%)	6 (6%)
	Above Normal	9 (38%)	1 (3%)
	Below Normal	16 (43%)	1 (2%)
	Dry	20 (43%)	2 (3%)
	Critical	13 (30%)	-5 (-8%)
	All	78 (33%)	4 (1%)

NA = could not be calculated because the denominator was 0.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because rearing habitat conditions would not be substantially degraded. There would be no substantial effects of Alternative 5A on rearing habitat for spring-run Chinook salmon in the Sacramento River. This conclusion is based on the similarity between Alternative 5A and the NEPA baseline in water temperatures during all months of the rearing period and in flows during all months except November. Results of SacEFT and SALMOD also support this conclusion. In the Feather River, habitat conditions would improve under Alternative 5A relative to the NEPA baseline. There would be no effects to spring-run Chinook salmon rearing in Clear Creek.

CEQA Conclusion: Collectively, the modeling results of the Impact AQUA-59 CEQA analysis show that the difference between the CEQA baseline and Alternative 5A could be significant because, when compared to the CEQA baseline, the alternative, including climate change, would substantially reduce the quantity and quality of juvenile rearing habitat for spring-run Chinook salmon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 5A would not affect the quantity and quality of juvenile rearing habitat for spring-run Chinook salmon relative to the CEQA conclusion.

Sacramento River

Flows were evaluated during the November through March larval and juvenile spring-run Chinook salmon rearing period in the Sacramento River between Keswick Dam and just upstream of Red Bluff (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be generally similar to or greater than those under Existing Conditions, except during November, in which flows would be up to 18% lower under A5A_ELT (Appendix B, *Supplemental Modeling for New Alternatives*).

As reported in Impact AQUA-40, Shasta Reservoir storage volume at the end of May under A5A_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% and 10% in dry and critical water years, respectively (Table 11-5A-9). As reported in Impact AQUA-58, storage volume at the end of September under A5A_ELT would be 6% to 12% lower relative to Existing Conditions (Table 11-5A-19).

Mean monthly water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the November through March spring-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Alternative 5A and Existing Conditions in any month or water year type throughout the period at either location.

SacEFT predicts that under A5A_ELT both the percentage of years with good juvenile rearing WUA conditions and the percentage of years with good (lower) juvenile stranding risk conditions would be greater than those under Existing Conditions (Table 11-5A-31)

SALMOD predicts that spring-run smolt equivalent habitat-related mortality under A5A_ELT would be 9% lower than under Existing Conditions.

Clear Creek

Flows in Clear Creek during the November through March rearing period under A5A_ELT would generally be similar to or greater than flows under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Relatively constant flows in the low flow channel throughout the November through June period under A5A_ELT would not differ from those under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*). In the high flow channel (at Thermalito Afterbay), flows under A5A_ELT would be mostly lower than flows under Existing Conditions during November through

March (up to 46% lower) and would be similar to or greater than flows under Existing Conditions (up to 60%) during April through June.

May Oroville storage volume under A5A_ELT would be similar to Existing Conditions in wet, above normal and below normal water years and would be 9% and 8% lower than Existing Conditions in dry and critical water years, respectively (Table 11-5A-28).

As reported in Impact AQUA-58, September Oroville storage volume under A5A_ELT would be similar to Existing Conditions in critical water years and would be 21%, 23%, 16%, and 6% lower than Existing Conditions in wet, above normal, and below normal, and dry water years, respectively (Table 11-5A-25).

Water temperatures in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were evaluated during the November through June juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperature under Alternative 5A would be similar to those under Existing Conditions during all months and water year types throughout the period at both locations.

The percent of months exceeding the 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during May through June (Table 11-5A-29). Although spring-run typically rear in the Feather River from November through June, NMFS requested that these months be evaluated to be consistent with water temperature targets set during the Oroville Dam FERC relicensing process, and evaluated in the NMFS (2009) Draft BiOp on the Oroville Dam project. As indicated in Table 11-5A-10, this criterion applies to both spring-run Chinook salmon and steelhead rearing. Therefore, the months of interest to spring-run Chinook salmon here are May and June only. The steelhead analysis below includes the remaining months. The percent of months exceeding the threshold under A5A_ELT would be similar to those under Existing Conditions during May, but up to 11% greater (expressed as an absolute difference) during June.

Total degree-months exceeding 63°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during May through August (Table 11-5A-30). Total degree-months (all water years combined) under A5A_ELT would be similar to those under Existing Conditions during May, but 57 degree-months to 78 degree-months higher during June through August.

Summary of CEQA Conclusion

Under Alternative 5A, there would be large flow reductions in the Feather River in several months, depending on water year type. Both SacEFT and SALMOD predict improvements to rearing habitat availability for spring-run Chinook salmon in the Sacramento River under Alternative 5A. Exceedances above NMFS temperature thresholds would be higher under Alternative 5A relative to Existing Conditions. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade rearing habitat and substantially reduce the number of spring-run Chinook salmon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on spring-run Chinook salmon juvenile rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-60: Effects of Water Operations on Migration Conditions for Chinook Salmon (Spring-Run ESU)

In general, Alternative 5A would not degrade migration conditions for spring-run Chinook salmon relative to the NAA.

Upstream of the Delta

Sacramento River

Flows in the Sacramento River upstream of Red Bluff were evaluated during the December through May juvenile Chinook salmon spring-run migration period. Mean flows under A5A_ELT during December through May would be similar to or greater than flows under NAA_ELT throughout the migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Flows in the Sacramento River upstream of Red Bluff were evaluated during the April through August adult spring-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or greater than flows under NAA_ELT throughout the migration period.

Water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Clear Creek

Mean flows in Clear Creek during the November through May juvenile Chinook salmon spring-run migration period under A5A_ELT would be similar to flows under NAA_ELT throughout the period (Appendix B, *Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek during the April through August adult spring-run Chinook salmon upstream migration period under A5A_ELT would be similar to flows under NAA_ELT throughout the migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile Chinook salmon spring-run migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or greater than flows under NAA_ELT throughout the period, with minor exceptions.

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Flows in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during April through July would be similar to or up to 28% greater (June of below normal water years) than flows under NAA_ELT, except for 38% lower flow in July of critical years. Mean flows under A5A_ELT during August would generally be lower (up to 13% lower) than flows under NAA_ELT.

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Through-Delta

Juveniles

During the juvenile spring-run Chinook salmon emigration period (November to May), mean monthly flows in the Sacramento River below the north Delta intake under Alternative 5A averaged across years would be 8% to 10% lower in most months, and 18.5% lower in November compared to NAA_ELT. Flows would be up to 25% lower in November of below normal years compared to NAA_ELT.

As described above in Impact AQUA-39, the north Delta export facilities would replace aquatic habitat and likely attract piscivorous fish around the intake structures. Estimates of potential predation losses at the single intake range from less than 0.1% of the estimated 4.2 million spring-run Chinook salmon entering the Delta (bioenergetics model, Table 11-5A-13; note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A) to 4.2% (based on a conservative fixed 5% loss per intake from the GCID study of Vogel [2008]; see additional discussion in Alternative 4A) of the juvenile spring-run population that reaches the Delta (For methods, see Appendix 5F, *Biological Stressors*, of the public draft BDCP).

Through-Delta survival to Chipps Island by emigrating juvenile winter-run Chinook salmon was modeled by the DPM. Average survival under Alternative 5A would be 29.5% across all years, 24% in drier years, and 39% in wetter years, which is similar or slightly lower to modeled survival under baseline conditions (Table 11-5A-31). As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 5A and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Table 11-5A-31. Through-Delta Survival (%) of Emigrating Juvenile Spring-Run Chinook Salmon under Baseline and Alternative 5A Scenarios, by Year Type

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Types	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wetter Years	42.1	41.4	39.2	-2.9 (-7%)	-2.2 (-6%)
Drier Years	24.8	24.3	23.6	-1.1 (-4%)	-0.7 (-2%)
All Years	31.3	30.7	29.5	-1.8 (-5%)	-1.2 (-4%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

The importance of attraction flows and olfactory cues to adult Chinook salmon migrating upstream is described in detail in Impact AQUA-42 for Alternative 1A. The proportion of Sacramento River flows at Collinsville (surrogate for olfactory cues) during the spring-run adult migration under A5A_ELT, are predicted to be 64% to 72% during March to May (the peak of the migration is March and April), which is 3% to 5% lower than NAA_ELT (Table 11-5A-15). As suggested by adult sockeye salmon studies, attraction due to olfactory cues could be adversely affected by dilution greater than 20%, but not discernibly affected by dilution of 10% or less (Fretwell 1989).

NEPA Effects: Upstream of the Delta, migration conditions for spring-run Chinook salmon under Alternative 5A would not be adverse because flow and temperature conditions would generally be similar to those under the NEPA baseline.

Near-field effects of Alternative 5A's proposed north Delta intake related to impingement and predation could result in negative effects on juvenile migrating spring-run Chinook salmon, although there is uncertainty regarding the overall effects. It is expected that the level of near-field impacts would be directly correlated to the number of new intake structures in the river and thus the level of impacts associated with 1 new intake would be considerably lower than those expected from having 5 new intakes in the river (as proposed for Alternative 1A, for example). Estimates within the effects analysis range from very low levels of effects (considerably less than 1% mortality) to larger effects (~ 4% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structure will be implemented as part of the final NDD screen design effort. Alternative 5A also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for spring-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains uncertain.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 5A would be similar (or slightly lower, accounting for similar Yolo Bypass entry for A5A_ELT and NAA_ELT, which was not modeled) to survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 5A on juvenile spring-run Chinook salmon migration suggests the potential for a small negative effect of the proposed operations on juvenile spring-run Chinook salmon. This effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 5A of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of spring-run Chinook salmon juveniles into the low-survival interior Delta.

Overall, there would not be an adverse effect on migration conditions for spring-run Chinook salmon from Alternative 5A.

CEQA Conclusion: In general, Alternative 5A would not affect migration conditions for spring-run Chinook salmon relative to Existing Conditions.

Upstream of the Delta

Sacramento River

Mean flows in the Sacramento River upstream of Red Bluff during the December through May juvenile spring-run Chinook salmon migration period under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except during May of wet years (10% decrease) (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through May juvenile Chinook salmon spring-run emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the April through August adult spring-run Chinook salmon upstream migration period under A5A_ELT would generally be similar to or slightly greater than Existing Conditions, except during May of wet years (10% decrease) and August of critical years (14% decrease).

Water temperatures in the Sacramento River at Red Bluff were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period, except for a 6% higher water temperature under A5A_ELT during August of critical water years.

Clear Creek

Mean flows in Clear Creek during the November through May juvenile Chinook salmon spring-run migration period under A5A_ELT would generally be similar to or greater (up to 40% greater flow for January of wet years) than flows under Existing Conditions, (Appendix B, *Supplemental Modeling for New Alternatives*).

Flows in Clear Creek during the April through August adult spring-run Chinook salmon upstream migration period under A5A_ELT would generally be similar to or greater than flows under Existing Conditions, except for 10% lower flow in August of critical water years (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Feather River

Flows were examined for the Feather River at the confluence with the Sacramento River during the November through May juvenile Chinook salmon spring-run migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions, except for 17%, 16%, and 13% lower flows during below normal years in January, February, and March, respectively.

Mean monthly water temperatures in the Feather River at the confluence with the Sacramento River were examined during the November through May juvenile spring-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Flows were examined for the Feather River at the confluence with the Sacramento River during the April through August adult spring-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows during April and May under A5A_ELT would generally be similar to flows under Existing Conditions. Mean flows under A5A_ELT relative to Existing Conditions would be highly variable during June through August; mean flows under A5A_ELT would be up to 24% greater (in August of wet years) and up to 44% lower (in July of critical years).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the April through August adult spring-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Through-Delta

During the juvenile spring-run Chinook salmon emigration period (November to May), mean monthly flows in the Sacramento River below the north Delta intake under Alternative 5A averaged across years would be 7% to 14% lower in most months, and 15% lower in November compared to Existing Conditions. Flows would be up to 21% lower in November of dry years and 24% lower in May of wet years compared to Existing Conditions.

As described above, estimates of potential predation losses at the single intake range from about less than 0.1% to 4.2% of the juvenile spring-run population that reaches the Delta.

Through-Delta survival to Chipps Island by emigrating juvenile spring-run Chinook salmon under Alternative 5A would be slightly decreased under Existing Conditions, up to 3% lower (7% relative decrease) in wetter years (Table 11-5A-31).

Attraction flows and olfactory cues for adults migrating through the Delta, as indicated by the proportion of Sacramento River flow at Collinsville during March to May, would be 5% to 6% lower than under Existing Conditions, but would still make up 64% to 72% of overall flows.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would be less than significant because the alternative would not substantially degrade suitable migration habitat or interfere with the movement of fish. No mitigation would be necessary. Upstream of the Delta, these modeling results indicate that the effect would be less than significant because it would not substantially reduce the suitability of migration habitat or interfere with the movement of fish. Flows in the Sacramento River and Clear Creek and water temperatures in the Sacramento and Feather Rivers would generally not be affected by Alternative 5A. Flows in the Feather River would be highly variable, but on average not differ between Existing Conditions and Alternative 5A. The relatively small difference in through-Delta migration survival between Alternative 5A and Existing Conditions, as well as inclusion of Environmental Commitments (6, 15, and 16) and bypass flow criteria and real-time operations (discussed above in the NEPA Effects), means that migration habitat conditions and movement would not be substantially reduced in the Delta.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-61: Effects of Construction of Restoration Measures on Chinook Salmon (Spring-Run ESU)

Impact AQUA-62: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Spring-Run ESU)

Impact AQUA-63: Effects of Restored Habitat Conditions on Chinook Salmon (Spring-Run ESU)

Impact AQUA-64: Effects of Methylmercury Management on Chinook Salmon (Spring-Run ESU) (Environmental Commitment 12)

Impact AQUA-67: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Spring-Run ESU) (Environmental Commitment15)

Impact AQUA-68: Effects of Nonphysical Fish Barriers on Chinook Salmon (Spring-Run ESU) (Environmental Commitment16)

NEPA Effects**:** All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on spring-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Fall-/Late Fall–Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-73: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

The potential effects of construction of the water conveyance facilities on fall-/late fall–run Chinook salmon would be similar to those described for Alternative 4A (Impact AQUA-73) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to fall-/late fall–run Chinook salmon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-73, and as discussed above, the effect would not be adverse for fall-run/late-fall run Chinook salmon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-37, and as discussed above, the impact of the construction of water conveyance facilities on fall-run/late-fall run Chinook salmon would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-74: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon (Fall-/Late Fall–Run ESU)

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-74 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-74 would not be adverse for fall-/late fall-run Chinook salmon under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-74 for fall-/late fall-run Chinook salmon under Alternative 4A, the impact of the maintenance of water conveyance facilities on for fall-/late fall–run Chinook salmon would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-75: Effects of Water Operations on Entrainment of Chinook Salmon (Fall-/Late Fall–Run ESU)

Water Exports from SWP/CVP South Delta Facilities

Fall-Run

Alternative 5A would reduce overall entrainment of juvenile fall-run Chinook salmon at the south Delta export facilities compared to NAA_ELT. Under Alternative 5A, juvenile fall-run Chinook salmon entrainment, estimated by the salvage density method, would be reduced by 31% (Table 11-5A-32) across all water year types compared to NAA_ELT. The greatest reduction in juvenile fall-run Chinook salmon entrainment under Alternative 5A would occur in wet years (77% decrease). Entrainment would be similar in dry years compared to NAA_ELT. Overall, Alternative 5A would provide a beneficial effect on juvenile fall-run Chinook salmon due to the reduction in entrainment and associated pre-screen predation loss at the south Delta export facilities compared to NAA_ELT (Table 11-5A-32).

Late Fall–Run

Average entrainment of juvenile late fall–run Chinook salmon at the south Delta export facilities under Alternative 5A would be reduced by 5% compared to NAA_ELT (Table 11-5A-32). The greatest relative reduction would occur in wet years (10% decrease), whereas there would be an 8% increase in critical years.

Water Exports from SWP/CVP North Delta Intake Facilities

Similar to the effects as described for winter-run Chinook salmon under Alternative 1A (Impact AQUA-39) above, potential entrainment of juvenile salmonids at the north Delta intakes would be greater than baseline, but the effects would be minimal because the single north Delta intake under Alternative 5A would have state-of-the-art screens to exclude juvenile fish.

Predation Associated with Entrainment

Pre-screen loss of fall-run/late fall-run juvenile Chinook salmon at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 5A, commensurate with entrainment reductions. Predation at the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River. Application of bioenergetics modeling for ELT water temperature with a median predator density for the single intake proposed under Alternative 5A predicts increased predation loss of over 33,000 juvenile fall-run and 5,600 juvenile late fall-run Chinook salmon, or 0.05% of fall-run Chinook salmon juvenile abundance and 0.13% of late fall-run Chinook salmon entering the Delta (See Table 11-5A-13 under discussion of predation under Impact AQUA-42). Note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A. See additional discussion of predation under Impact AQUA-78.

NEPA Effects: In conclusion, Alternative 5A would reduce overall entrainment and related predation losses of juvenile fall-run and late fall-run Chinook salmon relative to NAA_ELT. This effect would be beneficial.

CEQA Conclusion: Entrainment and related predation losses of juvenile fall-run and late fall–run Chinook salmon at the south Delta export facilities would generally be reduced under Alternative 5A compared to Existing Conditions (Table 11-5A-32). As described in the NEPA analysis above, there may be additional predation at the north Delta intake. Overall, impacts of water operations on fall-run Chinook salmon would be beneficial and impacts of water operations on late fall–run Chinook salmon would be less than significant and may be beneficial because of the reductions in entrainment loss at the south Delta facilities compared to Existing Conditions (Table 11-5A-32). No mitigation would be required.

Table 11-5A-32. Juvenile Fall-Run and Late Fall-Run Chinook Salmon Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Fall-Run Chinook Salmon		
Wet	-96,618 (-76%)	-102,094 (-77%)
Above Normal	-1,526 (-5%)	-2,322 (-7%)
Below Normal	-871 (-6%)	-702 (-5%)
Dry	1,988 (10%)	295 (1%)
Critical	-6,196 (-15%)	-4,142 (-11%)
All Years	-15,971 (-29%)	-17,298 (-31%)
Late Fall–Run Chinook Salmon		
Wet	-437 (-7%)	-608 (-10%)
Above Normal	-54 (-9%)	-52 (-9%)
Below Normal	3 (6%)	2 (3%)
Dry	-11 (-8%)	-2 (-2%)
Critical	2 (1%)	13 (8%)
All Years	-75 (-4%)	-97 (-5%)

Shading indicates10% or greater increased entrainment.

[a] Estimated annual number of fish lost, based on normalized data.

Impact AQUA-76: Effects of Water Operations on Spawning and Egg Incubation Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 5A would not affect spawning and egg incubation habitat for fall-/late fall–run Chinook salmon relative to NAA_ELT.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be greater than or similar to flows under NAA_ELT in October, December and January, and would be lower (7% to 17% lower) than flows under NAA_ELT during November of all water years. These results indicate that there would generally be no flow-related effects of Alternative 5A on spawning and egg incubation habitat except during November, in which there would be small, intermittent flow reductions.

Shasta Reservoir storage at the end of September would affect flows during the fall-run spawning and egg incubation period. As reported in Impact AQUA-58 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to or slightly greater than storage under NAA_ELT in all water year types (Table 11-5A-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-5A-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and A5A_ELT in the levels of concern across all months and all 82 modeled years are presented in Table 11-5A-20. There would be little or no difference in the number of years with a "red", "orange", or "yellow" level of concern under A5A_ELT.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water years combined) under A5A_ELT would be similar to (<5% difference) total degree-days under NAA_ELT for all seven months (Table 11-5A-21).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be lower than or similar to mortality under NAA_ELT in all water year types, including below normal water years in which, although there would be an 8% relative increase in the mortality rate, the absolute increase would be about 1% of the late fall-run population (Table 11-5A-33). Therefore, these results indicate that A5A_ELT would have negligible effects on fall-run Chinook salmon egg mortality.

Table 11-5A-33. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	4 (41%)	0.3 (2%)
Above Normal	5 (43%)	1 (5%)
Below Normal	6 (57%)	1 (8%)
Dry	8 (54%)	1 (3%)
Critical	5 (18%)	-0.2 (-1%)
All	6 (40%)	1 (3%)

SacEFT predicts that there would be a 33% increase in the percentage of years with good spawning availability for fall-run Chinook salmon, measured as weighted usable area, under A5A_ELT relative to NAA_ELT (Table 11-5A-34). SacEFT predicts that there would be a 12% reduction in the percentage of years with good (lower) redd scour risk under A5A_ELT relative to NAA_ELT. SacEFT predicts that there would be no difference between A5A_ELT and NAA_ELT in the number of years with good egg incubation conditions. SacEFT predicts that there would be a 3% reduction in the percentage of years with good (lower) redd dewatering risk under A5A_ELT relative to NAA_ELT.

Table 11-5A-34. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Spawning WUA	9 (19%)	14 (33%)
Redd Scour Risk	-3 (-5%)	-8 (-12%)
Egg Incubation	-5 (-5%)	0 (0%)
Redd Dewatering Risk	1 (4%)	-1 (-3%)
Juvenile Rearing WUA	1 (3%)	-4 (-11%)
Juvenile Stranding Risk	-8 (-26%)	0 (0%)

WUA = Weighted Usable Area.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to flows under NAA_ELT throughout the period.

Shasta Reservoir storage at the end of September would affect flows during the late fall–run spawning and egg incubation period. As reported in Impact AQUA-58 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to or slightly greater than storage under NAA_ELT in all water year types (Table 11-5A-19).

The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be similar to mortality under NAA_ELT in all water years, including above normal water years in which, although there would be a 10% relative reduction in the mortality rate, the absolute reduction would be less than 1% of the late fall-run population (Table 11-5A-35).

Table 11-5A-35. Difference and Percent Difference in Percent Mortality of Late Fall–Run Chinook Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	2 (78%)	-0.1 (-3%)
Above Normal	1 (58%)	-0.4 (-10%)
Below Normal	2 (115%)	-0.04 (-1%)
Dry	2 (66%)	-0.1 (-3%)
Critical	1 (64%)	-0.01 (-0.3%)
All	2 (74%)	-0.1 (-3%)

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-5A-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and Alternative 5A in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-20. There would be little or no difference in the number of years with a "red", "orange", or "yellow" level of concern under A5A_ELT.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water years combined) under A5A_ELT would be similar to (<5% difference) total degree-days under NAA_ELT for all seven months (Table 11-5A-21).

SacEFT predicts that there would be a 6% relative decrease in the percentage of years with good spawning availability for late fall–run Chinook salmon, measured as weighted usable area, under A5A_ELT compared to NAA_ELT (Table 11-5A-36). SacEFT predicts that there would be a negligible (<5%) differences in the percentage of years with redd scour risk, good (lower) egg incubation conditions, and redd dewatering risk between A5A_ELT and NAA_ELT.

Table 11-5A-36. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Late Fall–Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Spawning WUA	-7 (-13%)	-3 (-6%)
Redd Scour Risk	-3 (-4%)	-1 (-1%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-5 (-8%)	1 (2%)
Juvenile Rearing WUA	3 (7%)	-9 (-16%)
Juvenile Stranding Risk	-23 (-32%)	-11 (-18%)

WUA = Weighted Usable Area.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Clear Creek flows below Whiskeytown Reservoir were examined for the September through February fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to flows under NAA_ELT, in all months and water year types.

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning is assumed to occur. The greatest monthly reduction in Clear Creek flows during September through February under A5A_ELT would be 33% more negative (i.e., worse; expressed as an absolute difference) in dry years under A5A_ELT relative to the greatest reduction under NAA_ELT and would be similar to the greatest reduction under NAA_ELT for the other water year types (Table 11-5A-24).

Feather River

Fall-Run

Flows in the Feather River in the low flow and high flow channels were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows in the low-flow channel under A5A_ELT would be identical to those under NAA_ELT. Mean flows in the high-flow channel under A5A_ELT would generally be similar to or up to 40% greater (during December of critical water years) than those under NAA_ELT, except for reductions in flow of 13% to 15% during January.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Flows in the low-flow channel during October through January were identical between A5A_ELT and NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on redd dewatering in the Feather River low-flow channel.

Water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River at Gridley was evaluated during October through April (Table 11-5A-38). The percent of months exceeding the threshold under A5A_ELT would be similar to or less than (up to 12% less expressed as an absolute difference) the percent under NAA_ELT during October, November, March and April. There would be no differences during December through February.

Table 11-5A-38. Differences Alternative 5A and Baseline Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 56°F Threshold, October through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
October	-2 (-3%)	4 (4%)	0 (0%)	15 (36%)	19 (100%)
November	4 (100%)	4 (300%)	2 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	5 (67%)	5 (133%)	4 (300%)	1 (NA)	0 (NA)
April	5 (7%)	7 (13%)	12 (40%)	5 (29%)	1 (11%)
NAA_ELT vs. A5A_ELT					
October	-4 (-4%)	-5 (-5%)	-11 (-13%)	-11 (-17%)	-12 (-25%)
November	-9 (-54%)	-1 (-20%)	0 (0%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-6 (-33%)	0 (0%)	0 (0%)	-1 (-50%)	-1 (-100%)
April	-4 (-5%)	-4 (-5%)	-7 (-15%)	-7 (-25%)	-4 (-23%)

NA = could not be calculated because the denominator was 0.

The effects of Alternative 5A on water temperature-related spawning and egg incubation conditions for fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-months in the Feather River at Gridley for months that exceed the 56°F NMFS threshold during the October through April fall-run Chinook salmon spawning and egg incubation period for all 82 years (Table 11-5A-39). Total degree-months (all water year types combined) would be similar between NAA_ELT and A5A_ELT for all months of the period.

Table 11-5A-39. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
October	Wet	29 (40%)	-5 (-5%)
	Above Normal	14 (32%)	0 (0%)
	Below Normal	11 (20%)	-6 (-8%)
	Dry	20 (38%)	-2 (-3%)
	Critical	13 (32%)	-5 (-8%)
	All	86 (32%)	-19 (-5%)
November	Wet	2 (NA)	1 (100%)
	Above Normal	6 (300%)	3 (60%)
	Below Normal	2 (200%)	-1 (-25%)
	Dry	5 (NA)	-1 (-17%)
	Critical	2 (200%)	-2 (-40%)
	All	16 (400%)	-1 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	1 (NA)	0 (0%)
	Above Normal	-1 (-100%)	0 (NA)
	Below Normal	7 (700%)	1 (14%)
	Dry	6 (150%)	-1 (-9%)
	Critical	6 (150%)	0 (0%)
	All	19 (190%)	0 (0%)
April	Wet	16 (114%)	1 (3%)
	Above Normal	9 (39%)	1 (3%)
	Below Normal	6 (15%)	0 (0%)
	Dry	18 (37%)	2 (3%)
	Critical	13 (45%)	2 (5%)
	All	62 (40%)	6 (3%)

NA = could not be calculated because the denominator was 0.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under A5A_ELT would be similar expressed as an absolute difference (ranging from a 1% reduction to a 0.3% increase, depending on water year type) to mortality under NAA_ELT despite the much larger relative differences (-19% to +9%). The absolute differences are used here as more reliable estimators of differences in mortality rates because they are directly related to the size of the egg population (Table 11-5A-40). An increase of <1% in the mortality rate would not cause an overall effect to fall-run Chinook salmon.

Table 11-5A-40. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Feather River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	1 (91%)	-0.1 (-2%)
Above Normal	1 (64%)	-0.4 (-19%)
Below Normal	2 (90%)	0.3 (9%)
Dry	3 (154%)	-1 (-12%)
Critical	5 (96%)	-1 (-11%)
All	2 (105%)	-0.4 (-8%)

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or up to 17% greater (critical water years) than flows under NAA_ELT during October and would be lower (up to 12% lower) than flows under NAA_ELT during November. Mean flows during December and January would generally be similar between A5A_ELT and NAA_ELT.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-5A-41). The percent of months exceeding the threshold under A5A_ELT would similar to or up to 12% lower (expressed as an absolute difference) than the percent under NAA_ELT.

Table 11-5A-41. Differences between Baseline and Alternative 5A Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
November	25 (54%)	27 (100%)	21 (155%)	19 (750%)	9 (700%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	1 (10%)	5 (67%)	2 (100%)	1 (100%)	1 (NA)
April	11 (16%)	7 (12%)	9 (19%)	10 (31%)	4 (14%)
NAA_ELT vs. A5A_ELT					
November	-12 (-15%)	-6 (-10%)	-9 (-20%)	-10 (-32%)	-9 (-47%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-5 (-27%)	-1 (-9%)	-5 (-50%)	0 (0%)	-1 (-50%)
April	-6 (-7%)	-5 (-7%)	-10 (-15%)	-7 (-15%)	-1 (-4%)

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-5A-42). The absolute difference (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between NAA_ELT and A5A_ELT in most cases are mathematical artifacts due to the small values of degree-months for NAA_ELT (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon. The largest change in the American River in the degree-months between NAA_ELT and A5A_ELT (14 degree-months lower for November) for the 82-year period of analysis would equate to an average increase of less than 0.2 degrees per month. Given the highly variable nature of the American River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur daily on a diel cycle.

Table 11-5A-42. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
November	Wet	35 (140%)	-4 (-6%)
	Above Normal	14 (127%)	-3 (-11%)
	Below Normal	24 (300%)	-2 (-6%)
	Dry	23 (177%)	-3 (-8%)
	Critical	17 (106%)	-1 (-3%)
	All	112 (153%)	-14 (-7%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	5 (125%)	0 (0%)
	Critical	6 (60%)	-1 (-6%)
	All	18 (95%)	-1 (-3%)
April	Wet	19 (68%)	-3 (-6%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	16 (44%)	0 (0%)
	Dry	15 (20%)	0 (0%)
	Critical	16 (27%)	0 (0%)
	All	80 (36%)	-3 (-1%)

NA = could not be calculated because the denominator was 0.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. The greatest (maximum) monthly reductions in American River flows during November through January under A5A_ELT would be 2% to 41% more negative (i.e., worse; expressed as an absolute difference) than under NAA_ELT in wet, above normal, below normal, and critical water years and 8% smaller than NAA_ELT in dry water years (Table 11-5A-43).

Table 11-5A-43. Difference and Percent Difference in Greatest Monthly Reduction (Percent Change) in Instream Flow in the American River at Nimbus Dam during the October through January Spawning and Egg Incubation Period[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	20 (91%)	-2 (NA)
Above Normal	-4 (-13%)	-10 (-44%)
Below Normal	-9 (-49%)	-14 (-92%)
Dry	27 (59%)	8 (31%)
Critical	-5 (-10%)	-41 (-261%)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in October, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under A5A_ELT would be similar (<5% difference) to mortality under NAA_ELT in all water years (Table 11-5A-44).

Table 11-5A-44. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the American River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	16 (103%)	0.4 (1%)
Above Normal	14 (132%)	-0.4 (-2%)
Below Normal	13 (108%)	1 (3%)
Dry	10 (63%)	0.5 (2%)
Critical	4 (18%)	-0.2 (-1%)
All	12 (80%)	0.3 (1%)

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be largely the same as flows under NAA_ELT throughout the period.

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and Alternative 5A throughout the October through January period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to flows under NAA_ELT throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). There would be no difference in mean flows between A5A_ELT and NAA_ELT for all water year types throughout the period.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, it is concluded that the effect is not adverse because spawning and egg incubation habitat conditions are not substantially degraded. There are no reductions in flows under Alternative 5A or increases in temperatures that would translate into adverse biological effects on fall-/late fall-run Chinook salmon spawning and egg incubation habitat. The Reclamation egg mortality model predicts no effects of Alternative 5A on fall-/late fall-run Chinook salmon spawning and egg incubation habitat in the Sacramento, Feather, and American Rivers and SacEFT predicts generally small or beneficial effects on spawning and egg incubation habitat in the Sacramento River.

CEQA Conclusion: In general, the modeling results for the Alternative 5A analysis indicate that Alternative 5A could affect spawning and egg incubation habitat for fall-/late fall–run Chinook salmon relative to the Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 5A would not affect the quantity and quality of spawning and egg incubation habitat for fall-/late fall-run Chinook salmon relative to the CEQA baseline.

Sacramento River

Fall-Run

Flows were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows in the Sacramento River upstream of Red Bluff under A5A_ELT would generally be similar to Existing Conditions during December and January. During October and November, flows under A5A_ELT would be generally lower (by up to 15%) than flows under Existing Conditions. These results indicate that there would generally be no flow-related effects of Alternative 5A on spawning and egg incubation habitat, except for intermittent, negligible-to-small flow reductions during October and November.

Shasta Reservoir mean storage volume at the end of September would be 6% to 12% lower under A5A_ELT relative to Existing Conditions, depending on water year type (Table 11-5A-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-5A-10). The combination of number of days and degrees above the 56°F threshold were further assigned a “level of concern” as defined in Table 11-5A-11. Differences between baselines and A5A_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-20. There would be 75% and 133% increases in the number of years with “red” and “orange” levels of concern, respectively, under A5A_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days (all water year types combined) under A5A_ELT would be 75% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-5A-21).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be 18% to 57% greater than mortality under Existing Conditions, and 4% to 8% greater expressed as an absolute difference (Table 11-5A-33).

SacEFT predicts that there would be a 19% increase in the percentage of years with good spawning habitat availability, measured as weighted usable area, under A5A_ELT relative to Existing Conditions (Table 11-5A-34). SacEFT predicts that there would be a 5% reduction in the percentage of years with good (lower) redd scour risk under A5A_ELT relative to Existing Conditions. SacEFT predicts that there would be a 5% relative decrease in the percentage of years with good (lower) egg incubation conditions under A5A_ELT compared to Existing Conditions. SacEFT predicts that there would be little difference (<5%) in the percentage of years with good (lower) redd dewatering risk under A5A_ELT relative to Existing Conditions.

Late Fall–Run

Flows in the Sacramento River upstream of Red Bluff were examined during the February through May late fall–run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be greater than or similar to flows under Existing Conditions, except during March of below normal years (8% lower) and May of wet years (11% lower) and below normal years (7% lower).

Shasta Reservoir storage volume at the end of September would be 6% to 12% lower under A5A_ELT relative to Existing Conditions (Table 11-5A-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F increments was determined for each month during October through April and year of the 82-year modeling period (Table 11-5A-10). The combination of number of days and degrees above the 56°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and Alternative 5A in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-20. There would be 75% and 133% increases in the number of years with "red" and "orange" levels of concern under A5A_ELT relative to Existing Conditions.

Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during October through April. Total degree-days under A5A_ELT would be 75% to 585% higher than those under Existing Conditions during October, November, March, and April, and similar during December through February (Table 11-5A-21).

The Reclamation egg mortality model predicts that late fall–run Chinook salmon egg mortality in the Sacramento River under A5A_ELT would be 58% to 115% greater than mortality under Existing Conditions, depending on water year type (Table 11-5A-35). However, absolute differences in the percent of the late-fall population subject to mortality would be no more than 2% for any water year type.

SacEFT predicts that there would be a 13% relative decrease in the percentage of years with good spawning availability, measured as weighted usable area, under A5A_ELT compared to Existing Conditions (Table 11-5A-36). SacEFT predicts that there would be a 4% relative decrease in the percentage of years with good (lower) redd scour risk under A5A_ELT compared to Existing Conditions. SacEFT predicts that there would be no difference in the percentage of years with good (lower) egg incubation conditions under A5A_ELT relative to Existing Conditions. SacEFT predicts that there would be an 8% relative decrease in the percentage of years with good (lower) redd dewatering risk under A5A_ELT compared to Existing Conditions.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir under A5A_ELT during the September through February fall-run spawning and egg incubation period would generally be similar to or up to 40% greater than (January of wet years) flows under Existing Conditions, except during September and October of critical water years (9% lower and 11% higher, respectively).

The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in September when spawning occurred. The greatest monthly reduction in Clear Creek flows during October through February under A5A_ELT would be similar to or smaller than that under Existing Conditions in wet and below normal water years, but the reduction would be 41%, 100%, and 33% greater (i.e., worse; expressed as absolute differences) under A5A_ELT in above normal, dry, and critical water years, respectively (Table 11-5A-24).

Feather River

Fall-Run

Flows in the low-flow channel during October through January under A5A_ELT would be identical to those under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives* Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows in the high-flow channel under A5A_ELT would generally be up to 46% lower than flows under Existing Conditions during January. Mean flows during October through December would generally be similar to or greater (up to 22% greater) than flows under Existing Conditions, except for 11% and 22% lower flows during November and December, respectively, of wet years. These results indicate that there would be intermittent, negligible-to-moderate flow-related effects of Alternative 5A on spawning and egg incubation habitat during November, December and January.

The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October when spawning is assumed to occur. Minimum flows in the low-flow channel would be identical between A5A_ELT and Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on redd dewatering in the Feather River low-flow channel.

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under A5A_ELT would be 64% to 154% greater than mortality under Existing Conditions, depending on water year type, and 2% to 5% greater expressed as an absolute difference (Table 11-5A-40).

Water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and below Thermalito Afterbay (high-flow channel) were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A5A_ELT relative to Existing Conditions would be no different (<5%) in either the low-flow or high-flow channel throughout the period

The percent of months exceeding the 56°F temperature threshold in the Feather River at Gridley was evaluated during October through April (Table 11-5A-38). The percent of months exceeding the threshold under A5A_ELT would similar to or up to 19% higher (expressed as an absolute difference) than the percent under Existing Conditions during all months except December through February, during which there would be no difference in the percent of months exceeding the threshold.

Total degree-months exceeding 56°F were summed by month and water year type at Gridley during October through April (Table 11-5A-39). Total degree-months (all water year types combined) exceeding the 56°F threshold under A5A_ELT would be 16 degree-months to 86 degree months higher than total degree-months under Existing Conditions, except during December through February, in which there would be little to no differences. The absolute difference (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between Existing Conditions and A5A_ELT in most cases are mathematical artifacts due to the small values of degree-months for Existing Conditions (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon. The largest change in the Feather River in the degree-months between Existing Conditions and A5A_ELT (86 degree-month increase for October) for the 82-year period of analysis would equate to an average increase of about 1 degree per month. Given the highly variable nature of the American River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur regularly on a diel cycle.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be lower by up to 28% than flows under Existing Conditions during November, December, and January, and would be similar in October, with exceptions. These results indicate that there would be intermittent, negligible-to-moderate flow-related effects of Alternative 5A on spawning and egg incubation habitat during November, December, and January.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean temperatures under A5A_ELT would be 5% to 7% greater than those under Existing Conditions in October, depending on water year type, and would be similar to those under Existing Conditions during the other three months of the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-5A-41). The percent of months exceeding the threshold under A5A_ELT would be up to 27% greater (expressed as absolute difference) than the percent under Existing Conditions during November, March, and April and similar to the percent under Existing Conditions during December through February.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-5A-42). Total degree-months (all water year types combined) under Alternative 5A would be 18 to 112 degree-months greater than total degree-months under Existing Conditions during November, March and April and similar to total degree months under Existing Conditions during December through February. The absolute difference (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between Existing Conditions and A5A_ELT in most cases are mathematical artifacts due to the small values of degree-months for Existing Conditions (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon. The largest change in the American River in the degree-months between Existing Conditions and A5A_ELT (112 degree-months lower for November) for the 82-year period of analysis would equate to an average increase of about 1.4 degrees per month. Given the highly variable nature of the American River, this change is not expected to be biologically meaningful.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in

October when spawning is assumed to occur. The greatest monthly reduction in American River flows during November through January would be 4%, 9%, and 5% larger (absolute differences) under A5A_ELT in above normal, below normal, and critical water years, respectively, than those under Existing Conditions, and would be 20% and 27% smaller in wet and dry years (Table 11-5A-43).

The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the American River under A5A_ELT would be 18% to 132% greater (4% to 16% absolute differences) than mortality under Existing Conditions (Table 11-5A-44).

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to those under Existing Conditions during the spawning and egg incubation period, except for January of below normal and critical water years when flows would be 8% and 12% lower, respectively.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A5A_ELT would not be different (<5% difference) from those under Existing Conditions for all months and water year types.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be generally similar to or slightly higher than flows under Existing Conditions.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the October through January fall-run Chinook salmon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions during October, November and January, and would be up to 28% higher (above normal years) during December.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable spawning habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of egg mortality. Under Alternative 5A, there would be small to moderate reductions in Feather and American River flows, and small to moderate flow increases in the exceedances of NMFS temperature thresholds in the Sacramento, Feather and American rivers that would interfere with fall-/late fall-run Chinook salmon spawning and egg incubation. The

Reclamation egg mortality model predicts moderate to substantial negative impacts of Alternative 5A on fall-/late fall-run Chinook salmon in the Sacramento, Feather, and American Rivers. SacEFT predicts slightly degraded egg incubation habitat conditions for fall-run Chinook salmon in the Sacramento River and more substantially degraded spawning habitat conditions for late fall-run Chinook salmon.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be no effect of Alternative 5A on flows, reservoir storage, and water temperatures that would cause a substantial reduction in fall-/late fall-run Chinook salmon. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-77: Effects of Water Operations on Rearing Habitat for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, Alternative 5A would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall–run Chinook salmon relative to NAA_ELT.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to flows under NAA_ELT throughout the period.

Shasta Reservoir storage at the end of September would affect flows during the fall-run larval and juvenile rearing period. As reported in Impact AQUA-59 for spring-run Chinook salmon, end of September Shasta Reservoir storage would be similar to or slightly greater than storage under NAA_ELT (Table 11-5A-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*

Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

SacEFT predicts that there would be an 11% relative decrease (4% absolute decrease) in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under A5A_ELT relative to NAA_ELT (Table 11-5A-34). SacEFT predicts that there would be no difference in the percentage of years with "good" (lower) juvenile stranding risk under A5A_ELT relative to NAA_ELT.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under A5A_ELT would be similar to mortality under NAA_ELT.

Late Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the late fall–run Chinook salmon juvenile rearing period of March through July (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to those under NAA_ELT throughout the rearing period.

Shasta Reservoir mean storage at the end of September and May would affect flows during the late fall–run larval and juvenile rearing period. As reported in Impact AQUA-156, end of September Shasta Reservoir storage would be similar to or slightly greater than storage under NAA_ELT in all water year types (Table 11-5A-19). Similarly, as reported in Impact AQUA-59, Shasta storage at the end of May under A5A_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-5A-9).

Water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

SacEFT predicts that there would be a 16% relative decrease (9% absolute decrease) in the percentage of years with good juvenile rearing availability for late fall–run Chinook salmon, measured as weighted usable area, under A5A_ELT relative to NAA_ELT (Table 11-5A-36). SacEFT predicts that there would be an 18% relative decrease (11% absolute decrease) in the percentage of years with "good" (lower) juvenile stranding risk under A5A_ELT relative to NAA_ELT.

SALMOD predicts that late fall–run smolt equivalent habitat-related mortality under A5A_ELT would be similar (<1% absolute and relative difference) to mortality under NAA_ELT.

Both SacEFT and SALMOD are considered to be reliable models for late fall-run Chinook salmon in the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used to draw conclusions about late fall-run Chinook salmon rearing conditions. The SALMOD model incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although SacEFT predicts that juvenile rearing habitat availability would be reduced under Alternative 5A, when combined with all early life stage effects in SALMOD, there would be no effect of the alternative on late fall-run Chinook salmon habitat-related survival of all early life stages, including juveniles. Further, results from SALMOD are consistent with results described above that indicate that there would be no differences in instream flows or reservoir storage between NAA_ELT and Alternative 5A.

Clear Creek

No water temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir during January through May were examined for the fall-run Chinook salmon rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under NAA_ELT throughout the rearing period.

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout this period under A5A_ELT would not differ from those under NAA_ELT. In the high flow channel, mean flows under A5A_ELT would mostly be similar to or up to 40% greater (both in December of critical water years and June of above normal years) than flows under NAA_ELT, except for 13% to 15% lower flows during January, depending on water year type.

As reported in Impact AQUA-59 for spring-run Chinook salmon, May Oroville storage volume under A5A_ELT would be similar to storage under NAA_ELT, (Table 11-5A-28).

As reported in Impact AQUA-58 for spring-run Chinook salmon, September Oroville storage volume under A5A_ELT would be similar to or up to 13% higher than that under NAA_ELT, depending on water year type (Table 11-5A-25).

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under NAA_ELT during January through May, with minor exceptions.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Stanislaus River

Mean flows in the Stanislaus River at the confluence with the San Joaquin River for Alternative 5A are not different from those under NAA_ELT, for the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*).

Mean water temperatures throughout the Stanislaus River would be similar between NAA_ELT and Alternative 5A throughout the January through May fall-run rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Mean flows in the San Joaquin River at Vernalis for Alternative 5A are not different from those under NAA_ELT, for the January through May fall-run Chinook salmon rearing period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River at the Delta for Alternative 5A are not different from those under NAA_ELT, for the January through May fall-run Chinook salmon rearing period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Taken together, these modeling results indicate that the effect to fall-/late fall-run juvenile rearing habitat is not adverse because the effect does not have the potential to substantially reduce the amount of suitable habitat of fish. The changes in flow rates and water temperatures are generally small and infrequent under Alternative 5A relative to the NAA_ELT. SacEFT predicts that for late fall-run under Alternative 5A there would be a 16% relative decrease in the percentage of years with good juvenile rearing habitat availability compared to NAA_ELT and an 18% relative reduction in the number of years with good (lower) juvenile stranding risk. However, after review of these SacEFT results in combination with the results of SALMOD, which evaluates habitat-related survival of all early life stages and found no effects of Alternative 5A, it is concluded that the effect to juvenile habitat conditions predicted by SacEFT would not have a substantial effect on early life stages combined, including juveniles, as predicted by SALMOD. As such, the effect in not adverse because it does not have the potential to substantially reduce the amount of suitable habitat of fish. There are no effects of Alternative 5A on fall-run or late fall-run Chinook salmon in other waterways that would rise to the level of adverse.

CEQA Conclusion: In general, Alternative 5A would not affect the quantity and quality of larval and juvenile rearing habitat for fall-/late fall–run Chinook salmon relative to the Existing Conditions.

Sacramento River

Fall-Run

Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be greater than or similar to flows under Existing Conditions, except during March of below normal years (8% lower) and May of wet years (11% lower) and below normal years (7% lower).

As reported in Impact AQUA-59, end of September Shasta Reservoir storage would be 6% to 12% lower under A5A_ELT relative mean to Existing Conditions, depending on water year type (Table 11-5A-19).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

SacEFT predicts that there would be a 3% increase in the percentage of years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted usable area, under A5A_ELT relative to Existing Conditions (Table 11-5A-34). SacEFT predicts that there would be a 26% reduction in the percentage of years with "good" (lower) juvenile stranding risk under A5A_ELT relative to Existing Conditions.

SALMOD predicts that fall-run smolt equivalent habitat-related mortality under A5A_ELT would be little different from the mortality under Existing Conditions.

Late Fall–Run

Sacramento River flows upstream of Red Bluff were examined for the late fall–run Chinook salmon juvenile March through July rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows during March through July under A5A_ELT would generally be similar to or slightly greater than those under Existing Conditions, except during March of below normal years (8% lower) and May of wet years (11% lower) and below normal years (7% lower).

As reported in Impact AQUA-59, mean end of September Shasta Reservoir storage would be 6% to 12% lower under A5A_ELT relative to Existing Conditions, depending on water year type (Table 11-5A-19).

As reported in Impact AQUA-41, end of May Shasta storage under A5A_ELT would be similar to Existing Conditions in wet, above normal, and below normal water years, but lower by 6% to 9% in dry and critical water years (Table 11-5A-9).

Water temperatures in the Sacramento River at Red Bluff were examined during the March through July late fall–run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

SacEFT predicts that there would be a 7% increase in the percentage of years with good juvenile rearing availability for late fall–run Chinook salmon, measured as weighted usable area, under A5A_ELT relative to Existing Conditions (Table 11-5A-36). SacEFT predicts that there would be a 32% reduction in the percentage of years with "good" (lower) juvenile stranding risk under A5A_ELT relative to Existing Conditions.

SALMOD predicts that late fall–run smolt equivalent habitat-related mortality under A5A_ELT would be 2% higher than mortality under Existing Conditions.

Clear Creek

No temperature modeling was conducted in Clear Creek.

Fall-Run

Flows in Clear Creek below Whiskeytown Reservoir were examined the January through May fall-run Chinook salmon rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or slightly greater than flows under Existing Conditions for the entire period, except for 40% and 13% higher flow during January and February, respectively, of wet years (Appendix B, *Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) during December through June were reviewed to determine flow-related effects on larval and juvenile fall-run rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Relatively constant flows in the low flow channel throughout the period under A5A_ELT would not differ from those under Existing Conditions. In the high flow channel, mean flows under A5A_ELT would be mostly lower (up to 52% lower in February of below normal water years) during December through March and generally similar to or up to 60% greater (during June of below normal years) than flows under Existing Conditions during April through June, with minor exceptions.

As reported under in Impact AQUA-59, May Oroville mean storage volume under A5A_ELT would be 9% and 8% lower than Existing Conditions in dry and critical water years, respectively, and would be similar to Existing Conditions for the other water year types (Table 11-5A-25).

As reported in Impact AQUA-59, September Oroville mean storage volume would be 6% to 23% lower under A5A_ELT relative to Existing Conditions, depending on water year type, except in critical water years, in which storage would be similar to that under Existing Conditions (Table 11-5A-28).

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). In both the low-flow channel and the high-flow channel, mean water temperatures under A5A_ELT would be the same (<5% difference) as those under Existing Conditions throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined for the January through May fall-run larval and juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions, except during January in below normal, dry and critical years (9% to 22% lower), February and March of critical years (15% and 8% lower, respectively), and May of all water year types (8% to 21% lower) other than critical years.

Water temperatures in the American River at the Watt Avenue Bridge were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no difference (<5%) in mean water temperatures between Alternative 5A and Existing Conditions throughout the rearing period.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be lower than those under Existing Conditions for most water years throughout the period (up to 29% lower in February of critical years), with minor exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under Alternative 5A be the same (<5% difference) as those under Existing Conditions in all months during the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be slightly lower (up to 12% lower) than those under Existing Conditions for most water years throughout the period.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the January through May fall-run Chinook salmon juvenile rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during January through March, and would be up to 11% lower than flows under Existing Conditions during April and May.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable rearing habitat and substantially reduce the number of fall-/late fall-run Chinook salmon as a result of degraded juvenile rearing conditions. Under Alternative 5A, including climate change effects, there would be small-to-moderate flow reductions in the Feather and American rivers that would interfere with fall-run Chinook salmon juvenile rearing habitat conditions. Flows in the Feather River would be lower in the majority of water year types during January and February, with flows in February up to 52% lower. SacEFT predicts that there would be a 26% reduction in years with low juvenile stranding risk for fall-run and a 32% reduction for late fall-run, indicating that flows would be more variable during the rearing period. Both SacEFT and SALMOD predict degraded rearing habitat conditions under Alternative 5A relative to Existing Conditions for late fall-run Chinook salmon.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage, and water temperatures in the Sacramento River would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required. Therefore, the effects of Alternative 5A on fall-/late fall-run Chinook salmon juvenile rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-78: Effects of Water Operations on Migration Conditions for Chinook Salmon (Fall-/Late Fall–Run ESU)

In general, the effects of Alternative 5A on fall- and late fall-run Chinook salmon migration conditions relative to the NAA are adverse.

Upstream of the Delta

Sacramento River

Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile fall-run migrants during February through May under A5A_ELT would be similar to flows under NAA_ELT throughout the February through May juvenile fall-run migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult fall-run Chinook salmon upstream migration period (August through December) under A5A_ELT would generally be similar to those under NAA_ELT during most months, except for September (up to 9% lower) and November (up to 217% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under A5A_ELT would generally be similar to flows under NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under A5A_ELT would be similar to those under NAA_ELT throughout the migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Flows in the Clear Creek below Whiskeytown Reservoir were examined for juvenile fall-run migrants during February through May. Mean flows under A5A_ELT would be similar to flows under NAA_ELT during all months and water year types of the migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon upstream migration period (August through December) under A5A_ELT would be similar to those under NAA_ELT, except during October of below normal water years, in which flows would be 6% higher (Appendix B, *Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run juvenile migration period (February through May) under A5A_ELT would generally be similar to or slightly greater than flows under NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Mean flows in the Feather River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period under A5A_ELT would generally be similar to those under NAA_ELT during November, up to 33% greater during October and December, and up to 41% lower during August and September (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be generally similar to or slightly greater than flows under NAA_ELT throughout the migration period.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type of the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to those under NAA_ELT in October and December, but up to 25% lower during August, September, and November.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under Alternative 5A would be similar to those under NAA_ELT throughout the year.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under Alternative 5A would be similar to those under NAA_ELT throughout the year.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under Alternative 5A would be similar to those under NAA_ELT throughout the year.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Fall-Run

Juveniles

During the juvenile fall-run Chinook salmon emigration period (November to May), mean monthly flows in the Sacramento River below the north Delta intake under Alternative 5A averaged across years would be 8% to 10% lower in most months, and 18.5% lower in November compared to NAA_ELT. Flows would be up to 25% lower in November of below normal years compared to NAA_ELT.

As described above in Impact AQUA-39, the north Delta export facilities would replace aquatic habitat and likely attract piscivorous fish around the intake structures. Estimates of potential predation losses at the single intake range from less than 0.1% of the estimated 62 million juvenile fall-run Chinook salmon entering the Delta (bioenergetics model, Table 11-5A-13; note that this estimate does not provide context to the level of predation in this reach that would occur without implementation of Alternative 5A) to 4.5% (based on a conservative fixed 5% loss per intake from the GCID study of Vogel [2008]; see additional discussion in Alternative 4A) of the juvenile fall-run population that reaches the Delta (For methods, see Appendix 5F, *Biological Stressors*, of the public draft BDCP).

Through-Delta survival by emigrating juvenile fall-run Chinook salmon under Alternative 5A (A5A_ELT) would average 24.6% across all years. Under Alternative 5A, juvenile survival was similar to NAA_ELT (Table 11-5A-45). As described for Alternative 4A, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 5A and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

Table 11-5A-45 Through-Delta Survival (%) of Emigrating Juvenile Fall-Run Chinook Salmon under Baseline and Alternative 5A Scenarios

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Types	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River					
Wetter Years	34.5	33.0	31.3	-3.2 (-10%)	-1.7 (-6%)
Drier Years	20.6	20.6	20.6	0.1 (1%)	0.0 (0%)
All Years	25.8	25.3	24.6	-1.2 (-3%)	-0.7 (-2%)
Mokelumne River					
Wetter Years	17.2	16.3	16.1	-1.1 (-7%)	-0.2 (-2%)
Drier Years	15.6	15.7	15.6	0.0 (0%)	-0.1 (-1%)
All Years	16.2	15.9	15.8	-0.4 (-3%)	-0.2 (-1%)
San Joaquin River					
Wetter Years	19.3	20.7	19.7	0.4 (2%)	-1.0 (-3%)
Drier Years	10.0	9.8	9.8	-0.1 (-1%)	0.0 (0%)
All Years	13.7	13.9	13.5	0.1 (0%)	-0.4 (-1%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

The adult fall-run migration extends from September-December. The proportion of Sacramento River water in the Delta under Alternative 5A would be similar (<10% change) to NAA_ELT during the entire migration period (Table 11-5A-15). Olfactory cues for fall-run adults would likely still be strong, as the proportion of Sacramento River under Alternative 5A would still represent 63–66% of Delta outflows. Because the proportion of Sacramento River water in the Delta would not substantially change during the peak adult migration period under Alternative 5A, there would not be an adverse effect on adult fall-run migration success through the Delta.

Late Fall–Run

Juveniles

During the juvenile late fall-run Chinook salmon emigration period (October-February), mean monthly flows in the Sacramento River below the north Delta intake under Alternative 5A averaged across years would be 6% to 12% lower in most months, and 19% lower in November compared to NAA_ELT. Flows would be up to 23% lower in November of above normal years compared to NAA.

Estimates of potential predation losses at the single intake range from about 0.1% of the estimated 4.3 million juvenile late fall-run reaching the Delta (bioenergetics model, Table 11-5A-13) to 4.5% (based on a fixed 5% loss per intake) of the juvenile late fall-run population that reaches the Delta (For methods, see Appendix 5F, *Biological Stressors*, of the public draft BDCP). As noted for fall-run Chinook salmon, the bioenergetics modeling does not account for the predation that would occur without implementation of Alternative 5A, and the fixed 5% loss estimate is based on a conservative assumption from the study at GCID (Vogel 2008).

Through-Delta survival by emigrating juvenile late fall–run Chinook salmon under Alternative 5A (A5A_ELT) would average 22.5% across all years, ranging from 20% in drier years to 27% in wetter years. Under Alternative 5A, juvenile survival would be similar to NAA_ELT (Table 11-5A-34). As described above for fall-run Chinook salmon, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 5A and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT. Overall, Alternative 5A would not have an adverse effect on late fall–run Chinook salmon juvenile survival through the Delta.

Table 11-5A-34. Through-Delta Survival (%) of Emigrating Juvenile Late Fall–Run Chinook Salmon under Baseline and Alternative 5A Scenarios

	Percentage Survival			Difference in Percentage Survival (Relative Difference)	
Year Types	EXISTING CONDITIONS	NAA_ELT	A5A_ELT	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wetter Years	28.8	27.5	27.2	-1.6 (-4%)	-0.3 (-1%)
Drier Years	18.8	20.0	19.7	0.9 (6%)	-0.3 (0%)
All Years	22.5	22.8	22.5	0.0 (2%)	-0.3 (0%)

Note: Delta Passage Model results for survival to Chipps Island.
Wetter = Wet and above normal water years (6 years).
Drier = Below normal, dry and critical water years (10 years).

Adults

The adult late fall–run migration is from November through March, peaking in January through March. The proportion of Sacramento River water in the Delta at Collinsville would be similar (5% or less different) to NAA_ELT throughout this migration period (Table 11-5A-15). Based on the similarity in Sacramento River olfactory cues during the adult late fall–run migration, it is assumed that adult migration success through the Delta would be similar between Alternative 5A and NAA_ELT. Therefore, Alternative 5A would not have an adverse effect on late fall–run adult migration.

Mokelumne River

Juveniles

Through-Delta survival by emigrating juvenile fall-run Chinook salmon under Alternative 5A would be 15.8%, which is similar to NAA_ELT (Table 11-5A-45).

San Joaquin River

Fall-Run

Juveniles

The only changes to San Joaquin River flows at Vernalis would result from the modeled effects of climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows. There are no San Joaquin River flow changes associated with the alternatives. From the perspective of the flow-based assessment using the DPM, Alternative 5A would have little effect on fall-run migration success through the Delta relative to NAA_ELT (Table 11-5A-45).

Adults

Alternative 5A would slightly increase the proportion of San Joaquin River water in the Delta at Collinsville in September through December by 0.5 to 1.7 % (compared to NAA_ELT) (Table 11-5A-15). As noted for Alternative 4A, even the seemingly small increase in San Joaquin River flow could provide moderate benefits: as illustrated in *BDCP Appendix 5.C, Section 5C.5.3.13.1.5 hereby incorporated by reference*, based on the study of Marston et al. (2012), greater olfactory cues under Alternative 5A could decrease the straying rate of adult San Joaquin River Chinook salmon to the Sacramento River. This would not be an adverse effect on adult fall-run Chinook salmon migrating to the San Joaquin River.

NEPA Effects: Overall, these modeling results indicate that the effect of Alternative 5A is adverse because it has the potential to substantially decrease fall-/late fall-run Chinook salmon migration habitat conditions upstream of the Delta. In the American River, flows would be up to 25% lower under Alternative 5A in three of five months of the adult migration period. These reductions represent an adverse effect of the alternative on fall-/late fall-run Chinook salmon migration because they could impact the ability of adult fall-run Chinook salmon to migrate upstream successfully. There would be no other effects of Alternative 5A on upstream flows or water temperatures during the juvenile or adult migration periods for fall- and late fall-run Chinook salmon. As described for other races of Chinook salmon, near-field effects of Alternative 5A's proposed north Delta intake related to impingement and predation could result in negative effects on juvenile migrating fall-/late fall-run Chinook salmon, although there is uncertainty regarding the overall effects. It is expected that the level of near-field impacts would be directly correlated to the number of new intake structures in the river and thus the level of impacts associated with 1 new intake would be considerably lower than those expected from having 5 new intakes in the river (as proposed for Alternative 1A, for example). Estimates within the effects analysis range from very low levels of effects (considerably less than 1% mortality) to larger effects (~ 4.5% mortality above current baseline levels). As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structure will be implemented as part of the final NDD screen design effort. Alternative 5A also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for fall-/late fall-run Chinook. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains uncertain.

As described for Alternative 4A, the DPM is a flow-based model incorporating flow-survival and junction routing relationships with flow modeling of water operations to estimate relative differences between scenarios in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration survival under Alternative 5A would be similar (or slightly lower, accounting for similar Yolo Bypass entry for A5A_ELT and NAA_ELT, which was not modeled) to survival estimated for NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual presence of fish. Although refinements to the DPM are likely to occur based on new data available from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative 5A on juvenile fall-/late fall-run Chinook salmon migration suggests the potential for a small negative effect of the proposed operations on juvenile fall-/late fall-run Chinook salmon. This effect would be reduced through the bypass flow criteria and real-time operations outlined above, as well as inclusion within Alternative 5A of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of fall-/late fall-run Chinook salmon juveniles into the low-survival interior Delta.

Because upstream effects would be adverse, it is concluded that the overall effect of Alternative 5A on fall-/late fall-run Chinook salmon migration conditions would be adverse. While the implementation of the mitigation measures described below would address these impacts, these measures are not anticipated to reduce the impact to a level considered not adverse.

The effect of Alternative 5A in the LLT on fall-/late-fall run Chinook migration conditions would not be adverse. Instream flows during fall-/late-fall run Chinook juvenile and adult migration periods would improve from ELT to LLT such that flows would not be substantially reduced under Alternative 5A relative to the NEPA baseline in the LLT. This effect is described in detail under Impact AQUA-78 for Alternative 5.

CEQA Conclusion: In general, Alternative 5A would degrade migration conditions for fall-/late fall–run Chinook salmon relative to Existing Conditions.

Upstream of the Delta

Sacramento River

Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile fall-run migrants during February through May under A5A_ELT would generally be similar to or greater than those under Existing Conditions, except during March of below normal water years (8% lower) and during May of below normal (7% lower) and wet years (11% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

Mean flows were examined in the Sacramento River upstream of Red Bluff during the adult fall-run Chinook salmon upstream migration period (August through December). Flows under A5A_ELT would generally be similar to those under Existing Conditions during August and December and up to 22% lower during September through November (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would generally be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A throughout the period.

Late Fall-Run

Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants (January through March) under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions throughout the period, except in below normal water years during March (8% reduction) (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period (December through February) under A5A_ELT would generally be similar to or slightly greater than those under Existing Conditions throughout the period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Red Bluff were examined during the December through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

Clear Creek

Water temperature modeling was not conducted in Clear Creek.

Fall-Run

Mean flows in Clear Creek below Whiskeytown Reservoir during the juvenile fall-run Chinook salmon upstream migration period (February through May) under A5A_ELT would be similar to or greater than those under Existing Conditions throughout the period (Appendix B, *Supplemental Modeling for New Alternatives*).

Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon upstream migration period (August through December) under A5A_ELT would generally be similar to those under Existing Conditions with few exceptions (Appendix B, *Supplemental Modeling for New Alternatives*).

Feather River

Fall-Run

Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run juvenile migration period (February through May) under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except in below normal years during February and March (16% and 13% lower, respectively) and in wet years during May (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Mean flows were examined in the Feather River at the confluence with the Sacramento River during the August through December fall-run Chinook salmon adult migration period. Flows under A5A_ELT during August would up to 24% greater than those under Existing Conditions in wetter water years and up to 30% lower in drier water years. During September, flows would be up to 71% greater and up to 33% lower than those under Existing Conditions. During October and November, flows would be similar between A5A_ELT and Existing Conditions. During December, flows would be up to 16% greater under A5A_ELT compared to Existing Conditions.

Water temperatures in the Feather River at the confluence with the Sacramento River were examined during the August through December fall-run Chinook salmon adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and Alternative 5A throughout the period.

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the February through May juvenile Chinook salmon fall-run migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during February through April would generally be similar to or greater than flows under Existing Conditions, with minor exceptions (up to 15% lower flow during February of critical years). Flows would be lower (up to 21% lower) under A5A_ELT during May of all water year types.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Flows in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during August, September, and November would be lower (up to 52% lower) than flows under Existing Conditions. Mean flows under A5A_ELT during October and December would generally be similar to those under Existing Conditions.

Water temperatures in the American River at the confluence with the Sacramento River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A5A_ELT would be similar to those under Existing Conditions during all months in this period except October, in which water temperatures under A5A_ELT would be 5% to 6% higher than those under Existing Conditions.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be lower than those under Existing Conditions (up to 29% lower during February of critical years) for most water year types in all months of the period, although flows under A5A_ELT in February and March of wet years would be up to 17% greater than those under Existing Conditions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under Existing Conditions with few minor exceptions (up to 7% difference).

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under AD5A_ELT would be 5% to 12% lower than those under Existing Conditions during February through May of below normal, dry and critical years, except for February of below normal years for which flow under AD2_ELT would be similar to those under Existing Conditions.

Flows in the San Joaquin River at Vernalis were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for*

New Alternatives). Mean flows under A5A_ELT would be up to 14% lower than those under Existing Conditions during August and September and would be similar during October through December.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the February through May juvenile fall-run Chinook salmon migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to those under Existing Conditions during February and up to 6%, 7%, and 11% lower than those under Existing Conditions during March, April and May, respectively.

Flows in the Mokelumne River at the Delta were examined during the August through December adult fall-run Chinook salmon upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be up to 32% lower than those under Existing Conditions during August and September, generally similar to flows under Existing Conditions during October and November, and up to 28% greater than flows under Existing Conditions during December.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

As described above, Sacramento River flows below the north Delta intake would be reduced under Alternative 5A compared to Existing Conditions. Estimates of potential predation losses at the single intake range from 0.1% to 4.5% of the population that reaches the Delta. Compared to Existing Conditions, through-Delta survival by emigrating juveniles under Alternative 5A ranges from 0.9% greater (6% relative increase) in drier years for late-fall run Chinook salmon to 3.2% lower (10% relative decrease) in wetter years for fall-run Chinook salmon (Table 11-5A-45).

Mokelumne River

Through-Delta survival by emigrating juvenile fall-run Chinook salmon under Alternative 5A would be 15.8% (Table 11-5A-45). Compared to Existing Conditions, survival would be similar in drier years, but 1.1% lower (7% relative decrease) in wetter years, for an overall similar or slightly reduced survival (3% relative difference) averaged across all years.

San Joaquin River

Through-Delta survival by emigrating juvenile fall-run Chinook salmon under Alternative 5A would be similar to Existing Conditions (Table 11-5A-45).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effects of Alternative 5A on migration conditions for fall-/late fall-run Chinook salmon are significant. Upstream there would be substantial reductions in flows in multiple upstream waterways under Alternative 5A relative to Existing Conditions that would slow or inhibit migration of fall-/late fall-run Chinook salmon. In addition, there would be small increases in water temperatures the American River during the adult fall-run migration period that could further increase stress to migrants.

The upstream impact is a result of the specific reservoir operations and resulting flows associated with this alternative. Applying mitigation (e.g., changing reservoir operations in order to alter the flows) to the extent necessary to reduce this impact to a less-than-significant level would fundamentally change the alternative, thereby making it a different alternative than that which has been modeled and analyzed. As a result, this impact is significant and unavoidable because there is no feasible mitigation available. Even so, proposed below is mitigation that has the potential to reduce the severity of impact though not necessarily to a less-than-significant level.

Mitigation Measure AQUA-78a: Following Initial Operations of Water Conveyance Facilities, Conduct Additional Evaluation and Modeling of Impacts to Fall-/Late Fall–Run Chinook Salmon to Determine Feasibility of Mitigation to Reduce Impacts to Migration Conditions

Please refer to Mitigation Measure AQUA-78a under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Mitigation Measure AQUA-78b: Conduct Additional Evaluation and Modeling of Impacts on Fall-/Late Fall–Run Chinook Salmon Migration Conditions Following Initial Operations of Water Conveyance Facilities

Please refer to Mitigation Measure AQUA-78b under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Mitigation Measure AQUA-78c: Consult with NMFS and CDFW to Identify and Implement Potentially Feasible Means to Minimize Effects on Fall-/Late Fall–Run Chinook Salmon Migration Conditions Consistent with Water Conveyance Facility Operations

Please refer to Mitigation Measure AQUA-78c under Alternative 1A (Impact AQUA-78) for fall/late fall-run Chinook salmon.

Through-Delta migration conditions for adult fall-run and late fall-run Chinook salmon under Alternative 5A would be similar to Existing Conditions, whereas through-Delta migration conditions for the juveniles of these races would be similar or slightly degraded compared to Existing Conditions. The relatively small difference in through-Delta migration survival between Alternative 5A and Existing Conditions, as well as inclusion of Environmental Commitments (6, 15, and 16) and bypass flow criteria and real-time operations (discussed above in the NEPA Effects), means that migration habitat conditions and movement would not be substantially degraded in the Delta.

Fall-/late fall-run Chinook salmon migration conditions would improve from ELT to LLT to a level that is considered less than significant. No mitigation is necessary. For more information, see the evaluation of Impact AQUA-78 under Alternative 5.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-79: Effects of Construction of Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-80: Effects of Contaminants Associated with Restoration Measures on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-81: Effects of Restored Habitat Conditions on Chinook Salmon (Fall-/Late Fall–Run ESU)

Impact AQUA-82: Effects of Methylmercury Management on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 12)

Impact AQUA-85: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 15)

Impact AQUA-86: Effects of Nonphysical Fish Barriers on Chinook Salmon (Fall-/Late Fall–Run ESU) (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on fall/late fall-run Chinook salmon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Steelhead

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-91: Effects of Construction of Water Conveyance Facilities on Steelhead

The potential effects of construction of the water conveyance facilities on steelhead or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-91) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to steelhead.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-91, and as discussed above, the effect would not be adverse for steelhead or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-91, and as discussed above, the impact of the construction of water conveyance facilities on steelhead and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-92: Effects of Maintenance of Water Conveyance Facilities on Steelhead

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-92 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-92 would not be adverse for steelhead under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-92 for steelhead under Alternative 4A, the impact of the maintenance of water conveyance facilities on steelhead or critical habitat would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-93: Effects of Water Operations on Entrainment of Steelhead

Water Exports from SWP/CVP South Delta Facilities

Under Alternative 5A, average entrainment of juvenile steelhead at the south Delta export facilities, estimated by the salvage density method across all years, would be reduced by 9% compared to NAA_ELT (Table 11-5A-46). Pre-screen losses typically attributed to predation would also be expected to decrease commensurate with entrainment.

Table 11-5A-46. Juvenile Steelhead Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-621 (-10%)	-920 (-14%)
Above Normal	-918 (-7%)	-1,311 (-10%)
Below Normal	-561 (-5%)	-706 (-6%)
Dry	-261 (-3%)	-28 (0%)
Critical	174 (3%)	264 (5%)
All Years	-609 (-7%)	-800 (-9%)

[a] Estimated annual number of fish lost, based on non-normalized data.

Water Exports from SWP/CVP North Delta Intake Facilities

As described for winter-run Chinook salmon under Alternative 1A (Impact AQUA-39), potential entrainment of juvenile salmonids at the north Delta intakes would be greater than baseline, but the effects would be minimal because the north Delta intake would have state-of-the-art screens to exclude juvenile fish.

Predation Associated with Entrainment

Pre-screen loss of steelhead at the south Delta facilities is typically attributed to predation, and is expected to decrease under Alternative 5A, commensurate with entrainment reductions. As discussed further under Impact AQUA-96, predation at the north Delta would increase due to the installation of the proposed North Delta diversions on the Sacramento River.

NEPA Effects: Because entrainment and related predation loss would be reduced at the south Delta facilities and minimized at the north Delta intake, the effect under Alternative 5A would not be adverse.

CEQA Conclusion: Entrainment and related predation losses of juvenile steelhead would be reduced 7% under Alternative 5A compared to Existing Conditions (Table 11-5A-46). As described above, there may be additional mortality at the north Delta intake. Overall, impacts would be less than significant and may be beneficial to steelhead because of the reduction in entrainment and related predation loss and no mitigation would be required.

Impact AQUA-94: Effects of Water Operations on Spawning and Egg Incubation Habitat for Steelhead

In general, the effect of Alternative 5A on steelhead spawning habitat would be negligible relative to NAA_ELT.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam, where the majority of steelhead spawning in the mainstem Sacramento River occurs, were examined during the primary steelhead spawning and egg incubation period of January through April (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds, leading to mortality. Mean flows under A5A_ELT throughout the period would generally be similar to or greater than those under NAA_ELT.

Water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

SacEFT predicts that there would be little difference in the percentage of years with good spawning availability, measured as weighted usable area, under A5A_ELT relative to NAA_ELT (Table 11-5A-49). SacEFT predicts that there would be no differences between NAA_ELT and A5A_ELT in the percentage of years with good (lower) redd scour risk, good (lower) egg incubation conditions, or good (lower) redd dewatering risk. These results indicate Alternative 5A would result in a negligible effect on spawning habitat, redd scour or dewatering risk, or temperature-related egg incubation conditions.

Table 11-5A-49. Difference and Percent Difference in Percentage of Years with "Good" Conditions for Steelhead Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Spawning WUA	1 (2%)	1 (2%)
Redd Scour Risk	-3 (-4%)	0 (0%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-1 (-2%)	0 (0%)
Juvenile Rearing WUA	1 (2%)	-3 (-7%)
Juvenile Stranding Risk	-5 (-15%)	0 (0%)

WUA = Weighted Usable Area.

Overall, these results indicate that the effects of Alternative 5A on steelhead spawning and egg incubation habitat in the Sacramento River would be negligible.

Clear Creek

Flows in Clear Creek were examined during the steelhead spawning and egg incubation period (January through April). Mean flows under A5A_ELT would be similar to flows under NAA_ELT throughout the period (Appendix B, *Supplemental Modeling for New Alternatives*).

Results of the flow analyses for the risk of redd dewatering for Clear Creek indicate that the greatest monthly flow reduction would be identical between NAA_ELT and A5A_ELT for all water year types except above normal, in which the greatest reduction would be 44% higher magnitude (i.e., worse) under A5A_ELT (Table 11-5A-50).

Table 11-5A-50. Comparisons of Greatest Monthly Reduction (Percent Change) in Instream Flow under Alternative 5A Model Scenarios in Clear Creek during the January–April Steelhead Spawning and Egg Incubation Period[a]

Water Year Type	A5A_ELT vs. EXISTING CONDITIONS	A5A vs. NAA_ELT
Wet	-25 (-38%)	0 (0%)
Above Normal	-44 (NA)	-44 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in the month when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

No water temperature modeling was conducted in Clear Creek.

Overall, these results indicate that the effects of Alternative 5A on steelhead spawning and egg incubation habitat in Clear Creek would be negligible.

Feather River

Steelhead spawning and egg incubation on the Feather River occurs primarily in Hatchery Ditch and the low-flow channel in the general vicinity of the Feather River Hatchery. Effects of A5A_ELT on flow during the spawning and egg incubation period (January through April) in the Feather River were evaluated using the results of CALSIM analyses of instream flows within the reach where the majority of steelhead spawning occurs (low-flow channel) based on estimated flows above Thermalito Afterbay (Appendix B, *Supplemental Modeling for New Alternatives*). Although recent surveys have found that very few steelhead (0 to 28%) spawn in the high-flow channel (J. Kindopp pers. comm.), flows were also evaluated in the high-flow channel based on information in the Feather River at Thermalito Afterbay (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds leading to mortality.

Flows in the low-flow channel under A5A_ELT would not differ from NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*) because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006). Mean flows under A5A_ELT at Thermalito Afterbay would generally be similar to or greater than (up to 22% greater in March of dry years) flows under NAA_ELT, except for lower flows in January of above normal, below normal and critical years, and February and March of below normal years (up to 17% lower in February).

Oroville Reservoir storage volume at the end of September and end of May influences flows downstream of the dam during the steelhead spawning and egg incubation period. Mean storage volume at the end of September under A5A_ELT would be similar to or up to 13% higher (dry years) than storage under NAA_ELT, depending on water year type (Table 11-5A-25). May Oroville storage under A5A_ELT would be similar to storage under NAA_ELT in all water years types (Table 11-5A-28).

Water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during January through April (Table 11-5A-51). The percent of months exceeding the threshold under A5A_ELT would generally be similar to or lower (up to 5% lower expressed as an absolute difference) than the percent under NAA_ELT, depending on month and the threshold exceedance category.

Table 11-5A-51. Differences between Baseline and Alternative 5A Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River above Thermalito Afterbay Exceed the 56°F Threshold, January through April

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	1 (NA)	1 (NA)	0 (NA)	0 (NA)
April	7 (86%)	1 (25%)	1 (NA)	1 (NA)	0 (NA)
NAA_ELT vs. A5A_ELT					
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-1 (-50%)	1 (NA)	1 (NA)	0 (NA)	0 (NA)
April	-4 (-19%)	-5 (-44%)	-2 (-67%)	0 (0%)	0 (NA)

NA = could not be calculated because the denominator was 0.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during January through April (Table 11-5A-52). Total degree-months would be similar between NAA_ELT and A5A_ELT in all months.

Table 11-5A-52. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the Feather River above Thermalito Afterbay, January through April

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
January	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
February	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	4 (NA)	4 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	-1 (-100%)	-2 (-100%)
	All	3 (300%)	2 (100%)
April	Wet	14 (NA)	14 (NA)
	Above Normal	1 (50%)	0 (0%)
	Below Normal	-1 (-25%)	-4 (-57%)
	Dry	1 (20%)	-6 (-50%)
	Critical	4 (NA)	-3 (-43%)
	All	19 (173%)	1 (3%)

NA = could not be calculated because the denominator was 0.

Overall, these results indicate that the effects of Alternative 5A on steelhead spawning and egg incubation habitat in the Feather River would be negligible.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under NAA_ELT throughout the period, with minor exceptions.

Water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-5A-41). Steelhead spawn and eggs incubate in the American River between January and April. During this period, the percent of months exceeding the threshold under A5A_ELT would be similar to or up to 10% lower (expressed as an absolute difference) than the percent under NAA_ELT.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-5A-42). During the January through April steelhead spawning and egg incubation period, total degree-months would be similar between NAA_ELT and A5A_ELT.

Overall, these results indicate that the effects of Alternative 5A on steelhead spawning and egg incubation habitat in the American River would be negligible.

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT throughout this period would be nearly identical to flows under NAA_ELT.

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and Alternative 5A throughout the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT throughout this period would be nearly identical to flows under NAA_ELT.

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it would not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. There would be negligible effects of Alternative 5A on upstream flows, water temperatures, and reservoir stage that would not affect steelhead spawning and egg incubation in any of the rivers analyzed. Further, SacEFT predicts no effects of Alternative 5A on steelhead spawning and egg incubation habitat in the Sacramento River.

CEQA Conclusion: In general, these modeling results indicate that Alternative 5A could reduce the quantity and quality of steelhead spawning habitat relative to the Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 5A would not affect the quantity and quality of spawning and egg incubation habitat for steelhead relative to Existing Conditions.

Sacramento River

Flows in the Sacramento River between Keswick and upstream of Red Bluff Diversion Dam, where the majority of steelhead spawning occurs, were examined during the primary steelhead spawning and egg incubation period of January through April. (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation, and rapid reductions in flow can expose redds, leading to mortality. At Keswick, mean flows under A5A_ELT during the steelhead spawning and egg incubation period would generally be similar to or greater than flows under Existing Conditions, except for 14% lower flow in March of below normal years. Upstream of Red Bluff Diversion Dam, mean flows under A5A_ELT would generally be similar to or slightly greater than those under Existing Conditions, except for 8% lower flow in March of below normal years.

Water temperatures in the Sacramento River at Keswick and Red Bluff were examined during the January through April primary steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period at either location.

SacEFT predicts negligible changes (<5%) in spawning habitat, redd scour risk, and redd dewatering risk between Existing Conditions and Alternative 5A, and no difference in egg incubation conditions (Table 11-5A-15).

Overall in the Sacramento River, Alternative 5A would cause negligible reductions in mean monthly flow relative to Existing Conditions that would not affect steelhead spawning conditions in a biological meaningful way. SacEFT indicates that steelhead egg incubation and redd survival metrics would not be substantially affected by Alternative 5A relative to Existing Conditions. Impacts of Alternative 5A on water temperature would be less than significant.

Clear Creek

Flows in Clear Creek were examined during the steelhead spawning and egg incubation period (January through April). Mean flows under A5A_ELT would be similar to or up to 40% greater than flows under Existing Conditions throughout the period (Appendix B, *Supplemental Modeling for New Alternatives*).

Results of the flow analyses for the risk of redd dewatering for Clear Creek indicate that the greatest monthly flow reduction would be identical between Existing Conditions and A5A_ELT for all water year types except wet and above normal, in which the greatest reductions would be 25% and 44% larger (worse), respectively, under A5A_ELT than under Existing Conditions (Table 11-5A-50).

No water temperature modeling was conducted in Clear Creek.

Based on mean flows and increased maximum flow reductions only in wetter years, there would be little effect of Alternative 5A on steelhead spawning and egg incubation habitat conditions.

Feather River

Flows were examined in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) during the steelhead spawning and egg incubation period (January through April) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows in the low-flow channel under A5A_ELT would not differ from Existing Conditions because minimum Feather River flows are included in the FERC settlement agreement and would be met for all model scenarios (California Department of Water Resources 2006). Mean flows under A5A_ELT at Thermalito Afterbay would generally be lower than flows under Existing Conditions (up to 52% lower in February of below normal water years) during January through March, and would be similar to or slightly greater than flows under Existing Conditions in April.

Oroville Reservoir storage volume at the end of September and end of May influences flows downstream of the dam during the steelhead spawning and egg incubation period. Oroville Reservoir mean storage volume at the end of September would be similar to or up to 23% lower under A5A_ELT relative to Existing Conditions depending on water year type (Table 11-5A-25). Mean May Oroville storage volume under A5A_ELT would be similar to storage under Existing Conditions in wet, above normal, and below normal water years and up to 9% lower in dry and critical years (Table 11-5A-28).

Water temperatures in the Feather River low-flow channel (upstream of Thermalito Afterbay) and high-flow channel (at Thermalito Afterbay) were examined during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding the 56°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) was evaluated during January through April (Table 11-5A-51). The percent of months exceeding the threshold under A5A_ELT would generally be similar to the percent under Existing Conditions during January, February and March, and would be similar to or up to 7% greater (expressed as an absolute difference) than the percent under Existing Conditions during April, depending on month and the threshold exceedance category.

Total degree-months exceeding 56°F were summed by month and water year type above Thermalito Afterbay (low-flow channel) during January through April (Table 11-5A-52). Total degree-months (all water years combined) would be similar between Existing Conditions and A5A_ELT during January, February and March, and 19 degree-months higher under A5A_ELT during April. The absolute difference (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between the baselines and A5A_ELT in most cases are mathematical artifacts due to the small values of degree-months for the baseline (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on spring-run Chinook salmon. The largest change in the Feather River in the degree-months between Existing Conditions and A5A_ELT (19 degree-month increase for April) for the 82-year period of analysis would equate to an average increase of about 0.2 degrees per month. Given the highly variable nature of the Feather River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur daily on a diel cycle.

Overall, the effects of Alternative 5A on flows in the Feather River below Thermalito Afterbay would include substantial decreases in mean flow during some months and water year types. There would be minor increases in the exceedance of water temperature thresholds in the low-flow channel during April, coupled with reductions in coldwater pool availability in the Oroville Reservoir, especially in September.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be lower (up to 22% lower) than flows under Existing Conditions during January and April, and similar to or greater than flows under Existing Conditions during February and March, with some exceptions.

Water temperatures in the American River at the Watt Avenue Bridge were evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

The percent of months exceeding the 56°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during November through April (Table 11-5A-41). Steelhead spawn and eggs incubate in the American River between January and April. During January and February, there would be no differences in the percent of months exceeding the threshold between Existing Conditions and A5A_ELT. During March and April, the percent of months exceeding the threshold under A5A_ELT would be up to 11% greater (expressed as an absolute difference) than the percent under Existing Conditions.

Total degree-months exceeding 56°F were summed by month and water year type at the Watt Avenue Bridge during November through April (Table 11-5A-42). During the January and February, there would be no differences in total degree-months (all water years combined) above the threshold between Existing Conditions and A5A_ELT. During March and April, total degree-months under A5A_ELT would be 18 and 80 degree-months greater, respectively, than those under Existing Conditions. The largest change in the American River in the degree-months between Existing Conditions and A5A_ELT (80 degree-month increase for April) for the 82-year period of analysis would equate to an average increase of about one degree per month. Given the highly variable nature of the American River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur regularly on a diel cycle.

Overall, these results indicate that the effects of Alternative 5A on flows would be small and inconsistent. Mean flows would be greater in some months and water years types than flows under Existing Conditions and would be lower in other months and water years types. Water temperatures would not differ significantly from Existing Conditions. However, Alternative 5A would increase exposure of spawning steelhead and their eggs to critical water temperatures.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT throughout this period would be lower than flows under Existing Conditions (up to 29% lower for February of critical water years) in all months, with minor exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River was evaluated during the January through April steelhead spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no difference (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

San Joaquin River

The mainstem San Joaquin River does not provide habitat for steelhead spawning or egg incubation.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined during the January through April steelhead spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or up to 15% higher than flows under Existing Conditions during January through March and up to 7% lower during April.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially reduce suitable spawning habitat and substantially reduce the number of steelhead as a result of egg mortality. Under Alternative 5A, there are flow and cold water pool reductions in the Feather and Stanislaus Rivers, as well as temperature increases in the Feather River that would lead to biologically meaningful increases in egg mortality and overall degraded habitat conditions for spawning steelhead and egg incubation, as compared to Existing Conditions. Alternative 5A would not have significant effects on steelhead spawning conditions in the Sacramento River, Clear Creek, or the Mokelumne River. The effects of Alternative 5A on American River flows and water temperatures would be variable but would have a negligible net effect on steelhead spawning conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on mean monthly flows, water temperatures, and reservoir storage. Further, the SacEFT model predicts that there would be no effects to spawning and egg incubation habitat in the Sacramento River. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-95: Effects of Water Operations on Rearing Habitat for Steelhead

In general, Alternative 5A would not reduce the quantity and quality of steelhead rearing habitat relative to NAA_ELT.

Sacramento River

Juvenile steelhead rear within the Sacramento River for 1 to 2 years before migrating downstream to the ocean. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry or juveniles leading to mortality. Year-round Sacramento River flows within the reach where the majority of steelhead spawning and juvenile rearing occurs (Keswick Dam to upstream of RBDD) were evaluated (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or greater than those under NAA_ELT during most of the year, but would generally be lower under A5A_ELT during September and November (up to 22% lower at Keswick and 17% lower at Red Bluff during November of below normal years). The flow reductions would be mostly small and transitory and, therefore, would not have biologically meaningful effects on steelhead fry and juvenile rearing habitat.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period at either location.

SacEFT predicts that the percentage of years with good juvenile steelhead rearing WUA conditions under A5A_ELT would be 7% lower (3% on absolute scale) than that under NAA_ELT (Table 11-5A-49). The difference in percentage of years with good (lower) juvenile stranding risk conditions between A5A_ELT and NAA_ELT would be negligible (<5%). These results indicate that Alternative 5A would have little effect on rearing habitat availability in the Sacramento River. Based on mean monthly flows, SacEFT rearing metrics, and water temperature effects, project-related effects under Alternative 5A in the Sacramento River would not have biologically meaningful negative effects on steelhead rearing conditions.

Clear Creek

Mean flows in Clear Creek below Whiskeytown during the year-round steelhead rearing period under A5A_ELT would generally be similar to flows under NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives*).

Juvenile rearing habitat is assumed to increase in Clear Creek as instream flows increase, and therefore the use of the lowest monthly instream flow as an index of habitat constraints for juvenile rearing was selected for use in this analysis. Results of the analysis of minimum monthly instream flows affecting juvenile rearing habitat are shown in Table 11-5A-53. A5A_ELT would have no effect (0%) on minimum instream flows relative to Existing Conditions in any water year type, except for an increase (85 cfs) for below normal years and a decrease (-50 cfs or -100%) for dry water years.

Table 11-5A-53. Difference (cfs) and Percent Difference in Minimum Monthly Mean Flow in Clear Creek during the Year-Round Juvenile Steelhead Rearing Period

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (0%)	0 (0%)
Above Normal	0 (0%)	0 (0%)
Below Normal	15 (21%)	85 (NA)
Dry	-50 (-100%)	-50 (-100%)
Critical	-50 (-100%)	0 (NA)

Note: Minimum flows occurred between October and March.
NA = could not be calculated because the denominator was 0.

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-1A-4). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study the flow regime could be adjusted in the future. We expect that the modeled flows will be suitable for the existing steelhead populations in Clear Creek. No change in effect on steelhead in Clear Creek is anticipated.

No water temperature modeling was conducted in Clear Creek.

These results indicate that the effects of Alternative 5A on flows would not affect juvenile steelhead rearing habitat conditions in Clear Creek.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) were reviewed to determine flow-related effects on steelhead juvenile rearing habitat (Appendix B, *Supplemental Modeling for New Alternatives*). Although there is relatively little natural steelhead production in the river, most steelhead spawning and rearing appears to occur in the low-flow channel in habitats associated with well-vegetated side channels (Cavallo et al. 2003; California Department of Water Resources unpublished data). Because these habitats are relatively uncommon they could limit natural steelhead production. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand fry and juveniles leading to mortality.

There would be no change in flows for A5A_ELT relative to NAA_ELT in the low-flow channel. Flow in the low-flow channel is projected to remain between 700 and 800 cfs except during occasional flood control releases.

Mean May Oroville storage under A5A_ELT would be similar to storage under NAA_ELT for all water year types (Table 11-5A-28). Mean September Oroville storage volume would be similar to storage under NAA_ELT in above normal and below normal years, and would be up to 13% higher than storage under NAA_ELT in the other water year types (Table 11-5A-25).

The river channel downstream of Thermalito (high-flow channel) offers few of the habitat types upon which steelhead appear to rely in the low-flow channel. Experiments and fish observations also indicate that predation risk for juvenile steelhead is higher downstream of the Thermalito outlet (California Department of Water Resources 2004). Increased predation risk is likely a function of water temperature, whereby warm water nonnative species such as striped bass, largemouth bass, and smallmouth bass are more prevalent, and in general, have greater metabolic requirements. Thus, summer temperatures that exceed 65°F and the absence of preferred steelhead habitat currently appear to limit steelhead rearing in the river downstream of the Thermalito outlet. Comparisons of CALSIM data by month and water year type (Appendix B, *Supplemental Modeling for New Alternatives*) indicate that mean flows in the high-flow channel under A5A_ELT would generally be similar to or greater than (up to 40% greater in June of above normal water years and December of critical years) those under NAA_ELT in all months except in January and September (up to 64% lower in September of below normal years). Flows would also be lower under NAA_ELT for individual month and water year type combinations, including February of below normal years (18% lower), July of critical years (35% lower), and August of dry years (14% lower).

Water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).* There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

An additional analysis evaluated the percent of months exceeding a 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) (May through August) and exceeding a 56°F threshold at Gridley (October through April) for each model scenario. In the low-flow channel, the percent of months exceeding the threshold under A5A_ELT would generally be similar to or lower (up to 19% lower on an absolute scale) than the percent under NAA_ELT (Table 11-5A-29). At Gridley, the percent of months exceeding the threshold under A5A_ELT would similar to or up to 12% lower (absolute scale) than the percent under NAA_ELT (Table 11-5A-38).

Total degree-months exceeding 63°F were summed by month and water year type in the Feather River above Thermalito Afterbay (low-flow channel) during May through August, and total degree-months exceeding 56°F were summed at Gridley during October through April. In the low flow channel (Table 11-5A-30) and at Gridley (Table 11-5A-39), there would be small increases and decreases in exceedances above the thresholds, but no overall biologically meaningful effects.

Overall, these results indicate that Alternative 5A would have both increases and reductions of flow in the high-flow channel of the Feather River, depending on the month and water year type, but that there would be no net effect on juvenile steelhead rearing habitat.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the year-round steelhead rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under NAA_ELT during December through May and October, with some exceptions, greater (up to 36% greater) than flows under NAA_ELT during June and July, and lower (up to 25% lower) than flows under NAA_ELT during August, September, and November.

Water temperatures in the American River at the confluence with the Sacramento River and the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period at either location.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-5A-54). The percent of months exceeding the threshold under A5A_ELT would be similar to or up to 22% lower (absolute scale) than the percent under NAA_ELT.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-5A-55). Total degree-months (all water year types combined) exceeding the threshold would be similar between NAA_ELT and A5A_ELT or up to 34 degree-months lower under A5A_ELT in all months except August and September, in which degree-months would be 18 and 15 degree-months higher under A5A_ELT. The largest increase in the American River in the degree-months between Existing Conditions and A5A_ELT (18 degree-month increase for April) for the 82-year period of analysis would equate to an average increase of about 0.2 degrees per month. Given the highly variable nature of the American River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur daily on a diel cycle.

Table 11-5A-54. Differences between Baseline and Alternative 5A Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at the Watt Avenue Bridge Exceed the 65°F Threshold, May through October

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
May	21 (106%)	16 (108%)	4 (33%)	4 (60%)	1 (25%)
June	19 (29%)	12 (23%)	11 (27%)	14 (44%)	11 (53%)
July	0 (0%)	0 (0%)	10 (16%)	9 (24%)	15 (86%)
August	0 (0%)	2 (3%)	15 (18%)	42 (87%)	48 (156%)
September	7 (9%)	22 (42%)	21 (65%)	20 (123%)	17 (233%)
October	11 (225%)	10 (400%)	5 (NA)	1 (NA)	1 (NA)
NAA_ELT vs. A5A_ELT					
May	-6 (-13%)	-6 (-17%)	-9 (-37%)	-2 (-20%)	-2 (-29%)
June	-9 (-9%)	-12 (-16%)	-11 (-18%)	-9 (-16%)	-11 (-26%)
July	0 (0%)	-1 (-1%)	-22 (-23%)	-21 (-32%)	-15 (-32%)
August	0 (0%)	0 (0%)	-2 (-3%)	-2 (-3%)	2 (3%)
September	-1 (-1%)	-6 (-8%)	-5 (-9%)	-2 (-6%)	-1 (-5%)
October	-7 (-32%)	-1 (-9%)	-1 (-20%)	0 (0%)	1 (NA)

NA = could not be calculated because the denominator was 0.

Table 11-5A-55. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 65°F in the American River at the Watt Avenue Bridge, May through October

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
May	Wet	9 (150%)	0 (0%)
	Above Normal	8 (NA)	-1 (-11%)
	Below Normal	7 (233%)	-2 (-17%)
	Dry	21 (95%)	0 (0%)
	Critical	12 (63%)	-2 (-6%)
	All	58 (116%)	-4 (-4%)
June	Wet	31 (182%)	-7 (-13%)
	Above Normal	16 (67%)	-4 (-9%)
	Below Normal	19 (66%)	-9 (-16%)
	Dry	14 (21%)	-13 (-14%)
	Critical	31 (62%)	-1 (-1%)
	All	111 (59%)	-34 (-11%)
July	Wet	34 (44%)	-14 (-11%)
	Above Normal	4 (15%)	-4 (-11%)
	Below Normal	18 (53%)	2 (4%)
	Dry	20 (32%)	-8 (-9%)
	Critical	23 (28%)	-3 (-3%)
	All	98 (35%)	-28 (-7%)
August	Wet	62 (78%)	0 (0%)
	Above Normal	21 (51%)	4 (7%)
	Below Normal	31 (55%)	4 (5%)
	Dry	63 (93%)	15 (13%)
	Critical	33 (42%)	-5 (-4%)
	All	210 (65%)	18 (3%)
September	Wet	32 (133%)	9 (19%)
	Above Normal	11 (69%)	1 (4%)
	Below Normal	24 (86%)	5 (11%)
	Dry	30 (71%)	0 (0%)
	Critical	25 (51%)	0 (0%)
	All	122 (77%)	15 (6%)
October	Wet	6 (600%)	1 (17%)
	Above Normal	5 (NA)	0 (0%)
	Below Normal	1 (NA)	-1 (-50%)
	Dry	9 (NA)	0 (0%)
	Critical	12 (240%)	3 (21%)
	All	33 (550%)	3 (8%)

NA = could not be calculated because the denominator was 0.

These results indicate that effects of Alternative 5A on flow and water temperatures would not degrade juvenile steelhead rearing habitat in the American River.

Stanislaus River

Mean flows in the Stanislaus River under A5A_ELT would not differ from those under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

Mean water temperatures throughout the Stanislaus River would be similar under NAA_ELT and A5A_ELT throughout the year-round period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

San Joaquin River

Mean flows in the San Joaquin River under A5A_ELT would not differ substantially from those under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Mean flows in the Mokelumne River under Alternative 5A would not differ from those under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted in the Mokelumne River.

NEPA Effects: Collectively, these modeling results indicate that the effect of Alternative 5A is not adverse because it would not substantially degrade rearing habitat or substantially reduce the number of fish as a result of fry and juvenile mortality. Effects of Alternative 5A on flows would be small and transitory in the Sacramento River and Clear Creek, and effects in the Feather and American Rivers would be more variable, but in general are not expected to affect steelhead rearing habitat. Effects of Alternative 5A on water temperatures in the Sacramento, Feather, American and Stanislaus Rivers would be small. Overall, Alternative 5A is not expected to have biologically meaningful negative effects on steelhead rearing conditions.

The effect of Alternative 5A in the LLT on steelhead rearing conditions would be adverse. Instream flows in the Feather and American Rivers would decline from ELT to LLT such that flows would be substantially reduced under Alternative 5A relative to the NEPA baseline in the LLT. This effect is described in detail under Impact AQUA-95 for Alternative 5.

CEQA Conclusion: In general, the modeling results presented below suggest that Alternative 5A could reduce the quantity and quality of rearing habitat for steelhead relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 5A would not affect the quantity and quality of rearing habitat for steelhead relative to Existing Conditions.

Sacramento River

Comparisons of CALSIM outputs of year-round flow for the Sacramento River between Keswick and upstream of Red Bluff, averaged by month and water year type, were used to evaluate effects of A5A_ELT compared to Existing Conditions (Appendix B, *Supplemental Modeling for New*

Alternatives). Mean flows under A5A_ELT at Keswick would generally be similar to or up to 13% greater than those under Existing Conditions. However, during August, October and November, flows would be up to 18% lower under A5A_ELT, and during September, flows would be up to 47% higher in wet and above normal years and up to 24% lower in below normal, dry and critical years. The results for mean flows at Red Bluff would be similar to those for flows at Keswick, except that the differences between A5A_ELT and Existing Conditions would be smaller. The most substantial effects on juvenile rearing habitats would occur from the flow reductions in dry and critical water years of August through November. Based on the generally small size of the August through November flow reductions, and the beneficial increases in mean flow for other months and water year types, the flow reductions are not expected to have biologically meaningful negative effects on juvenile steelhead rearing conditions in the Sacramento River.

Water temperatures in the Sacramento River at Keswick and Bend Bridge were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). At both locations, mean water temperatures under A5A_ELT would generally be similar to those under Existing Conditions, except during August of critical water years, in which the temperature would be 7% higher at Keswick and 6% higher at Red Bluff.

SacEFT predicts that there would be a negligible difference in the percentage of years with good rearing availability, measured as weighted usable area, under A5A_ELT relative to Existing Conditions (Table 11-5A-49). SacEFT predicts that there would be a 15% reduction in the number of years with good (lower) juvenile stranding risk under A5A_ELT relative to Existing Conditions.

Overall, these results indicate that Alternative 5A would not have biologically meaningful effects on juvenile rearing success in the Sacramento River. Alternative 5A would cause small to moderate reductions in mean monthly flows during four months of the year and SacEFT predicts that stranding risk would be increased by 15%. Water temperatures would be higher in one month during critical water years.

Clear Creek

Mean flows in Clear Creek during the year-round rearing period under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 40% greater flow in January of wet years and 10% and 9% lower flows in August and September of critical years (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures were not modeled in Clear Creek.

Juvenile rearing habitat is assumed to increase in Clear Creek as instream flows increase, and therefore the use of the lowest monthly instream flow as an index of habitat constraints for juvenile rearing was selected for use in this analysis. Results of the analysis of minimum monthly instream flows affecting juvenile rearing habitat are shown in Table 11-5A-53. Results indicate that Alternative 5A would have no effect on juvenile rearing habitat, based on minimum instream flows, compared to Existing Conditions in wet and above normal water years. Minimum flows would be 21% higher in dry years (reduction from 70 cfs to 85 cfs), and 100% lower in dry and critical years (reduction from 50 cfs to 0 cfs).

Denton (1986) developed flow recommendations for steelhead in Clear Creek using IFIM (Figure 11-1A-4). The current Clear Creek management regime uses flows slightly lower than those recommended by Denton. Results from a new IFIM study on Clear Creek are currently being analyzed. Depending on results of this study the flow regime could be adjusted in the future. We expect that the modeled flows will be suitable for the existing steelhead populations in Clear Creek. No change in effect on steelhead in Clear Creek is anticipated.

Overall in Clear Creek, Alternative 5A would result in no biologically meaningful changes in mean monthly flow that would affect juvenile rearing habitats.

Feather River

Year-round flows in the Feather River above Thermalito Afterbay (low-flow channel) under A5A_ELT would be the same as flows under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows in the Feather River below Thermalito Afterbay (high-flow channel) under A5A_ELT would generally be similar to or up to 60% greater than flows under Existing Conditions during April through June and October, and would generally be lower than flows under Existing Conditions (up to 52% lower) during January through March. Mean flows under A5A_ELT would also be substantially lower during July of critical years (40% lower), August of dry and critical years (32% and 23% lower, respectively), and September of below normal and dry years (54% and 57% lower, respectively), but would be substantially higher during these three months in wetter years (up to 136% higher in September of wet years). Mean flows in November and December under A5A_ELT would generally be similar to flows under Existing Conditions, with exceptions.

Mean May Oroville storage volume under A5A_ELT would be similar to that under Existing Conditions in wet, above normal and below normal water years, and would be 8% and 9% lower in critical and dry years (Table 11-5A-28).

As reported in Impact AQUA-58 for spring-run Chinook salmon, mean September Oroville storage volume would be similar to that under Existing Conditions in critical years, and would be 6% to 23% lower under A5A_ELT relative to Existing Conditions in the other water year types (Table 11-5A-25).

Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito Afterbay (high-flow channel) were examined during the year-round steelhead juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis.* There would be negligible differences (<5%) in mean water temperatures for any month or water year type in the low-flow channel. In the high-flow channel, mean water temperatures under A5A_ELT would be similar to those under Existing Conditions except for a 6% higher mean temperature in July of critical years.

An additional analysis evaluated the percent of months exceeding a 63°F temperature threshold in the Feather River above Thermalito Afterbay (low-flow channel) (May through August) and exceeding a 56°F threshold at Gridley (October through April). In the low-flow channel, the percent of months exceeding the threshold under A5A_ELT would generally be similar to the percent under Existing Conditions during May, and similar or up to 19% (absolute scale) higher than the percent under Existing Conditions during June through August (Table 11-5A-29). At Gridley, the percent of months exceeding the threshold under A5A_ELT would be similar to the percent under Existing Conditions during December through February, but similar to or up to 19% greater (absolute scale) than the percent under Existing Conditions in the remaining four months (Table 11-5A-38).

Total degree-months exceeding 63°F were summed by month and water year type in the Feather River above Thermalito Afterbay (low-flow channel) during May through August and total degree-months exceeding 56°F were summed at Gridley during October through April. In the low-flow channel, total degree-months (all water years types combined) under A5A_ELT would be similar to those under Existing Conditions during May and 50 to 79 degree-months higher during June through August (Table 11-5A-30). At Gridley, total degree-months under A5A_ELT would be similar to those under Existing Conditions during December through and February and 19 to 86 degree-days greater than those under Existing Conditions in the remaining four months of the period (Table 11-5A-39). The largest change in the Feather River in the degree-months between Existing Conditions and A5A_ELT (86 degree-month increase for October at Gridley) for the 82-year period of analysis would equate to an average increase of about one degree per month. Given the highly variable nature of the Feather River, this change is not expected to be biologically meaningful. In fact, this amount of change would be expected to occur often on a diel cycle, particularly when atmospheric conditions are controlling water temperatures instead of reservoir releases.

Overall, these results indicate that Alternative 5A could affect juvenile steelhead rearing conditions in the Feather River, although very few steelhead rear in this reach of the Feather River (Cavallo et al. 2003; California Department of Water Resources unpublished data). Fish rearing in the high-low channel under Alternative 5A would experience lower flows during multiple months and fish rearing in both the low- and high-flow channels would experience increased exceedances of water temperature thresholds.

American River

Flows in the American River at the confluence with the Sacramento River were examined for the year-round steelhead rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or up to 14% greater than to flows under Existing Conditions during February through April, October and December and up to 52% lower than flows under Existing Conditions during January, May, July through September, and November, with some exceptions. Mean flows during June would vary from 36% lower to 18% higher under A5A_ELT, depending on water year type.

Water temperatures in the American River at the confluence with the Sacramento River and at the Watt Avenue Bridge were examined during the year-round steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be little difference in water temperatures (<5%) at either location, except during October, for which there would 5% to 7% temperature increases at the Watt Avenue Bridge and 5% to 6% increases at the confluence location, depending on water year type. There would also be a 5% increase in mean water temperature in August of dry years at both locations.

The percent of months exceeding a 65°F temperature threshold in the American River at the Watt Avenue Bridge was evaluated during May through October (Table 11-5A-54). In comparison to Existing Conditions, the temperature thresholds would be exceeded in a greater percentage of months under A5A_ELT for all the threshold exceedance categories in each month by up to 48% on the absolute scale, with minor exceptions during July and August.

Total degree-months exceeding 65°F were summed by month and water year type at the Watt Avenue Bridge during May through October (Table 11-5A-55). Total degree-months (all water year types combined) would be higher in all months, by 33 to 210 degree-months under A5A_ELT compared to Existing Conditions. The largest change in the American River in the degree-months between Existing Conditions and A5A_ELT (210 degree-month increase for August) for the 82-year period of analysis would equate to an average increase of >2.5 degrees per month. This level of increase is expected to have an adverse effect on rearing juvenile steelhead in the American River.

Overall, these results indicate that there would be substantial effects of Alternative 5A on juvenile steelhead rearing habitat in the American River during much of the year.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the year-round steelhead rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows would generally be lower under A5A_ELT relative to Existing Conditions during January through July (up to 29% lower for February of critical water years) and would generally be similar during August through December, with minor exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the year-round juvenile steelhead rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperatures between A5A_ELT and Existing Conditions throughout the year.

San Joaquin River

Flows in the San Joaquin River at Vernalis were examined for the year-round steelhead rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be up to 23% lower than flows under Existing Conditions during February through September and similar to or greater than flows under Existing Conditions during October through January, with minor exceptions.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta were examined for the year-round steelhead rearing period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be up to 34% lower than flows under Existing Conditions during April through September, up to 28% greater than flows under Existing Conditions during December, and similar to flows under Existing Conditions during October, November, and January through March, with some exceptions.

Water temperature modeling was not conducted in the Mokelumne River.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade rearing habitat and substantially reduce the number of steelhead as a result of fry and juvenile mortality. Under Alternative 5A, there would be flow reductions in the Feather, American, Stanislaus, San Joaquin, and Mokelumne rivers and water temperature increases in the Sacramento, Feather and American rivers that would lead to reductions in quantity and quality of fry and juvenile steelhead rearing habitat relative to Existing Conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is

Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows would be small and infrequent in the Sacramento, Stanislaus, San Joaquin and Mokelumne rivers and Clear Creek. Effects in the Feather and American rivers would be variable, but net effects on rearing habitat are expected to be minor. Water temperatures in the Sacramento, Feather, American, and Stanislaus rivers would not be affected by Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on steelhead fry and juvenile rearing habitat conditions would be less than significant and no mitigation is necessary.

Upstream flows, reservoir operations, and water temperatures in the Feather and American rivers, and their effects on for rearing juvenile steelhead, would decline from ELT to LLT to a level that is considered significant. For more information, see the evaluation of Impact AQUA-95 under Alternative 5.

Impact AQUA-96: Effects of Water Operations on Migration Conditions for Steelhead

In general, Alternative 5A would not affect steelhead migration conditions relative to NAA_ELT.

Upstream of the Delta

Sacramento River

Juveniles

Flows in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period. Mean flows under A5A_ELT would be 7% to 17% lower than flows under NAA_ELT during November, and generally similar to flows under NAA_ELT during the remaining six months of the juvenile migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Adults

Flows in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be 5% to 17% lower than flows under NAA_ELT during September and November, depending on water year type, and similar to flows under NAA_ELT in the remaining five months of the period.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period

Kelts

Flows in the Sacramento River upstream of Red Bluff were evaluated during the March and April steelhead kelt (post-spawning adult) downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean Flows during these two months would differ little between NAA_ELT and A5A_ELT.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period

Overall in the Sacramento River, these results indicate that Alternative 5A would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration in the Sacramento River.

Clear Creek

Water temperatures were not modeled in Clear Creek.

Juveniles

Mean flows in Clear Creek during the October through May juvenile steelhead migration period under A5A_ELT would be similar to flows under NAA_ELT throughout the juvenile migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Adults

Mean flows in Clear Creek during the September through March adult steelhead migration period under A5A_ELT would be similar to flows under NAA_ELT throughout the juvenile migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Kelt

Mean flows in Clear Creek during the March through April steelhead kelt downstream migration period under A5A_ELT would be similar to flows under NAA_ELT in both months of the migration period (Appendix B, *Supplemental Modeling for New Alternatives*).

Overall in Clear Creek, these results indicate that effects of Alternative 5A on flows would not affect juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Flows in the Feather River at the confluence with the Sacramento River were examined during the October through May juvenile steelhead migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be 8% to 13% higher than flows under NAA_ELT during October, 33% higher than flows under NAA_ELT in December of critical water years, and generally similar to flows under NAA_ELT in the remaining months and water years of the period.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Adults

Flows in the Feather River at the confluence with the Sacramento River were examined during the September through March adult steelhead upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean Flows under A5A_ELT would be 14% to 41% lower than flows under NAA_ELT during September, 8% to 13% higher than flows under NAA_ELT during October, 33% higher than flows under NAA_ELT in December of critical water years, and generally similar to flows under NAA_ELT in the remaining water year types and months of the period.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period

Kelt

Flows in the Feather River at the confluence with the Sacramento River were examined during the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to those under NAA_ELT in both months of the kelt downstream migration period.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in either month of the period.

Overall in the Feather River, Alternative 5A would not have biologically meaningful effects on juvenile, adult, or kelt steelhead migration.

American River

Juveniles

Flows in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period. Mean flows under A5A_ELT during October would generally be similar to flows under NAA_ELT, except for 17% higher flow in critical years. Mean flows under A5A_ELT during November would be 7% to 12% lower than flows under NAA_ELT. In the remaining six months of the period, flows would generally be similar between A5A_ELT and NAA_ELT, (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Adults

Flows in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during September and November would be up to 23% lower than flows under NAA_ELT, depending on water year type. Flows would generally be similar in the remaining five months of the period, except for 17% higher flow in October of critical years.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Kelt

Flows in the American River at the confluence with the Sacramento River were evaluated for the March and April kelt migration period. Mean flows under A5A_ELT would be similar to flows under NAA_ELT in both months of the migration period and all water types (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and Alternative 5A in either month of the period.

Overall in the American River, these results indicate that Alternative 5A would not have a biologically meaningful effect on juvenile, adult, or kelt steelhead migration.

Stanislaus River

Flows in the Stanislaus River at the confluence with the San Joaquin River for A5A_ELT are not different from flows under NAA_ELT for any month (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on juvenile, adult, or kelt migration in the Stanislaus River.

Mean monthly water temperatures in the Stanislaus River at the confluence with the San Joaquin River for A5A_ELT are not different from flows under NAA_ELT for any month (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Therefore, there would be no effect of Alternative 5A on juvenile, adult, or kelt migration in the Stanislaus River.

San Joaquin River

Flows in the San Joaquin River at Vernalis for Alternative 5A are not different from flows under NAA_ELT for any month (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on juvenile, adult, or kelt migration in the San Joaquin River.

Water temperature modeling was not conducted in the San Joaquin River.

Mokelumne River

Flows in the Mokelumne River at the Delta for Alternative 5A are not different from flows under NAA_ELT for any month (Appendix B, *Supplemental Modeling for New Alternatives*). Therefore, there would be no effect of Alternative 5A on juvenile, adult, or kelt migration in the Mokelumne River.

Water temperature modeling was not conducted in the Mokelumne River.

Through-Delta

Sacramento River

Juveniles

Based on DPM results for winter-run Chinook salmon (migration period November to May) (Impact AQUA-42), survival of migrating juvenile steelhead under Alternative 5A would be expected to be similar to baseline (Table 11-5A-14). However, as described for winter-run Chinook salmon and in the analysis of Alternative 4A, the modeling of NAA_ELT does not account for actions that would be pursued as part of other projects and programs, notably Yolo Bypass improvements and tidal habitat restoration under the NMFS and USFWS BiOps. As shown for Alternative 4A, the difference in through-Delta survival between Alternative 5A and NAA_ELT would be somewhat greater if the improvements to Yolo Bypass (particularly Fremont Weir modifications) were included in the modeling for NAA_ELT.

The new north Delta intake structure of Alternative 5A would increase potential predation loss of migrating juvenile salmonids and would displace 3.8 acres of aquatic habitat. Based on bioenergetics modeling and the study from GCID (Vogel 2008) losses of juvenile winter-run Chinook salmon were estimated ranging from 0.04% to 4% of juveniles reaching the Delta (see Impact AQUA-42 above). However, juvenile steelhead would be less vulnerable than winter-run Chinook salmon to predation associated with the intake facilities because of their greater size and strong swimming ability. As noted in the analysis of winter-run Chinook salmon and discussed further in Alternative 4A, the bioenergetics modeling does not provide context as to the level of predation in this reach that would occur without implementation of Alternative 5A, and the 5% fixed loss impact based on GCID (Vogel 2008) is considered a conservative estimate.

Adults

As assessed by DSM2 fingerprinting analysis, the average percentage of Sacramento River–origin water at Collinsville under Alternative 5A was within 5% of proportions for NAA_ELT during the September-March steelhead upstream migration period (Table 11-5A-15). For a discussion of the topic see the analysis for Alternative 1A.

Alternative 5A would not have an adverse effect on adult and kelt steelhead migration through the Delta.

San Joaquin River

Juveniles

The only changes to San Joaquin River flows at Vernalis would result from the modeled effects of climate change on inflows to the river downstream of Friant Dam and reduced tributary inflows. There no flow changes associated with the Alternatives.

Adults

The percentage of water at Collinsville that originated from the San Joaquin River during the steelhead migration period (September–March) is small, 0.2% to 2.6% under NAA (Table 11-5A-15). Alternative 5A operations would incrementally increase olfactory cues associated with the San Joaquin River (0.7–3.2%), which would benefit adult steelhead migrating to the San Joaquin River. For a discussion of the topic see the analysis for Alternative 1A.

NEPA Effects: Overall, these modeling results indicate that the effect of Alternative 5A would not be adverse because it would not substantially reduce the amount of suitable migration habitat of substantially interfere with the movement of fish.

Upstream of the Delta, these results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. Effects of Alternative 5A in all locations analyzed would consist primarily of small and variable effects on mean monthly flow and no effects on water temperatures for the juvenile, adult, and kelt migration periods.

Adult attraction flows in the Delta under Alternative 5A would be lower than those under NAA_ELT, but adult attraction flows are expected to be adequate to provide olfactory cues for migrating adults.

As noted for winter-run Chinook salmon, near-field effects of Alternative 5A's proposed north Delta intake related to impingement and predation could result in negative effects on juvenile migrating steelhead, although there is uncertainty regarding the overall effects. It is expected that the level of near-field impacts would be directly correlated to the number of new intake structures in the river and thus the level of impacts associated with 1 new intake would be considerably lower than those expected from having 5 new intakes in the river (as proposed for Alternative 1A, for example). Estimates within the effects analysis for near-field predation of winter-run Chinook salmon range from very low levels of effects (considerably less than 1% mortality) to larger effects (~ 4% mortality above current baseline levels); the larger body size of juvenile steelhead may result in lower predation susceptibility. As noted for Alternative 4A, Environmental Commitment 15 would be implemented with the intent of providing localized and temporary reductions in predation pressure at the NDD. Additionally, several pre-construction studies to better understand how to minimize losses associated with the new intake structure will be implemented as part of the final NDD screen design effort. Alternative 5A also includes biologically-based triggers to inform real-time operations of the NDD, intended to provide adequate migration conditions for steelhead. However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento River/Delta, the degree of mortality expected from near-field effects at the NDD remains uncertain.

Negative effects of operations on juvenile steelhead migration conditions would be reduced through the bypass flow criteria and real-time operations proposed under Alternative 5A, as well as inclusion within Alternative 5A of specific important environmental commitments. These include *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of steelhead juveniles into the low-survival interior Delta.

In conclusion, the proposed operations of Alternative 5A would not have an adverse effect on steelhead.

CEQA Conclusion: In general, under Alternative 5A water operations, the quantity and quality of migration habitat for steelhead would not be affected relative to the CEQA baseline.

Upstream of the Delta

Sacramento River

Juveniles

Flows in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period. Mean flows under A5A_ELT would be generally similar to or slightly higher than flows under Existing Conditions throughout the juvenile migration period, except for 6% to 15% lower flows, depending on water year type, in October and November (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in all months of the period.

Adults

Flows in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during September would be 26% and 47% higher in wet and above normal years, respectively, than flows under Existing Conditions, and 6% to 22% lower in the remaining three water year types. Mean flows under A5A_ELT during October and November would be 6% to 15% lower than flows under Existing Conditions, depending on water year type.

Flows would be generally similar or slightly greater in the remaining four months of the migration period.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT throughout the migration period.

Kelts

Flows in the Sacramento River upstream of Red Bluff were evaluated during the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to those under Existing Conditions during both months of the period, with minor exceptions.

Water temperatures in the Sacramento River upstream of Red Bluff were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and A5A_ELT in either month of the period.

Overall in the Sacramento River, Alternative 5A would not affect flow or water temperature conditions for juvenile, adult, or kelt steelhead migration.

Clear Creek

Water temperatures were not modeled in Clear Creek.

Juveniles

Mean flows in Clear Creek during the October through May juvenile steelhead migration period under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions except for 40% and 13% greater flows in January and February, respectively, of wet years (Appendix B, *Supplemental Modeling for New Alternatives*).

Adults

Mean flows in Clear Creek during the September through March adult steelhead migration period under A5A_ELT would generally be similar to or slightly greater than flows under Existing Conditions, except for 9% lower flow in September of critical water years and 40% and 13% greater flows in January and February, respectively, of wet years (Appendix B, *Supplemental Modeling for New Alternatives*).

Kelt

Flows in Clear Creek during the March through April steelhead kelt downstream migration period under A5A_ELT would generally be similar to or 10% greater than flows under Existing Conditions (Appendix B, *Supplemental Modeling for New Alternatives*).

Overall in Clear Creek, Alternative 5A would not affect flow conditions for juvenile, adult, or kelt steelhead migration.

Feather River

Juveniles

Flows in the Feather River at the confluence with the Sacramento River were examined during the October through May juvenile steelhead migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or greater (up to 22% greater) than flows under Existing Conditions during October through December and April and May. Flows would generally be up to 17% lower under A5A_ELT during January. Differences in the mean flows during February and March would be small, but would include increases in flow of up to 12% under A5A_ELT and reductions of up to 16%, depending on the water year type.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT throughout the migration period.

Adults

Flows in the Feather River at the confluence with the Sacramento River were examined during the September through March adult steelhead upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be lower (up to 33% lower) than flows under Existing Conditions during September and January, and would be similar to or greater (up to 22% greater) than flows under Existing Conditions during October through December. Differences in the mean flows during February and March would be small, but would include increases in flow of up to 12% under A5A_ELT and reductions of up to 16%, depending on the water year type.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT throughout the migration period.

Kelts

Flows in the Feather River at the confluence with the Sacramento River were examined during the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Differences in the mean flows between A5A_ELT and Existing Conditions during March would generally be small, but would include increases in flow of up to 8% under A5A_ELT and reductions of up to 13%, depending on the water year type. Mean flows under A5A_ELT during April would be similar to those under Existing Conditions for all water year types.

Water temperatures in the Feather River at the confluence with the Sacramento River were evaluated during the March through April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and Alternative 5A in either month of the kelt migration period.

Overall, these results indicate that migration conditions for steelhead in the Feather River would not be affected by Alternative 5A. Changes in flow from Existing Conditions to Alternative 5A would be highly variable, but no net negative effect is expected. Water temperatures would be similar between Existing Conditions and Alternative 5A.

American River

Juveniles

Flows in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to or up to 14% greater than flows under Existing Conditions during October, December, and February through April. Flows under A5A_ELT would generally be lower, by up to 28% lower (November of dry years), than flows under Existing Conditions during November, January and May, with some exceptions.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the October through May juvenile steelhead migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A5A_ELT would be 5% to 6% higher than those under Existing Conditions during October of wet, above normal and dry years and would be similar in the remaining months of the migration period.

Adults

Flows in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT during September, November and January would range from 9% to 40% lower than flows under Existing Conditions, depending on water year type, and would generally be similar to or up to 14% greater than flows under Existing Conditions during October, December, February and March.

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures under A5A_ELT would be 5% to 6% higher than those under Existing Conditions during October of wet, above normal and dry years and would be similar in the remaining months of the migration period.

Kelts

Flows in the American River at the confluence with the Sacramento River were evaluated for the March and April kelt migration period. Mean flows under A5A_ELT during March and April would generally be similar to or slightly greater than flows under Existing Conditions, except for 8% lower flow in March of critical years and 7% and 9% lower flows in April of above normal and dry years, respectively (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the American River at the confluence with the Sacramento River were evaluated during the March and April kelt migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in either month of the kelt migration period.

Overall in the American River, the effect of Alternative 5A on flows would include frequent moderate reductions in flows that would affect juvenile and adult migration conditions, particularly in drier water years, but would generally not affect kelt migration.

Stanislaus River

Juveniles

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the October through May steelhead juvenile downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under Existing Conditions during October through December, and would generally be lower than flows under Existing Conditions during January through May (up to 29% lower in February of critical water years), with some exceptions.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the October through May steelhead juvenile downstream migration period (Appendix 11D, Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT throughout the migration period.

Adults

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be similar to flows under Existing Conditions during September through December, and would generally be lower than flows under Existing Conditions during January through March (up to 29% lower in February of critical water years), with some exceptions.

Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the September through March steelhead adult upstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT throughout the migration period.

Kelts

Flows in the Stanislaus River at the confluence with the San Joaquin River were evaluated for the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean monthly flows under A5A_ELT would be up to 23% and 12% lower than flows under Existing Conditions during March and April, respectively.

Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were evaluated during the March and April steelhead kelt downstream migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in either month of the kelt migration period.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Juveniles

Flows in the San Joaquin River at Vernalis were evaluated for the October through May steelhead juvenile downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or slightly greater than flows under Existing Conditions during October through January, and up to 12% lower than flows under Existing Conditions during February through May.

Adults

Flows in the San Joaquin River at Vernalis were evaluated for the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or slightly greater than flows under Existing Conditions during October through January, and up to 12% lower than flows under Existing Conditions during September, February, and March.

Kelt

Flows in the San Joaquin River at Vernalis were evaluated for the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be up to 12% and 8% lower than flows under Existing Conditions during March and April, respectively.

Mokelumne River

Water temperature modeling was not conducted in the Mokelumne River.

Juveniles

Flows in the Mokelumne River at Delta were evaluated for the October through May steelhead juvenile downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or up to 28% greater than (December of above normal years) flows under Existing Conditions during October through March and would be up to 11% lower than flows under Existing Conditions during April and May.

Adults

Flows in the Mokelumne River at Delta were evaluated for the September through March steelhead adult upstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to or up to 28% greater (December of above normal years) than flows under Existing Conditions during October through March and would be up to 22% lower than flows under Existing Conditions during September.

Kelt

Flows in the Mokelumne River at Delta were evaluated for the March and April steelhead kelt downstream migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would be similar to flows under Existing Conditions during March and slightly lower than flows under Existing Conditions during April.

Through-Delta

Sacramento River

Juveniles

During the juvenile steelhead emigration period (October through May), mean monthly flows in the Sacramento River below the north Delta intake would be reduced (7% to 16% lower, averaged across all years) under Alternative 5A compared to Existing Conditions. Based on DPM results for winter-run Chinook salmon (migration period November to May) (Impact AQUA-42), survival of migrating juvenile steelhead under Alternative 5A would be expected to be similar or slightly lower than Existing Conditions (Table 11-5A-14). As discussed above in Impact AQUA-42, potential predation loss at the new north Delta intake would be 0.04% to 4% for migrating juvenile winter-run Chinook salmon, but this would be expected to be lower for juvenile steelhead because of their greater size and strong swimming ability. The impact to juvenile steelhead migration through the Delta would be less than significant, and no mitigation would be required.

Adults

As assessed by DSM2 fingerprinting analysis, the average percentage of Sacramento River–origin water at Collinsville under Alternative 5A was within 6% of proportions for Existing Conditions during the September–March steelhead upstream migration period (Table 11-5A-15).

San Joaquin River

The percentage of water at Collinsville that originated from the San Joaquin River during the steelhead migration period (September to March) is small (0.2% to 2.6%) under Existing Conditions. Alternative 5A operations conditions would incrementally increase olfactory cues associated with the San Joaquin River (0.7–3.2%), which would benefit adult steelhead migrating to the San Joaquin River. For a discussion of the topic see the analysis for Alternative 1A. As noted in the NEPA Effects, juvenile survival under Alternative 5A would be expected to be similar to NAA_ELT.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially reduce the amount of suitable migration habitat and substantially interfere with the movement of fish. Under Alternative 5A, there would be reductions in flow in the American, Stanislaus, San Joaquin, and Mokelumne rivers that would lead to biologically meaningful reductions in juvenile and adult migration conditions, thereby reducing survival relative to Existing Conditions. Alternative 5A would not affect migration conditions for steelhead in the Sacramento and Feather Rivers or in Clear Creek. Degraded migration conditions would delay or eliminate successful migration necessary to complete the steelhead life cycle. Taking account of the flow effects of all rivers, the net effect would be reduced flow, resulting in degraded migration conditions. Water temperatures under Alternative 5A would generally be similar to those under Existing Conditions in all rivers examined, with minor exceptions.

There would be no effects of Alternative 5A on in-Delta migration conditions for juvenile or adult steelhead, given the relatively small differences in flows and olfactory cues from operations, and the inclusion of *Environmental Commitment 6 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-field (water level) effects, *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to limit predation potential at the NDD, and *Environmental Commitment 16 Nonphysical Fish Barriers* to reduce entry of steelhead juveniles into the low-survival interior Delta.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows would be small and infrequent. Therefore, the effects of Alternative 5A on steelhead migration habitat conditions would be less than significant and no mitigation is necessary.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-97: Effects of Construction of Restoration Measures on Steelhead

Impact AQUA-98: Effects of Contaminants Associated with Restoration Measures on Steelhead

Impact AQUA-99: Effects of Restored Habitat Conditions on Steelhead

Impact AQUA-100: Effects of Methylmercury Management on Steelhead (Environmental Commitment 12)

Impact AQUA-103: Effects of Localized Reduction of Predatory Fish on Steelhead (Environmental Commitment 15)

Impact AQUA-104: Effects of Nonphysical Fish Barriers on Steelhead (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on steelhead for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Sacramento Splittail

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-109: Effects of Construction of Water Conveyance Facilities on Sacramento Splittail

The potential effects of construction of the water conveyance facilities on Sacramento splittail would be similar to those described for Alternative 4A (Impact AQUA-109) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to Sacramento splittail.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-109, and as discussed above, the effect would not be adverse for Sacramento splittail.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-109, and as discussed above, the impact of the construction of water conveyance facilities on Sacramento splittail would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-110: Effects of Maintenance of Water Conveyance Facilities on Sacramento Splittail

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-110 was concluded to not be adverse for Alternative 4A, it is also concluded that

Impact AQUA-110 would not be adverse for Sacramento splittail under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-110 for Sacramento splittail under Alternative 4A, the impact of the maintenance of water conveyance facilities on Sacramento splittail would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-111: Effects of Water Operations on Entrainment of Sacramento Splittail

Water Exports from SWP/CVP South Delta Facilities

As with Alternative 4A, the analysis of juvenile splittail entrainment for Alternative 5A used the per capita method, which evaluates how changes in exports would affect entrainment potential independent of other factors (for details of method, see *BDCP Effects Analysis, Appendix 5B – Entrainment; Section 5.B.5.4.5 hereby incorporated by reference*). The per capita method was used because Yolo Bypass inundation is not included in the method, thus allowing an appropriate comparison between NAA_ELT (for which Yolo Bypass improvements would occur, but were not modeled) and A5A_ELT (for which Yolo Bypass improvements would also occur as part of a program separate from Alternative 5A, and which was included in the modeling). The per capita rate of juvenile splittail entrainment under A5A_ELT, which is an index of entrainment risk of an individual splittail and is directly related to the amount of water exported, averaged across all years would be fairly similar (reduced 4%; Table 11-5A-56) compared to NAA_ELT. For adult splittail, the reductions under A5A_ELT relative to NAA_ELT averaged 10% across all years (Table 11-5A-57), because of reduced south Delta exports during the main period of adult entrainment.

Table 11-5A-56. Juvenile Sacramento Splittail Entrainment Index[a] (per Capita Method) at the SWP and CVP Salvage Facilities and Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-226,806 (-11%)	-118,243 (-6%)
Above Normal	-9,558 (-7%)	1,897 (2%)
Below Normal	-122 (-1%)	466 (5%)
Dry	-339 (-17%)	-65 (-4%)
Critical	-406 (-31%)	-251 (-21%)
All Years	-76,874 (-14%)	-22,018 (-4%)

Shading indicates entrainment increased by 10% or more.

[a] Estimated annual number of fish lost, based on normalized data, estimated from delta inflow.

Table 11-5A-57. Adult Sacramento Splittail Entrainment Index[a] (Salvage Density Method) at the SWP and CVP Salvage Facilities and Differences between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-462 (-12%)	-657 (-16%)
Above Normal	-536 (-11%)	-500 (-10%)
Below Normal	-217 (-6%)	-209 (-6%)
Dry	-82 (-3%)	-17 (-1%)
Critical	49 (1%)	149 (5%)
All Years	-295 (-8%)	-337 (-10%)

Shading indicates entrainment increased by 10% or more.

[a] Estimated annual number of fish lost, based on normalized data. Average (December–March).

Water Exports from SWP/CVP North Delta Intake Facilities

The impact would be similar in type to Alternative 1A (with five intakes), but the degree would be less because Alternative 5A would only have one north Delta intake. Therefore, under Alternative 5A there would be about an 80% reduction in impingement and predation risk associated with the north Delta facilities relative to Alternative 1A (Impact AQUA-111).

Predation Associated with Entrainment

Under Alternative 5A, per capita juvenile splittail entrainment, and therefore associated predation losses, at the south Delta would be fairly similar (4% decreased) to NAA_ELT, based on the above analysis.

The impact from potential predation associated with the north Delta intake would be the same as described for Alternative 5 (Impact AQUA-111). These losses would be offset by the reduction in entrainment and predation loss at the SWP/CVP south Delta intakes, habitat restoration under Environmental Commitment 6, and reduction in potential predation under Environmental Commitment 15. Further, as described for Alternative 1A and as noted for Alternative 4A, the fishery agencies concluded that predation was not a factor currently limiting splittail abundance.

NEPA Effects: In conclusion, the effect from entrainment and predation loss under Alternative 5A would not be adverse, because while predation loss of splittail would be potentially increased at the north Delta intake, it would be offset by reductions in adult entrainment and associated predation at the south Delta facilities compared to the NAA_ELT actions, as well as other conservation measures (Environmental Commitment 6, Environmental Commitment 15, and potentially Environmental Commitment 16). As noted above, predation is not currently thought to limit splittail abundance.

CEQA Conclusion: Operational activities associated with reduced south Delta water exports would result in an overall small decrease in the proportion of the splittail population entrained. Although entrainment of smaller life stages at the north Delta intakes is likely to occur during lower flow years when floodplain inundation is less, the bulk of reproduction occurs when floodplains are inundated, which would occur more often under NAA_ELT and Alternative 5A because of Yolo Bypass improvements; splittail emerging from the Yolo Bypass at its downstream terminus in the Cache Slough subregion would not be susceptible to north Delta intake entrainment. Under Scenario A5A_ELT, estimated juvenile entrainment and hence pre-screen predation losses would be 14%

lower and adult entrainment and pre-screen predation losses would be 8% lower than Existing Conditions. The impact and conclusion for predation associated with entrainment would be the same as described above in the NEPA Effects.

In conclusion, the impact from entrainment and associated predation loss under Alternative 5A would be less than significant, because of reduction in overall entrainment and the increased production of juvenile splittail from Yolo Bypass modifications that would occur irrespective of Alternative 5A. No mitigation would be required.

Impact AQUA-112: Effects of Water Operations on Spawning and Egg Incubation Habitat for Sacramento Splittail

In general, Alternative 5A would have little to no effect on splittail spawning habitat relative to the NAA_ELT because improvements to the Yolo Bypass would occur under the NAA_ELT and therefore would not differentiate Alternative 5A from NAA_ELT. There would be negligible effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River, and negligible effects on water temperatures in the Feather River, relative to NAA_ELT. There would be beneficial effects on spawning conditions in channel margin and side-channel habitats from increases in flow during the spawning period in both the Sacramento River and the Feather River. There would also be a beneficial effect from reductions in the occurrence of critically high water temperatures in the Feather River in wetter water year types.

Sacramento splittail spawn in floodplains and channel margins and in side-channel habitat upstream of the Delta, primarily in the Sacramento River and Feather River. Floodplain spawning overwhelmingly dominates production in wet years. During low-flow years when floodplains are not inundated, spawning in side channels and channel margins is much more critical.

Floodplain Habitat

Effects of Alternative 5A on floodplain spawning habitat were evaluated for Yolo Bypass, using the same approach detailed for Alternative 4A. There would be little to no difference in floodplain habitat availability or acreage between NAA_ELT and Alternative 5A because Yolo Bypass improvements would be present in both (Table 11-5A-60; Table 11-5A-61).

Table 11-5A-60. Differences in Frequencies of Inundation Events (for 82-Year Simulations) of Different Durations on the Yolo Bypass under Different Scenarios and Water Year Types, February through June, from 15 2-D and Daily CALSIM II Modeling Runs

Number of Days of Continuous Inundation	Change in Number of Inundation Events for Each Scenario	
	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
30–49 Days		
Wet	-4	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	4	Little to no difference[a]
Dry	1	Little to no difference[a]
Critical	1	Little to no difference[a]
50–69 Days		
Wet	-5	Little to no difference[a]
Above Normal	0	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]
≥70 Days		
Wet	8	Little to no difference[a]
Above Normal	2	Little to no difference[a]
Below Normal	1	Little to no difference[a]
Dry	0	Little to no difference[a]
Critical	0	Little to no difference[a]

[a] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the number of inundation events between NAA_ELT and A5A_ELT.

Table 11-5A-61. Increase in Splittail Weighted Habitat Area (HUs[c] and Percent) in Yolo Bypass from Existing Biological Conditions to Alternative 5A by Water Year Type from 15 2-D and Daily CALSIM II Modeling Runs

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	1,123 (73%)	Little to no difference[b]
Above Normal	704 (61%)	Little to no difference[b]
Below Normal	329 (251%)	Little to no difference[b]
Dry	5 (NA[a])	Little to no difference[b]
Critical	5 (NA[a])	Little to no difference[b]

[a] NA = percent differences could not be computed because no splittail weighted habitat occurred in the bypass for NAA_ELT and EXISTING CONDITIONS in those years (dividing by 0).

[b] The inclusion of Yolo Bypass improvements was not modeled for NAA_ELT, but would be expected to result in minimal differences in the weighted habitat area between NAA_ELT and H3_ELT.

[c] HUs = Habitat Units. HUs were computed as the product of habitat acreage and a Habitat Suitability Index (based on water depth) that ranges from 0 to 1, where maximum suitability = 1. Therefore, HUs are always less than or equal to habitat acreage.

As noted for Alternative 4A, a potential effect of Yolo Bypass improvements is changes in inundation of the Sutter Bypass as a result of increased flow diversion at the modified Fremont Weir. Because modification of the Fremont Weir would occur under Alternative 5A and the NAA_ELT, there would be little to no difference in inundated acreage in the lower Sutter Bypass between A5A_ELT and NAA_ELT. Therefore, Alternative 5A would not affect splittail spawning and rearing habitat in the Sutter Bypass relative to NAA_ELT.5A

Channel Margin and Side-Channel Habitat

In addition to spawning on floodplains, splittail spawning and larval and juvenile rearing also occur in channel margin and side-channel habitat upstream of the Delta. These habitats are likely to be especially important during dry years, when flows are too low to inundate the floodplains (Sommer et al. 2007). Side-channel habitats are affected by changes in flow because greater flows cause more flooding, thereby increasing availability of such habitat, and because rapid reductions in flow dewater the habitats, potentially stranding splittail eggs and rearing larvae. Effects of Alternative 5A on flow in side-channel habitat are expected to be most important to the splittail population in years with low flows because in years of high flows, when most production comes from floodplain habitats, the upstream side-channel habitats contribute relatively little production. However, as noted by Sommer (1997), splittail have high fecundity and so can respond rapidly to improvements in environmental conditions (e.g., floodplain inundation), so that very high recruitment occurs in years with floodplain inundation.

Effects on channel margin and side-channel habitat were evaluated by comparing flow conditions for the Sacramento River at Wilkins Slough and the Feather River at the confluence with the Sacramento River for the time-frame February through June. These are the most important months for splittail spawning and larval rearing (Sommer pers. comm.), and juveniles likely emigrate from the side-channel habitats during May and June if conditions become unfavorable.

Differences between model scenarios for monthly average flows during February through June by water-year type were determined for the Sacramento River at Wilkins Slough and for the Feather River at the confluence.

Flows under A5A_ELT relative to NAA_ELT in the Sacramento River at Wilkins Slough were compared for the February through June spawning period (Appendix B, *Supplemental Modeling for New Alternatives*). Modeling results indicate that A5A_ELT would have negligible effects (<5%) on mean flows during February through April. During May and June, flows under A5A_ELT would be up to 9% greater than flows under NAA_ELT. Due to the small size of the flow increases during May and June, they are not expected to have a biologically meaningful effect on splittail spawning conditions. Modeling results also show that Sacramento splittail spawning temperature tolerances would not be exceeded in the Sacramento River under Alternative 5A.

For the Feather River at the confluence with the Sacramento River, mean flows during February through May under A5A_ELT would generally be similar to flows under NAA_ELT. During June, mean flows under A5A_ELT would be up to 28% greater than flows under NAA_ELT. The flow increases would moderately increase the amount of channel margin and side channel habitat available for splittail spawning near the end of the spawning period.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively were used to investigate the potential effects of Alternative 5A on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected for evaluating the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between NAA_ELT and A5A_ELT in the frequency of water temperatures in the Sacramento or Feather rivers being within the suitable 45°F to 75°F temperature range regardless of water year type (Table 11-5A-62).

These results indicate that Alternative 5A would have no negative effects on splittail spawning conditions in channel margin and side-channel habitats resulting from changes in flow and water temperatures. Effects of Alternative 5A on mean flow would consist of negligible effects or increases in flow (increases of up to 9% in the Sacramento River and 28% in the Feather River) near the end of the spawning period that would have little effect on spawning habitat conditions. There would be negligible effects on exceedance of critical water temperatures in both rivers.

Table 11-5A-62. Difference (Percent Difference) in Percent of Days or Months[a] during February to June in Which Temperature Would Be below 45°F or above 75°F in the Sacramento River at Hamilton City and Feather River at the Confluence with the Sacramento River[b]

	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River at Hamilton City		
Temperatures below 45°F		
Wet	-2.8 (-61%)	0 (-1%)
Above Normal	-2.8 (-60%)	0 (0%)
Below Normal	-2.7 (-52%)	-0.1 (-6%)
Dry	-1.3 (-44%)	0 (2%)
Critical	-1.1 (-51%)	0 (0%)
All	-2.2 (-55%)	0 (-1%)
Temperatures above 75°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Feather River at Sacramento River Confluence		
Temperatures below 45°F		
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)
Temperatures above 75°F		
Wet	1.5 (NA)	-0.8 (-33%)
Above Normal	5.5 (NA)	-1.8 (-25%)
Below Normal	2.9 (NA)	-2.9 (-50%)
Dry	4.4 (100%)	-1.1 (-11%)
Critical	3.3 (200%)	-3.3 (-40%)
All	3.2 (260%)	-1.7 (-28%)

NA = could not be calculated because the denominator was 0.

[a] Days were used in the Sacramento River and months were used in the Feather River.

[b] Based on the modeling period of 1922 to 2003.

Stranding Potential

As indicated above, rapid reductions in flow can dewater channel margin and side-channel habitats, potentially stranding splittail eggs and rearing larvae. Yolo Bypass improvements would occur under the NAA_ELT and therefore would exist under Alternative 5A, so there would be little to no difference in stranding potential between Alternative 5A and NAA_ELT and these effects would not be adverse.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially degrade suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. The effects of Alternative 5A on splittail spawning and rearing habitat would consist of minor effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough (generally <5% change in flow) and the Feather River (increases in mean flow up to 28%), and negligible effects on water temperatures in the Sacramento and Feather Rivers (generally <5% change). There would be little difference in inundation potential for the Yolo Bypass because Yolo Bypass improvements (e.g., modification of Fremont Weir) would occur regardless of Alternative 5A and therefore would be part of Alternative 5A and NAA_ELT.

CEQA Conclusion: In general, Alternative 5A would have no effect on splittail spawning habitat relative to Existing Conditions. There would be negligible flow- and temperature-related effects on channel margin and side-channel habitats in the Sacramento River at Wilkins Slough and the Feather River. Yolo Bypass improvements (e.g., modification of Fremont Weir) would occur irrespective of Alternative 5A, but are not included in Existing Conditions, so there would be generally beneficial effects to splittail coinciding with the implementation of Alternative 5A (but not as a result of Alternative 5A).

Floodplain Habitat

Comparisons of the frequencies of inundation for A5A_ELT and Existing Conditions show relatively small increases in drier years under A5A_ELT (Table 11-5A-60). In wet years, there are reductions under A5A_ELT in the frequencies of the shorter inundation periods and an increase in the frequency of the longest inundation periods (70 days or more) because a number of what would be shorter inundation periods under Existing Conditions merge to produce longer inundation periods under A5A_ELT. Coincident with implementation of Alternative 5A, there would also be increased availability of suitable spawning habitat compared to Existing Conditions (Table 11-5A-61), with increases of between 5 and 1,123 Habitat Units (HUs; see footnote in Table 11-5A-61) of suitable spawning habitat depending on water year type. Increased HUs for wet, above normal, and below normal water years are predicted to be 73%, 61%, and 251%, respectively, under A5A_ELT. Comparisons for dry and critical water years indicate increases of 5 HUs of suitable spawning habitat compared to 0 HUs for Existing Conditions. These differences would provide beneficial effects on splittail habitat through increasing spawning habitats, but not as a result of Alternative 5A; as noted above, these improvements would occur under Alternative 5A and NAA_ELT, but not Existing Conditions.

Channel Margin and Side-Channel Habitat

Flows were compared between A5A_ELT and Existing Conditions for the Sacramento River at Wilkins Slough (Appendix B, *Supplemental Modeling for New Alternatives*) during February through June. Mean flows under A5A _ELT would generally not differ (<5%) from those under Existing Conditions during February through April, and would be up to 10% lower during May and up to 16% greater during June. Due to the small size and frequency of these flow changes, they are not expected to have a biologically meaningful effect on splittail spawning conditions.

Results for the Feather River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) show variable effects of A5A _ELT depending on month and water year type. Results for all months except April include negligible effects (<5%), small to moderate increases in mean flow (up to 23%), and small reductions (up to 16%), depending on water year type. During April, mean flows would be similar between A5A _ELT and Existing Conditions. Based on a prevalence of negligible to small effects on flow, these results indicate that effects of Alternative 5A on flow would not have biologically meaningful negative effects on splittail spawning conditions in channel margin and side-channel habitats in the Feather River.

Simulated daily and monthly water temperatures in Sacramento River at Hamilton City and Feather River at the confluence with the Sacramento River, respectively, were used to investigate the potential effects of Alternative 5A on the suitability of water temperatures for splittail spawning and egg incubation. A range of 45°F to 75°F was selected as the suitable range for splittail spawning and egg incubation.

There would be no biologically meaningful difference (>5% absolute scale) between Existing Conditions and A5A_ELT in the frequency of water temperatures in the Sacramento River being within the suitable 45°F to 75°F temperature range regardless of water year type (Table 11-5A-62). In the Feather River, there would be no differences between Existing Conditions and A5A_ELT in frequency of temperatures below 45°F, but there would be a 6% increase in the frequency of exceeding the 75°F threshold under A5A_ELT relative to Existing Conditions in above normal water years. Due to the low magnitude of this increase in frequency, it is not expected to have a biologically meaningful effect on splittail.

Stranding Potential

As noted for other alternatives, and due to a lack of quantitative tools and historical data to evaluate possible stranding effects, the following provides a narrative summary of potential effects in relation to stranding potential. The Yolo Bypass is exceptionally well-drained because of grading for agriculture, which likely helps limit stranding mortality of splittail. Moreover, water stage decreases on the bypass are relatively gradual (Sommer et al. 2001). Stranding of Sacramento splittail in perennial ponds on the Yolo Bypass does not appear to be a problem under Existing Conditions (Feyrer et al. 2004). Yolo Bypass improvements would be designed, in part, to further reduce the risk of stranding by allowing water to inundate certain areas of the bypass to maximize biological benefits, while keeping water away from other areas to reduce stranding in isolated ponds. Actions to increase the frequency of Yolo Bypass inundation that are separate from Alternative 5A but that would coincide with Alternative 5A would increase the frequency of potential stranding events in relation to Existing Conditions. For splittail, an increase in inundation frequency would also increase the production of Sacramento splittail in the bypass. While total stranding losses may be greater under Alternative 5A than under Existing Conditions (although not as a result of Alternative 5A), the total number of splittail would be expected to be greater under Alternative 5A (again, not as a result of Alternative 5A, but coincident with it).

In the Yolo Bypass, Sommer et al. (2005) found these potential losses are offset by the improvement in rearing conditions. Henning et al. (2006) also noted the potential for stranding risk as wetlands desiccate and oxygen concentrations decline, but the seasonal timing of use by juveniles may decrease these risks. Sommer et al. (2005) addressed the question of stranding and concluded the potential improvements in habitat capacity outweighed the potential stranding problems that may exist in some years. Overall, these effects are less than significant.

Summary of CEQA Conclusion

Collectively, the modeling results presented above indicate that the impact is not significant because it would not substantially degrade suitable spawning habitat or substantially reduce the number of fish as a result of egg mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would greater than the CEQA baseline, but not as a result of Alternative 5A, and the net result would be expected to be beneficial. No mitigation is necessary.

Impact AQUA-113: Effects of Water Operations on Rearing Habitat for Sacramento Splittail

Because both Alternative 5A and NAA_ELT are assumed to include Yolo Bypass improvements including Fremont Weir modification, there would be little to no difference in the quantity and quality of rearing habitat in the Yolo Bypass. There would be no effect on rearing conditions in channel margin and side-channel habitats due to negligible changes in mean monthly flow and water temperatures during most of the rearing period in the Sacramento River and the Feather River.

Floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for A5A_ELT. The small and infrequent changes to flow under A5A_ELT described above would also not substantially affect splittail rearing habitat conditions.

NEPA Effects: Based on the analyses above, the effect of Alternative 5A on splittail rearing habitat is not adverse because it would not substantially degrade rearing habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion: In general, there would be no effect of Alternative 5A on splittail rearing habitat relative to Existing Conditions.

As described above, floodplains are important rearing habitats for juvenile splittail during periods of high flows when areas like the Yolo Bypass are inundated. Alternative 5A would not result in changes in floodplain habitat, although there would be a greater extent of floodplain habitat available coincident with implementation of Alternative 5A because of Yolo Bypass improvements (e.g., Fremont Weir modification) that would occur regardless of Alternative 5A but that are not current present under Existing Conditions. During low flows when floodplains are not inundated, splittail rear in side-channel and channel margin habitat. Therefore, the previous impact discussion applies to rearing as well as spawning habitat for splittail for Alternative 5A.

Summary of CEQA Conclusion

Based on the analyses above, the impact of Alternative 5A on splittail rearing habitat is not significant because it would not substantially degrade rearing habitat or substantially reduce the number of fish as a result of mortality. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 5A. No mitigation is necessary.

Impact AQUA-114: Effects of Water Operations on Migration Conditions for Sacramento Splittail

Upstream of the Delta

In general, Alternative 5A would not affect migration conditions for juvenile or adult splittail in the Sacramento River or the Feather River relative to the NAA_ELT based on negligible or beneficial effects on mean monthly flow during the migration period and negligible effects on exposure to critical water temperatures in the Feather River. Adults migrate upstream primarily in December through March and juvenile migrate primarily in April through July (Moyle et al. 2004).

The effects of Alternative 5A on splittail migration conditions would be the same as described for channel margin and side-channel habitats in the Sacramento River and Feather River for Impact AQUA-112 above. One additional month (July) is included here that was not considered in Impact AQUA-112. During July, there would be negligible differences (<5%) or minor increases in mean flows under A5A_ELT in the Sacramento River, but mean flows in the Feather River at the confluence with the Sacramento River would be 38% lower in critical water years. Because this reduction would occur at the end of the migration period, the reduction is not likely to affect juvenile migration conditions. Therefore, overall, there would be a minimally negative effect of Alternative 5A on migration conditions in the Feather River, and essentially no effect in the Sacramento River.

Through-Delta

Alternative 5A is expected to generally reduce OMR reverse flows during the period of juvenile splittail migration through the Delta (May–July). OMR flows are improved or similar compared to NAA_ELT across all water years. For juvenile splittail migrating down the Sacramento River past the north Delta intake, migration flows downstream of the north Delta intakes under Alternative 5A generally would be somewhat reduced relative to NAA_ELT, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). The greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 5A because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences.

NEPA Effects: The effect of Alternative 5A is not adverse because it would not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a result of mortality.

CEQA Conclusion:

Upstream of the Delta

In general, effects of Alternative 5A would not affect splittail migration conditions relative to Existing Conditions due to a lack of effects to flows and water temperatures in the Sacramento River and the Feather River during the splittail migration period. There would be a 44% reduction in mean flow during July of critical years in the Feather River at the confluence with the Sacramento River, but as noted previously, because July is at the end of the migration period, the reduction is not likely to substantially affect juvenile migration conditions.

Effects of Alternative 5A on splittail migration conditions are the same as described for channel margin and side-channel habitats in Impact AQUA-112.

Through-Delta

As described above, average OMR flows under Alternative 5A are expected to generally improve during the juvenile splittail migration through the Delta, especially during the summer months. As described above in the discussion of the NEPA Effects, juvenile splittail migrating down the Sacramento River past the north Delta intakes would experience reduced migration flows downstream of the north Delta intake under Alternative 5A, which could reduce splittail survival in the more riverine reaches (as seen for juvenile Chinook salmon; Perry 2010). However, the greatest proportion of juvenile splittail would be expected to be emigrating from the Yolo Bypass in years when it is inundated (a more frequent occurrence under NAA_ELT and Alternative 5A because of Fremont Weir modifications) and therefore these juveniles would enter the Delta in its further downstream, tidal reaches in the Cache Slough subregion, where riverine flow-related migration influences would be very small relative to tidal flow influences. Thus the changes are expected to have a less-than-significant impact.

Summary of CEQA Conclusion

The impact is less than significant because it would not substantially degrade suitable migration habitat or substantially reduce the number of fish as a result of mortality and no mitigation is necessary. There would be negligible effects of the alternative on flow and water temperatures in channel margin habitats and side channels. Floodplain inundation and stranding potential would be greater than the CEQA baseline but not as a result of Alternative 5A. No mitigation is necessary.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example)because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-115: Effects of Construction of Restoration Measures on Sacramento Splittail

Impact AQUA-116: Effects of Contaminants Associated with Restoration Measures on Sacramento Splittail

Impact AQUA-117: Effects of Restored Habitat Conditions on Sacramento Splittail

Impact AQUA-118: Effects of Methylmercury Management on Sacramento Splittail (Environmental Commitments 12)

Impact AQUA-121: Effects of Localized Reduction of Predatory Fish on Sacramento Splittail (Environmental Commitments 15)

Impact AQUA-122: Effects of Nonphysical Fish Barriers on Sacramento Splittail (Environmental Commitments 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on Sacramento splittail for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Green Sturgeon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-127: Effects of Construction of Water Conveyance Facilities on Green Sturgeon

The potential effects of construction of the water conveyance facilities on green sturgeon or their designated critical habitat would be similar to those described for Alternative 4A (Impact AQUA-127) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to green sturgeon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-127, and as discussed above, the effect would not be adverse for green sturgeon or designated critical habitat.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-127, and as discussed above, the impact of the construction of water conveyance facilities on green sturgeon and critical habitat would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-128: Effects of Maintenance of Water Conveyance Facilities on Green Sturgeon

NEPA Effects: The potential effects of maintenance of water conveyance facilities on green sturgeon under Alternative 5A would be less than the potential effects of maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-128 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-128 would not be adverse for green sturgeon under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-128 for green sturgeon under Alternative 4A, the impact of maintenance of water conveyance facilities on green sturgeon or their designated critical habitat would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-129: Effects of Water Operations on Entrainment of Green Sturgeon

Water Exports

Alternative 5A is expected to reduce overall entrainment of juvenile green sturgeon across all water year types at the south Delta export facilities, estimated by the salvage density method, by about 27% (22 fish) compared to NAA_ELT (Table 11-5A-63). Like Alternative 1A (Impact AQUA-129), entrainment reductions would be greater in wet and above normal years (24% decrease, 26 fish) than in below normal, dry, and critical years (16% decrease, 7 fish) compared to NAA_ELT. Alternative 5A would be beneficial for reducing entrainment of juvenile green sturgeon.

Predation Associated with Entrainment

Juvenile green sturgeon predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. The total reduction of juvenile green sturgeon entrainment, and hence predation loss, would be about 27% under Alternative 5A compared to NAA_ELT. The impact and conclusion for predation risk associated with the north Delta intake would be the same as described for Alternative 1A, Impact AQUA-129 (i.e., not adverse).

NEPA Effects: The effect on entrainment and predation losses under Alternative 5A would not be adverse and may provide modest benefit due to reduced losses at the South Delta Facilities.

CEQA Conclusion: Annual entrainment losses of juvenile green sturgeon across all water year types would decrease 35% (33 fish) under Alternative 5A (A5A_ELT) relative to Existing Conditions (Table 11-5A-63). Impacts of water operations on entrainment of green sturgeon would be less than significant and no mitigation would be required.

Table 11-5A-63. Juvenile Green Sturgeon Entrainment Index[a] at the SWP and CVP Salvage Facilities—Differences (Absolute and Percentage) between Model Scenarios for Alternative 5

	Absolute Difference (Percent Difference)	
Water Year Type[b]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet and Above Normal	-32 (-27%)	-26 (-24%)
Below Normal, Dry, and Critical	-11 (-23%)	-7 (-16%)
All Years	-33 (-35%)	-22 (-27%)

Shading indicates entrainment increased by 10% or more.

[a] Estimated annual number of fish lost, based on non-normalized data.
[b] Sacramento Valley water year-types.

The impact and conclusion for predation associated with entrainment would be the same as described above. Because relatively few juvenile green sturgeon are entrained at the south Delta, reductions in entrainment (35% reduction compared to Existing Conditions, representing 33 fish) under Alternative 5A would have little effect in affecting entrainment-related predation loss. Overall, the impact would be less than significant, because there would be little change in predation loss under Alternative 5A.

Impact AQUA-130: Effects of Water Operations on Spawning and Egg Incubation Habitat for Green Sturgeon

In general, Alternative 5A would not affect spawning and egg incubation habitat for green sturgeon relative to NAA_ELT.

Sacramento River

Flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix B, *Supplemental Modeling for New Alternatives*). Lower flows can reduce the instream area available for spawning and egg incubation. Mean flows under A5A_ELT would generally be similar to or slightly greater than flows under NAA_ELT during March through July at both locations

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 63°F identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments was determined for each month (May through September) and year of the 82-year modeling period. The combination of number of days and degrees above the 63°F threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and A5A_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-64. There would be no biologically relevant differences between NAA_ELT and A5A_ELT in the exceedances for any of the levels of concern.

Table 11-5A-64. Differences between Baseline and Alternative 5A Scenarios in the Number of Years in Which Water Temperature Exceedances above 63°F Are within Each Level of Concern, Sacramento River at Bend Bridge, May through September

Level of Concern	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Red	3 (75%)	0 (0%)
Orange	2 (200%)	2 (67%)
Yellow	0 (0%)	-2 (-100%)
None	-5 (-7%)	0 (0%)

Total degree-days exceeding 63°F at Bend Bridge were summed by month and water year type during May through September (Table 11-5A-65). Combining all water years, total degree-days would be the same under A5A_ELT relative to NAA_ELT during May and June, and would be 1% to 20% lower during July through September.

Table 11-5A-65. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 63°F in the Sacramento River at Bend Bridge, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
May	Wet	0 (NA)	0 (NA)
	Above Normal	2 (NA)	0 (0%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	20 (154%)	0 (0%)
June	Wet	101 (1,263%)	-29 (-21%)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	5 (NA)	4 (400%)
	Critical	0 (NA)	-1 (-100%)
	All	0 (NA)	0 (NA)
July	Wet	0 (NA)	0 (NA)
	Above Normal	513 (327%)	-11 (-2%)
	Below Normal	611 (196%)	-99 (-10%)
	Dry	0 (NA)	0 (NA)
	Critical	2 (NA)	1 (100%)
	All	126 (1,575%)	-33 (-20%)
August	Wet	0 (NA)	0 (NA)
	Above Normal	24 (NA)	0 (0%)
	Below Normal	107 (345%)	8 (6%)
	Dry	17 (131%)	0 (0%)
	Critical	62 (NA)	25 (68%)
	All	642 (319%)	-53 (-6%)
September	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	657 (220%)	-14 (-1%)

NA = could not be calculated because the denominator was 0.

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June green sturgeon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT at Thermalito Afterbay would generally be similar to or up to 40% greater (June of above normal years) than flows under NAA_ELT, with minor exceptions. Differences at the confluence with the Sacramento River would generally be similar to but smaller than those at Thermalito. These results indicate that flows in the Feather River would generally increase during the green sturgeon spawning and egg incubation period under Alternative 5A independent of climate change.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

The percent of months exceeding the 64°F temperature threshold in the Feather River at Gridley was evaluated during May through September (Table 11-5A-66). For this impact, only the months of May and June were examined because green sturgeon spawning and egg incubation does not generally extend beyond June in the Feather River. Subsequent months are examined under Impact AQUA-131. In both May and June, the percent of months exceeding the threshold under A5A_ELT would be similar to or lower (up to 15% lower on an absolute scale) than the percent under NAA_ELT.

Table 11-5A-66. Differences between Baseline and Alternative 5A Scenarios in Percent of Months during the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at Gridley Exceed the 64°F Threshold, May through September

	Degrees Above Threshold				
Month	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. A5A_ELT					
May	15 (46%)	7 (40%)	6 (63%)	9 (233%)	2 (100%)
June	2 (3%)	2 (3%)	4 (5%)	11 (17%)	10 (21%)
July	0 (0%)	0 (0%)	0 (0%)	1 (1%)	5 (7%)
August	0 (0%)	-2 (-2%)	-1 (-1%)	1 (2%)	7 (12%)
September	-4 (-5%)	-7 (-14%)	-1 (-4%)	5 (67%)	2 (100%)
NAA_ELT vs. A5A_ELT					
May	-14 (-22%)	-10 (-28%)	-6 (-28%)	0 (0%)	-1 (-20%)
June	-1 (-1%)	-5 (-5%)	-9 (-9%)	-11 (-13%)	-15 (-20%)
July	0 (0%)	0 (0%)	0 (0%)	-9 (-9%)	-11 (-13%)
August	0 (0%)	-2 (-2%)	-10 (-10%)	-14 (-14%)	-12 (-15%)
September	15 (29%)	7 (19%)	-1 (-4%)	-7 (-38%)	-4 (-43%)

Total degree-months exceeding 64°F were summed by month and water year type at Gridley during May through September (Table 11-5A-67). Only May and June were examined for spawning and egg incubation habitat under this impact. Subsequent months are examined under Impact AQUA-131. Total degree-months exceeding the threshold under A5A_ELT would be lower than under the NAA_ELT by 4 degree-months and 45 degree-months during May and June, respectively.

The absolute scale (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between the baselines and A5A_ELT, when they occur, are in most cases mathematical artifacts due to the small values of degree-months for the baseline (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on green sturgeon. The largest reduction in degree-months for

A5A_ELT relative to NAA_ELT is 45 degree-months during June, which would equate to an average reduction of about one half degree per month. Given the highly variable nature of the Feather River outside of the low-flow channel, this change is not expected to be biologically meaningful. In fact, it is not unusual for this amount of change to occur regularly on a diel cycle.

Table 11-5A-67. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Months (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 64°F in the Feather River at Gridley, May through September

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
May	Wet	11 (183%)	0 (0%)
	Above Normal	7 (64%)	-1 (-5%)
	Below Normal	12 (150%)	-1 (-5%)
	Dry	16 (114%)	-1 (-3%)
	Critical	11 (65%)	-2 (-7%)
	All	58 (104%)	-4 (-3%)
June	Wet	30 (40%)	-14 (-12%)
	Above Normal	8 (16%)	-9 (-13%)
	Below Normal	5 (8%)	-13 (-16%)
	Dry	16 (17%)	-10 (-8%)
	Critical	21 (38%)	1 (1%)
	All	80 (23%)	-45 (-10%)
July	Wet	-6 (-4%)	-11 (-6%)
	Above Normal	1 (2%)	-4 (-7%)
	Below Normal	8 (12%)	-7 (-8%)
	Dry	26 (30%)	0 (0%)
	Critical	48 (61%)	22 (21%)
	All	77 (17%)	0 (0%)
August	Wet	6 (3%)	9 (5%)
	Above Normal	3 (7%)	-5 (-9%)
	Below Normal	16 (23%)	-2 (-2%)
	Dry	54 (79%)	11 (10%)
	Critical	28 (33%)	2 (2%)
	All	107 (24%)	15 (3%)
September	Wet	-3 (-8%)	30 (500%)
	Above Normal	3 (19%)	18 (1800%)
	Below Normal	4 (14%)	-9 (-22%)
	Dry	6 (21%)	-5 (-13%)
	Critical	18 (90%)	0 (0%)
	All	28 (21%)	34 (27%)

San Joaquin River

Flows in the San Joaquin River at Vernalis under Alternative 5A during March through June would not be different from flows under NAA_ELT (Appendix B, *Supplemental Modeling for New Alternatives)*.

No water temperatures modeling was conducted in the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that there would not be adverse effects on green sturgeon spawning and egg incubation habitat because the amount of suitable habitat would not be substantially degraded. Flow and temperature conditions would generally be similar between Alternative 5A and the NEPA baseline in the Sacramento River and San Joaquin River and would be beneficial under Alternative 5A relative the NEPA baseline in the Feather River. Alternative 5A would reduce the frequency of exceedances above NMFS temperature thresholds in the Sacramento and Feather Rivers.

CEQA Conclusion: Collectively, the modeling results of the Impact AQUA-130 CEQA analysis show that the difference between the CEQA baseline and Alternative 5A could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 5A would not affect the quantity and quality of spawning and egg incubation habitat for green sturgeon relative to the CEQA baseline.

Sacramento River

Mean flows were examined in the Sacramento River between Keswick and upstream of Red Bluff during the March to July spawning and egg incubation period for green sturgeon (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A_ELT would generally be slightly lower than those under Existing Conditions during March through May, and would generally be similar to or slightly greater than those under Existing Conditions during June and July. These results indicate that there would be no effect on flows in the Sacramento River under A5A_ELT relative to Existing Conditions.

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the March through July green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between Existing Conditions and Alternative 5A in any month or water year type throughout the period.

There would be 3 more years with a “red” NMFS level of concern in the Sacramento River at Bend Bridge under A5A_ELT than under Existing Conditions.

Total degree-days exceeding the 63°F NMFS threshold in the Sacramento River at Bend Bridge under A5A_ELT (for all water years combined) would be up to 1,575% higher (in July) than under Existing Conditions (Table 11-5A-65). Such a large increase on the relative scale is a mathematical artifact resulting from the small value of the divisor (i.e., degree-days for Existing Conditions). On an absolute scale, the increase would be 126 degree-days, which corresponds to an average daily temperature increase over the 82-year period of about 0.05 degrees per day. This is a negligible change.

Feather River

Flows were examined in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River during the February through June green sturgeon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). At Thermalito, mean flows under A5A_ELT would generally be lower than those under Existing Conditions during February and March (up to 52% lower in February of below normal years), with some exceptions, and would generally be similar to or greater than those under Existing Conditions during April through June (up to 60% greater in June of below normal years). At the confluence with the Sacramento River, flows under A5A_ELT would generally be similar to those under Existing Conditions in all months and water year types of the period, except June, in which flows under A5A_ELT would be up to 23% higher. These results indicate that there would generally be lower flows in the Feather River under A5A_ELT relative to Existing Conditions early in the spawning and egg incubation period and greater flows later in the period.

Mean water temperatures in the Feather River at Gridley were examined during the February through June green sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

Water temperature-related effects of A5A_ELT on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were evaluated by determining the percent of months during May through September exceeding the 64°F temperature threshold in the Feather River at Gridley (Table 11-5A-66). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. During the period, the percent of months exceeding the threshold under A5A_ELT relative to Existing Conditions would be similar to or higher (up to 15% higher on an absolute scale). These results indicate a small to moderate adverse effect on green sturgeon spawning, egg incubation, and rearing habitat.

Water temperature-related effects of Alternative 5A on green sturgeon spawning, egg incubation, and rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-5A-67). Effects on spawning and egg incubation are evaluated here for May and June; effects on rearing are evaluated under Impact AQUA-131. Combining water years, total degree-months exceeding the threshold during May and June under A5A_ELT would be 58 and 80 degree-months greater, respectively, relative to Existing Conditions. Within months, total degree-months under A5A_ELT would be consistently higher relative to Existing Conditions during both months.

As previously indicated, the absolute scale (degree-months) is used to compare results for these analyses because large relative differences (percent differences) between the baselines and A5A_ELT, when they occur, are in most cases mathematical artifacts due to the small values of degree-months for the baseline (i.e., dividing by a small number amplifies the relative difference), which would not translate into biologically meaningful effects on green sturgeon. The largest change in the Feather River in the degree-months between Existing Conditions and A5A_ELT during May and June (80 degree-month increase for June) for the 82-year period of analysis would equate to an average increase of about one degree per month. Given the highly variable nature of the Feather

River, this increase is not expected to be biologically meaningful and would not be large enough to negatively affect green sturgeon spawning and egg incubation temperature-related conditions in the Feather River.

San Joaquin River

Flows under A5A_ELT were examined in the San Joaquin River at Vernalis during the March through June green sturgeon spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows under A5A _ELT would be moderately lower (up to 16% lower in June of wet years) than those under Existing Conditions for all months of the period, with minor exceptions.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable spawning habitat and substantially reduce the number of green sturgeon in the San Joaquin River as a result of reduced flows. Under Alternative 5A, flows would generally not differ in the Sacramento River. Flows in the Feather River under Alternative 5A would be lower relative to Existing Conditions early in the spawning and egg incubation period and would be higher later in the period. Water temperature conditions in the Sacramento and Feather rivers under Alternative 5A would not differ significantly relative to Existing Conditions. Flows under Alternative 5A in the San Joaquin River would be consistently lower than those under Existing Conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flow and water temperature conditions under Alternative 5A would be similar to or better than those under NAA_ELT. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-131: Effects of Water Operations on Rearing Habitat for Green Sturgeon

In general, Alternative 5A would not affect the quantity and quality of green sturgeon larval and juvenile rearing habitat relative to NAA_ELT.

Water temperature was used to determine the potential effects of alternatives on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow.

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Water temperature-related effects of Alternative 5A on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures exceed a 64°F temperature threshold at Gridley (Table 11-5A-66). The percent of months exceeding the 64°F temperature threshold under A5A_ELT would be similar to or lower (up to 14% lower on an absolute scale) than the percent under NAA_ELT in all months except September, in which the percent of months under A5A_ELT would be 15% and 7% (absolute scale) higher than the percent under NAA_ELT for the >1.0°F and >2.0°F threshold exceedance categories, respectively. These small increases would not cause a substantial effect to rearing green sturgeon in the Feather River.

Water temperature-related effects of Alternative 5A on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley (Table 11-5A-67). Combining water years, total degree-months exceeding the threshold under A5A_ELT would be 4 and 45 degree-months lower relative to NAA_ELT during May and June and 15 and 34 degree-months higher during August and September, with no change in July. These results indicate that there would be both beneficial and negative temperature-related effects to green sturgeon rearing in the Feather River. However, the largest increase in degree-months (34 degree-months during September) would equate to an average increase of less than one half degree per month. Given the highly variable nature of the Feather River outside of the low-flow channel, this change is not expected to be biologically meaningful. In fact, it is not unusual for this amount of change to occur daily on a diel cycle.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River. However flows in all months and water year types, based on CALSIM II, were the same or very similar between NAA_ELT and A5A_ELT (Appendix B, *Supplemental Modeling for New Alternatives*) and, therefore, no temperature effects would occur as a result of Alternative 5A.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially reduce the amount of suitable rearing habitat available for green sturgeon. Water temperatures in the Sacramento and Feather Rivers and exceedances of NMFS temperature thresholds in the Feather River under Alternative 5A would generally be similar to those under NAA_ELT with few exceptions.

CEQA Conclusion: In general, the results presented above suggest that Alternative 5A could reduce the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 5A would not affect the quantity and quality of rearing habitat for larval and juvenile green sturgeon relative to Existing Conditions.

Water temperature was used to determine the potential effects of Alternative 5A on green sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic-oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Sacramento River

Mean water temperatures in the Sacramento River at Bend Bridge were examined during the May through October green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT for any month or water year type of the period, except a 6% higher mean temperature in August of critical water years.

Feather River

Mean water temperatures in the Feather River at Gridley were examined during the April through August green sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT for any month or water year type of the period, except for a 6% higher temperatures for July of critical water years.

Water temperature-related effects of A5A_ELT on green sturgeon rearing habitat in the Feather River were evaluated by determining the percent of months during May through September in which water temperatures would exceed a 64°F temperature threshold at Gridley (Table 11-5A-66). The percent of months exceeding the threshold under A5A_ELT would be similar to or greater by up to 15% (absolute scale) than the percent under Existing Conditions during May through August, and would be lower by up to 7% (absolute scale) during September, except for a 5% increase in September for the >4.0°F threshold exceedance category.

Water temperature-related effects of Alternative 5A on green sturgeon rearing habitat in the Feather River were also evaluated by determining the total degree-months exceeding the 64°F temperature threshold at Gridley during May through September (Table 11-5A-67). Combining water years, total degree-months exceeding the threshold under A5A_ELT would be 28 to 107 higher in all months. The largest increase in degree-months (107 degree-months during August) would equate to an average increase of more than one degree per month, which would be biologically meaningful. These results indicate that there would be negative temperature-related effects of Alternative 5A on green sturgeon rearing in the Feather River.

San Joaquin River

Water temperature modeling was not conducted in the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 5A, water temperatures would be slightly higher in the Sacramento and Feather rivers than those under the CEQA baseline, and the exceedances above NMFS temperature thresholds in the Feather River would be higher, which could increase stress, mortality, and susceptibility to disease for larval and juvenile green sturgeon. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade rearing habitat and substantially reduce the number of green sturgeon as a result of fry and juvenile mortality.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on water temperatures would be negligible and exceedances above thresholds would be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NEPA baseline, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-132: Effects of Water Operations on Migration Conditions for Green Sturgeon

In general, Alternative 5A would not degrade green sturgeon migration conditions relative to NAA_ELT.

Upstream of the Delta

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through June adult migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River mean flows at Keswick under A5A_ELT would generally be similar to flows under NAA_ELT in all months except September and November, in which flows would be up to 22% lower (November of below normal water years)(Appendix B, *Supplemental Modeling for New Alternatives*). Sacramento River flows at Wilkins Slough under A5A_ELT would generally be up to 18% lower than flows under NAA_ELT during September and November, slightly greater during June, and similar to flows under NAA_ELT in the remaining nine months, with minor exceptions (Appendix B, *Supplemental Modeling for New Alternatives*). The flow reductions would be infrequent (2 out of 12 months) and, therefore, would not cause substantial effects to green sturgeon migration.

Differences between A5A_ELT and NAA_ELT in Feather River mean flows at Thermalito would vary a great deal with month and water year type. In general, mean flows under A5A_ELT would be up to 64% lower (September of below normal years) than flows under NAA_ELT during January, August, and September, although flows in critical water years during September would be 17% higher (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be up to 40% greater (June of above normal years and December of critical years) during March, June, July, October, and December, although flows in critical water years during July would be 35% lower. Flows would be similar to flows under NAA_ELT in the remaining four months, with several exceptions.

Mean flows in the Feather River at the confluence with the Sacramento River under A5A_ELT would generally be up to 41% lower (September of below normal years) than flows under NAA_ELT during August and September, and would be 38% lower in July of critical years (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or up to 33% greater (December of critical years) under A5A_ELT during June, October, and December, and would be similar to flows under NAA_ELT in the remaining six months, with minor exceptions.

These changes represent a shift in the Oroville release pattern such that greater releases are made in the spring and less release is made in the summer. Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the project planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

Larval transport flows were also examined by utilizing the positive correlation between white sturgeon year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved green sturgeon larval transport that results in improved year class strength. However, there is high uncertainty about what the mechanism responsible for this relationship with white sturgeon year class strength is because many flow variables correlate throughout the Central Valley. In addition, this correlation was developed using data collected in the absence of north Delta intakes. Most importantly, there are temporal and spatial differences between green and white sturgeon larval presence that make this analysis highly uncertain and potentially not applicable (Murphy et al. 2011). In particular, unlike white sturgeon, during April and May, green sturgeon would be spawning and larvae rearing in the upper Sacramento River and Feather River. This mismatch in timing and location limits the confidence in using this as a surrogate for green sturgeon and suggests that year-class strength correlated with flow at another location within the Sacramento River or during a different period, if at all. Regardless, for lack of a known relationship for green sturgeon year-class strength, the results using white sturgeon as a surrogate for green sturgeon were examined here. Results for white sturgeon presented in Impact AQUA-150 below suggest that, using the positive correlation between Delta outflow and year class strength, green sturgeon year class strength would be lower under A5A_ELT than those under NAA_ELT (up to 50% lower) (Table 11-5A-73).

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows. The effect on green sturgeon would not be adverse.

NEPA Effects: Overall, these modeling results indicate that the effect would not be adverse. Sacramento River flows would generally be similar between Alternative 5A and NAA_ELT, with few exceptions. In the Feather River, there would be some summer flow reductions under Alternative 5A, but given the benthic nature of green sturgeon and that the flow regime is consistent with NMFS recommendations provided to mimic a more natural flow regime to benefit natives species, these reductions are not expected to adversely affect green sturgeon.

Due to the removal of water at the North Delta intakes, there are substantial differences in through-Delta flows between Alternative 5A and NAA_ELT. The percentage of months exceeding the USFWS (1995) Delta outflow thresholds in April and May of wet and above normal years under Alternative 5A was appreciably lower than that under NAA_ELT. Analysis of white sturgeon year-class strength (USFWS 1995), used here as a surrogate for green sturgeon, found a positive correlation between year class strength and Delta outflow during April and May. However, there are several problems with approach, as described above that make this analysis highly uncertain and potentially not applicable.

Determining whether a relationship exists between green sturgeon year class strength and river/Delta outflow and addressing the scientific uncertainty regarding which mechanisms are responsible for the positive correlation between white sturgeon year class strength and river/Delta flow will occur through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations. Given the outcome of these investigations, Delta outflow would be appropriately set for Alternative 5A operations such that the effect on green sturgeon Delta flow conditions would not be adverse. This, combined with similarities in flow conditions between Alternative 5A and NAA_ELT in the Sacramento River, the benthic nature of green sturgeon, and a lack of confidence in using white sturgeon as a surrogate for green sturgeon given the differences in timing and location of the two species, indicate that Alternative 5A would not be adverse to migration conditions for green sturgeon.

CEQA Conclusion: In general, Alternative 5A would not affect green sturgeon migration conditions relative to the Existing Conditions

Upstream of the Delta

Analyses for green sturgeon migration conditions focused on flows in the Sacramento River between Keswick and Wilkins Slough and in the Feather River between Thermalito and the confluence with the Sacramento River during the April through October larval migration period, the August through March juvenile migration period, and the November through July adult migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Because these periods encompass the entire year, flows during all months were compared. Reduced flows could slow or inhibit downstream migration of larvae and juveniles and reduce the ability to sense upstream migration cues and pass impediments by adults.

Sacramento River mean flows at Keswick under A5A_ELT would generally be up to 18% lower than flows under Existing Conditions during October and November, and up to 24% lower in September of below normal, dry and critical years (Appendix B, *Supplemental Modeling for New Alternatives*). During September of above normal and wet years, flows under A5A_ELT were up to 47% higher. In the other months and water year types, the mean flows would generally be similar to or greater than flows under Existing Conditions, with several exceptions. Mean flows at Wilkins Slough under A5A_ELT would generally be up to 25% lower than flows under Existing Conditions during August through November, except for September of wet and above normal water years when flows under A5A_ELT would be 27% and 47% higher, respectively. Mean flows in June and July would be up to 16% higher under A5A_ELT, and flows would be similar in other months and water year types, with minor exceptions.

Differences between A5A_ELT and Existing conditions in Feather River mean flows would vary greatly with month and water year type. Mean flows at Thermalito Afterbay under A5A_ELT would be up to 52% lower (February of below normal years) than flows under Existing Conditions during January through March and up to 60% higher than flows under Existing Conditions during May through July (Appendix B, *Supplemental Modeling for New Alternatives*). However, mean flow during July of critical years would be lower (40% lower) under A5A_ELT. During September, mean flows would be lower in dry and below normal year types (57% and 54% lower, respectively) and would be higher in wet, above normal and critical year types (up to 136% higher in wet years), while during August, mean flows would be lower in dry and critical year types (32% and 23% lower, respectively) and up to 50% higher in wet and above normal year types. Flows under A5A_ELT would be similar to, lower than, or higher than flows under Existing Conditions during April and October through December, depending on water year type. Mean flow under A5A_ELT at the confluence with the Sacramento River would generally be greater than flows under Existing Conditions during June of above normal, below normal, and dry water years and July through September of wet and above normal years (up to 71% higher in September of wet years), and would generally be up to 44% lower than flows under Existing Conditions during July through September of the drier water years types. Given the benthic nature of green sturgeon and that flows in the Feather River would be consistent with the flow schedule provided by NMFS during the project planning process that is meant to better mimic the natural flow regime while providing adequate storage to meet downstream temperature and water quality requirements, the reductions in summer flows at both locations in the Feather River are not expected to have a substantial effect on green sturgeon.

For Delta outflow, the percent of months exceeding outflow thresholds under A5A_ELT would consistently be lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (Table 11-5A-73).

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to Existing Conditions, because of reduced frequency of reverse OMR flows. The effect on green sturgeon would not be adverse.

Summary of CEQA Conclusion

Although there are reductions in flows in the Sacramento and Feather rivers during summer and fall months under the Alternative 5A relative to the Existing Conditions, these reductions are not frequent enough (two to three of 12 months) to have substantial effects on green sturgeon migration. Exceedances of Delta outflow thresholds would be lower under Alternative 5A than under Existing Conditions, although there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows co-vary with another unknown factor. Also, the appropriateness of using white sturgeon as a surrogate for green sturgeon is questionable, as described for the NEPA Effects section above. Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade upstream migration conditions for green sturgeon.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on green sturgeon migration conditions in upstream areas. Within the Plan Area, the Adaptive Management Program will evaluate water operations and make adjustments as necessary to protect green sturgeon abundance and ensure the impacts of water operations on migration conditions for green sturgeon are less than significant. Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-133: Effects of Construction of Restoration Measures on Green Sturgeon

Impact AQUA-134: Effects of Contaminants Associated with Restoration Measures on Green Sturgeon

Impact AQUA-135: Effects of Restored Habitat Conditions on Green Sturgeon

Impact AQUA-136: Effects of Methylmercury Management on Green Sturgeon (Environmental Commitment 12)

Impact AQUA-139: Effects of Localized Reduction of Predatory Fish on Green Sturgeon (Environmental Commitment 15)

Impact AQUA-140: Effects of Nonphysical Fish Barriers on Green Sturgeon (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on green sturgeon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

White Sturgeon

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-145: Effects of Construction of Water Conveyance Facilities on White Sturgeon

The potential effects of construction of the water conveyance facilities on white sturgeon would be similar to those described for Alternative 4A (Impact AQUA-145) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to white sturgeon.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-145, and as discussed above, the effect would not be adverse for white sturgeon.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-145, and as discussed above, the impact of the construction of water conveyance facilities on white sturgeon would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-146: Effects of Maintenance of Water Conveyance Facilities on White Sturgeon

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-146 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-146 would not be adverse for white sturgeon under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-146 for white sturgeon under Alternative 4A, the impact of the maintenance of water conveyance facilities on white sturgeon would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-147: Effects of Water Operations on Entrainment of White Sturgeon

Water Exports

Alternative 5A is expected to reduce overall entrainment of juvenile white sturgeon at the south Delta export facilities, estimated by the salvage-density method, by 19% (30 fish) across all water year types as compared to NAA_ELT (Table 11-5A-45). As discussed for Alternative 1A (Impact AQUA-147), entrainment is highest in wet and above normal water years. Under Alternative 5A, entrainment in wet and above normal water years would be reduced 23% (60 fish), compared to NAA_ELT. Therefore, Alternative 5A would have beneficial effects on juvenile white sturgeon.

Predation Associated with Entrainment

Juvenile white sturgeon predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. The total reduction of juvenile green sturgeon entrainment, and hence predation loss, would be just under 20% between Alternative 5A and NAA (30 fish). The effect on predation loss under Alternative 5A would not be adverse.

NEPA Effects: The effect on entrainment and predation losses under Alternative 5A would not be adverse.

CEQA Conclusion: Operational activities associated with water exports from SWP/CVP south Delta facilities would decrease entrainment for juvenile white sturgeon by 29% (51 fish) under Alternative 5A (A5A_ELT) relative to Existing Conditions (Table 11-5A-68). Impacts of water operations on entrainment of white sturgeon would be less than significant and no mitigation would be required.

Table 11-5A-68. Juvenile White Sturgeon Entrainment Index[a] at the SWP and CVP Salvage Facilities for Sacramento Valley Water Year-Types and Differences (Absolute and Percentage) between Model Scenarios for Alternative 5A

	Absolute Difference (Percent Difference)	
Water Year Type[b]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet and Above Normal	-89 (-31%)	-60 (-23%)
Below Normal, Dry, and Critical	-9 (-23%)	-4 (-12%)
All Years	-51 (-29%)	-30 (-19%)

Shading indicates entrainment increase of 10% or more.

[a] Estimated annual number of fish lost, based on non-normalized data.
[b] Sacramento Valley water year-types.

The impact and conclusion for predation associated with entrainment would be the same as described immediately. Because few juvenile white sturgeon are entrained at the south Delta, reductions in entrainment (29% reduction compared to Existing Conditions, representing 51 fish) under Alternative 5A would have little effect in affecting entrainment-related predation loss. Overall, the impact would be less than significant, because there would be little change in predation loss under Alternative 5A.

Impact AQUA-148: Effects of Water Operations on Spawning and Egg Incubation Habitat for White Sturgeon

In general, Alternative 5A would not affect spawning and egg incubation habitat for white sturgeon relative to NAA_ELT.

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon. Mean flows under A5A_ELT would generally be similar to or slightly greater than flows under NAA_ELT during all months and water year types of the period at Wilkins Slough, and would largely be similar to flows under NAA_ELT during February through April at Verona (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and Alternative 5A in any month or water year type throughout the period.

The number of days when temperatures in the Sacramento River at Hamilton City exceeded the analysis criterion (i.e., 61°F optimal and 68°F lethal threshold identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above each threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and A5A_ELT in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-69. For the 61°F threshold, there would be 4 fewer (13% fewer) "red" years under A5A_ELT than under NAA_ELT. For the 68°F threshold, there would be no difference between NAA_ELT and A5A_ELT in the number of years under each level of concern.

Table 11-5A-69. Differences and Percent Differences between Alternative 5A and Baseline Scenarios in the Number of Years by Level of Concern that are Based on Water Temperature Exceedances above the 61°F and 68°F Thresholds in the Sacramento River at Hamilton City, March through June

Level of Concern	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
61°F threshold		
Red	24 (300%)	-4 (-13%)
Orange	2 (13%)	-4 (-24%)
Yellow	-10 (-32%)	4 (19%)
None	-16 (-57%)	4 (33%)
68°F threshold		
Red	0 (NA)	0 (NA)
Orange	0 (NA)	0 (NA)
Yellow	2 (NA)	0 (0%)
None	-2 (-2%)	0 (0%)
NA = could not be calculated because the denominator was 0.		

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-5A-70, Table 11-5A-71). There would be little difference in total degree-days (all water years combined) exceeding the 61°F threshold between A5AELT and NAA_ELT during March and April. During May and June, total degree days above 61°F would be 191 and 267 degree-days lower (7% to 8% lower), respectively, under A5A_ELT. These totals would not be biologically meaningful to white sturgeon considering that, since there are 2,542 and 2,460 total days during May and June, respectively, over the 82-year modeling period, the reduction in average daily temperature would be <0.1°F. Total degree-days exceeding the 68°F threshold would be similar between NAA_ELT and A5A_ELT for all four months.

Table 11-5A-70. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 61°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	3 (NA)	0 (0%)
	Critical	0 (NA)	0 (NA)
	All	3 (NA)	0 (0%)
April	Wet	17 (142%)	-1 (-3%)
	Above Normal	15 (150%)	0 (0%)
	Below Normal	19 (317%)	-1 (-4%)
	Dry	42 (82%)	-1 (-1%)
	Critical	3 (300%)	-1 (-20%)
	All	96 (120%)	-4 (-2%)
May	Wet	480 (144%)	1 (0%)
	Above Normal	156 (72%)	-80 (-18%)
	Below Normal	245 (133%)	-24 (-5%)
	Dry	232 (115%)	-82 (-16%)
	Critical	220 (109%)	-6 (-1%)
	All	1,333 (117%)	-191 (-7%)
June	Wet	465 (81%)	-25 (-2%)
	Above Normal	175 (57%)	-32 (-6%)
	Below Normal	195 (92%)	-52 (-11%)
	Dry	243 (73%)	-87 (-13%)
	Critical	165 (44%)	-71 (-12%)
	All	1,243 (69%)	-267 (-8%)

NA = could not be calculated because the denominator was 0.

Table 11-5A-71. Differences between Baseline and Alternative 5A Scenarios in Total Degree-Days (°F-Days) by Month and Water Year Type for Water Temperature Exceedances above 68°F in the Sacramento River at Hamilton City, March through June

Month	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
March	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
April	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	0 (NA)	0 (NA)
May	Wet	9 (129%)	0 (0%)
	Above Normal	13 (NA)	0 (0%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	23 (329%)	0 (0%)
June	Wet	2 (NA)	0 (0%)
	Above Normal	0 (0%)	-1 (-50%)
	Below Normal	0 (NA)	0 (NA)
	Dry	0 (NA)	0 (NA)
	Critical	1 (NA)	0 (0%)
	All	3 (300%)	-1 (-20%)

NA = could not be calculated because the denominator was 0.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows at Thermalito Afterbay under A5A_ELT would generally be similar to or greater by up to 22% (March of dry years) than those under NAA_ELT, with minor exceptions. Mean flows at the confluence with the Sacramento River under A5A _ELT would be similar to flows under NAA_ELT.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period. Mean water temperatures differences would be negligible (<5%) between NAA_ELT and A5A_ELT at both locations throughout the period.

San Joaquin River

Mean flows in the San Joaquin River at Vernalis under A5A_ELT during February through May would be similar to flows under NAA_ELT for all water year types (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted for the San Joaquin River.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable habitat. Flows under Alternative 5A would generally be higher in the Feather River relative to the NAA_ELT and generally similar to flows under the NAA_ELT in the Sacramento and San Joaquin Rivers. Alternative 5A would not affect temperatures in any river during the white sturgeon spawning and egg incubation period.

CEQA Conclusion: Collectively, the modeling results of the Impact AQUA-148 CEQA analysis show that the difference between the CEQA baseline and Alternative 5A could be significant because, when compared to the CEQA baseline, the alternative would substantially reduce the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, the comparison to the NAA_ELT is a better approach because it isolates the effects of the alternative from those of sea level rise, climate change, and future water demand. Based on this identification of the actual increment of change attributable to the alternative, Alternative 5A would not affect the quantity and quality of spawning and egg incubation habitat for white sturgeon relative to the Existing Conditions.

Sacramento River

Flows in the Sacramento River at Wilkins Slough and Verona were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix B, *Supplemental Modeling for New Alternatives*). At Wilkins Slough, mean flows under A5A_ELT would generally be similar to those under Existing Conditions. At Verona, mean flow under A5A_ELT would be slightly lower (less than 10% lower) than flows under Existing Conditions during most months and water year types, with a maximum flow reduction of 14% in March of below normal years.

Mean water temperatures in the Sacramento River at Hamilton City were examined during the February through May white sturgeon spawning period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period.

The number of days when temperatures exceeded the analysis criterion (i.e., 61°F optimal and 68°F lethal threshold identified in Table 11-5A-10) by >0.5°F to >5°F in 0.5°F increments were determined for each month (March through June) and year of the 82-year modeling period. The combination of number of days and degrees above each threshold were further assigned a "level of concern" as defined in Table 11-5A-11. Differences between baselines and Alternative 5A in the highest level of concern across all months and all 82 modeled years are presented in Table 11-5A-69. For the 61°F threshold, there would be 24 more (300% increase) "red" years under A5A_ELT than under Existing Conditions. For the 68°F threshold, there would be negligible differences in the number of years under each level of concern between Existing Conditions and A5A_ELT.

Total degree-days exceeding 61°F and 68°F were summed by month and water year type at Hamilton City during March through June (Table 11-5A-70, Table 11-5A-71). Total degree-days (all water year types combined) exceeding the 61°F threshold under A5A_ELT would be 3 degree-days (percent change unable to be calculated due to division by 0) to 1,333 degree-days (117%) higher depending on month. The maximum increase, 1,333 degree-days, corresponds to an average increase in daily temperature of about 0.5°F, which would not have a biologically meaningful effect on white sturgeon. Total degree-days exceeding the 68°F threshold would differ little between Existing Conditions and A5A_ELT during March, April and June. During May, total degree-days would be 23 (329%) degree-days higher under A5A_ELT, which would not have a biologically meaningful effect on white sturgeon.

Feather River

Flows in the Feather River between Thermalito Afterbay and the confluence with the Sacramento River were examined during the February to May spawning and egg incubation period for white sturgeon (Appendix B, *Supplemental Modeling for New Alternatives*). Differences in mean flows between A5A_ELT and Existing Conditions at Thermalito Afterbay would vary greatly during the period. Mean flows during February and March of below normal and dry years would be up to 52% lower under A5A _ELT, and would be similar or moderately higher in other water year types. During April and May, flows would be up to 19% higher, depending on water year type. Mean flows at the confluence with the Sacramento River under A5A _ELT would generally be similar to or greater than flows under Existing Conditions, except in below normal years during February and March (16% and 13% lower, respectively). These modeling results indicate that there would be substantial reductions in flows during half of the spawning and egg incubation period in the Feather River under A5A _ELT relative to Existing Conditions.

Mean water temperatures in the Feather River below Thermalito Afterbay and at the confluence with the Sacramento River were examined during the February through May white sturgeon spawning and egg incubation period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would not differ between Existing Conditions and H4_ELT at either location throughout the period.

San Joaquin River

Flows under A5A_ELT were examined in the San Joaquin River at Vernalis during February through May. Mean flows under A5A _ELT would be slightly lower (up to 12% lower March of dry years) than those under Existing Conditions throughout the spawning and egg incubation period (Appendix B, *Supplemental Modeling for New Alternatives*).

Water temperature modeling was not conducted for the San Joaquin River.

Summary of CEQA Conclusion

Under Alternative 5A, there would be small to moderate reductions in flows in the Sacramento, Feather, and San Joaquin Rivers that would cause biologically meaningful effects to white sturgeon spawning and egg incubation habitat. Further, there would be increases in exceedances of NMFS temperature thresholds in the Sacramento River that would cause a biologically meaningful effect to white sturgeon spawning and egg incubation.

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially reduce the quantity and quality of suitable spawning and egg incubation habitat.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows under Alternative 5A would generally be higher in the Feather River and generally similar in the Sacramento and San Joaquin Rivers. Alternative 5A would not affect temperatures in any river during the white sturgeon spawning and egg incubation period. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Impact AQUA-149: Effects of Water Operations on Rearing Habitat for White Sturgeon

In general, Alternative 5A would not affect the quantity and quality of white sturgeon larval and juvenile rearing habitat relative to NAA_ELT.

Water temperature was used to determine the potential effects of Alternative 5A on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Sacramento River

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean monthly water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Feather River

Mean water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between NAA_ELT and A5A_ELT in any month or water year type throughout the period.

Water temperatures were not modeled in the San Joaquin River.

NEPA Effects: These modeling results indicate that the effect is not adverse because it does not have the potential to substantially reduce the amount of suitable rearing habitat. There would be no differences in water temperatures between the NEPA baseline and Alternative 5A in either the Sacramento or Feather Rivers throughout the white sturgeon rearing period.

CEQA Conclusion: In general, Alternative 5A would not affect the quantity and quality of white sturgeon larval and juvenile rearing habitat relative to the Existing Conditions.

Water temperature was used to determine the potential effects of Alternative 5A on white sturgeon larval and juvenile rearing habitat because larvae and juveniles are benthic oriented and, therefore, their habitat is more likely to be limited by changes in water temperature than flow rates.

Sacramento River

Mean water temperatures in the Sacramento River at Hamilton City were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be negligible differences (<5%) in mean water temperature between Existing Conditions and A5A_ELT in any month or water year type throughout the period except for a 5% increase in temperature during August of critical water years.

Feather River

Mean water temperatures in the Feather River at Honcut Creek were examined during the year-round white sturgeon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean water temperatures would be similar between A5A_ELT and Existing Conditions during all months and water year types except July of critical water years, in which the mean would be 6% higher under A5A_ELT. This increase would not be large or frequent enough to substantially affect white sturgeon.

Water temperatures were not modeled in the San Joaquin River.

Summary of CEQA Conclusion

These modeling results indicate that the effect is less than significant because it does not have the potential to substantially reduce the amount of suitable habitat and no mitigation is required. There would be very few differences in water temperatures between Alternative 5A and the CEQA baseline that, when combined, would not amount to a substantial effect to the white sturgeon population.

Impact AQUA-150: Effects of Water Operations on Migration Conditions for White Sturgeon

In general, the effects of Alternative 5A on white sturgeon migration conditions relative to NAA_ELT are not adverse.

Upstream of the Delta

Analyses for white sturgeon focused on the Sacramento River (North Delta to RM 143 — i.e., Wilkins Slough and Verona CALSIM nodes). Larval transport flows were represented by the average number of months per year that exceeded thresholds of 17,700 cfs (Wilkins Slough) and 31,000 cfs (Verona) (Table 11-5A-72). Exceedances of the 17,700 cfs threshold for Wilkins Slough and the 31,000 cfs threshold at Verona would be similar under A5A_ELT to those under NAA_ELT. Despite some large relative increases and decreases (up to 50%), the changes on an absolute scale would be small (up to 0.2 fewer months per year). Overall, the differences in the threshold exceedances between A5A_ELT and NAA_ELT were negligible.

Table 11-5A-72. Difference and Percent Difference in Number of Months between February and May in Which Flow Rates Exceed 17,700 and 5,300 cfs in the Sacramento River at Wilkins Slough and 31,000 cfs at Verona

	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wilkins Slough, 17,700 cfs[a]		
Wet	-0.1 (-4%)	0 (0%)
Above Normal	0.2 (12%)	0.1 (6%)
Below Normal	-0.1 (-25%)	0 (0%)
Dry	0 (0%)	0 (0%)
Critical	0 (0%)	0 (0%)
Wilkins Slough, 5,300 cfs[b]		
Wet	0 (0%)	0 (-1%)
Above Normal	-0.2 (-3%)	0.1 (1%)
Below Normal	-0.1 (-3%)	0.2 (4%)
Dry	0 (0%)	0.1 (1%)
Critical	0.2 (5%)	0.1 (2%)
Verona, 31,000 cfs[a]		
Wet	-0.4 (-16%)	-0.2 (-8%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-0.1 (-29%)	-0.1 (-17%)
Dry	-0.2 (-60%)	-0.1 (-50%)
Critical	0 (NA)	0 (NA)

[a] Months analyzed: February through May.
[b] Months analyzed: November through May.

The potential effects of changes in flow for white sturgeon under Alternative 5A was also examined by utilizing the positive correlation between year class strength and Delta outflow during April and May (USFWS 1995) under the assumption that the mechanism responsible for the relationship is that Delta outflow provides improved transport (e.g., for white sturgeon larvae or other early life stages) that results in improved year class strength. An examination of monthly average Delta outflow exceedances above 15,000 cfs, 20,000 cfs, and 25,000 cfs during April and May of wet and above-normal years was used to provide context for differences in through-Delta migration conditions, per recommendations by the Anadromous Fish Restoration Program (USFWS 1995). The percentage of months exceeding flow thresholds under A5A_ELT would consistently be lower than those under NAA_ELT (up to 50% lower) (Table 11-4A-114). These results indicate that, using the positive correlation between Delta outflow and year class strength, year class strength could be consistently lower under A5A_ELT than NAA_ELT.

Table 11-5A-73. Difference and Percent Difference in Percentage of Months in Which Average Delta Outflow is Predicted to Exceed 15,000, 20,000, and 25,000 Cubic Feet per Second in April and May of Wet and Above-Normal Water Years

Flow	Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
April			
15,000 cfs	Wet	-4 (-4%)	-4 (-4%)
	Above Normal	-8 (-9%)	-8 (-9%)
20,000 cfs	Wet	-4 (-5%)	-4 (-5%)
	Above Normal	-17 (-22%)	-17 (-22%)
25,000 cfs	Wet	-8 (-10%)	-8 (-10%)
	Above Normal	-17 (-29%)	-17 (-29%)
May			
15,000 cfs	Wet	-4 (-4%)	-4 (-4%)
	Above Normal	-33 (-40%)	-25 (-33%)
20,000 cfs	Wet	-15 (-18%)	-4 (-5%)
	Above Normal	-8 (-20%)	0 (0%)
25,000 cfs	Wet	-12 (-17%)	-4 (-6%)
	Above Normal	-17 (-50%)	-17 (-50%)
April/May Average			
15,000 cfs	Wet	-8 (-8%)	-4 (-4%)
	Above Normal	-17 (-17%)	-17 (-17%)
20,000 cfs	Wet	-4 (-4%)	-4 (-4%)
	Above Normal	-17 (-25%)	-8 (-14%)
25,000 cfs	Wet	-12 (-14%)	-4 (-5%)
	Above Normal	-8 (-17%)	-8 (-17%)

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period (Appendix B, *Supplemental Modeling for New Alternatives*). Mean flows at Verona under A5A_ELT would be lower by up to 25% relative to NAA_ELT during September and November and during July of critical years, and would be up to 15% greater during June. In most other months and water year types, flows would be similar, with minor exceptions (Appendix B, *Supplemental Modeling for New Alternatives*).

For adults, the average number of months per year during the November through May adult migration period in which flows in the Sacramento River at Wilkins Slough exceed 5,300 cfs was determined (Table 11-5A-72). The average number of months exceeding 5,300 cfs would be similar between A5A_ELT and NAA_ELT.

Through-Delta

As described for other species (e.g., Sacramento splittail in Impact AQUA-114), migration conditions in the southern Delta generally would be considerably improved relative to NAA_ELT, because of reduced frequency of reverse OMR flows.

NEPA Effects: Overall, these modeling results indicate that the effect would not be adverse because the alternative would not have substantial effects to white sturgeon migration habitat conditions. Upstream flows (above north Delta intakes) would generally be similar between Alternative 5A and NAA_ELT. The percentage of months exceeding the USFWS (1995) Delta outflow thresholds in April and May of wet and above normal years under Alternative 5A was appreciably lower than that under NAA_ELT. The exact mechanism for the correlation between white sturgeon year-class strength and Delta outflow is not known at this time and was found in the absence of north Delta intakes. One hypothesis suggests that the correlation is caused by high flows in the upper river resulting in improved migration, spawning, and rearing conditions in the upper river. In this case, there would be no causal link between Delta outflow and white sturgeon year-class strength. Another hypothesis suggests that the positive correlation is a result of higher flows through the Delta triggering more adult sturgeon to move up into the river to spawn. It is also possible that some combination of these factors are working together to produce the positive correlation between high flows and sturgeon year-class strength.

The scientific uncertainty regarding which mechanisms are responsible for the positive correlation between year class strength and river/Delta flow will be addressed through targeted research and monitoring to be conducted in the years leading up to the initiation of north Delta facilities operations as described in the adaptive management and monitoring program in Section 4.1 to inform decisions regarding Delta outflow such that the effect on white sturgeon Delta flow conditions would not be adverse. This uncertainty and the associated adaptive management and monitoring program, combined with similarities in upstream flow conditions between Alternative 5A and NAA_ELT, indicate that Alternative 5A would not be adverse to migration conditions for white sturgeon.

CEQA Conclusion: In general, Alternative 5A could reduce the quantity and quality of migration habitat for white sturgeon relative to Existing Conditions. However, as further described below in the Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demand. Informed by the NAA_ELT comparison, Alternative 5A would not affect the quantity and quality of migration habitat for white sturgeon.

Upstream of the Delta

The number of months per year with exceedances above the 17,700 cfs threshold for Wilkins Slough under A5A_ELT would be similar to those under Existing Conditions on the relative scale (%), except in below normal years (25% lower) (Table 11-5A-72). The number of months per year above 31,000 cfs at Verona under A5A_ELT would be up to 0.4 months lower (16% reduction) relative to Existing Conditions in wet years and, on an absolute scale, would be little different for other water year types. These changes would be small on the absolute scale (up to 0.4 fewer months per year).

For Delta outflow, the percent of months exceeding outflow thresholds under A5A_ELT would be consistently lower than those under Existing Conditions for each flow threshold, water year type, and month (4% to 50% lower on a relative scale) (Table 11-5A-73).

For juveniles, flows in the Sacramento River at Verona were examined during the year-round migration period. In general, mean flows under A5A_ELT would be slightly lower (up to 14%) relative to Existing Conditions during January through May and October and November, with some exceptions (Appendix B, *Supplemental Modeling for New Alternatives*). The flows would generally be similar to or slightly greater than flows under Existing Conditions during June, July and December, except for 24% lower flow in July of critical years. Flows during August and September would be up to 27% lower in below normal, dry, and critical years and up to 41% higher in wet and above normal years.

For adult migration, the average number of months exceeding 5,300 cfs under A5A_ELT would be similar (absolute scale) to the number of months under Existing Conditions (Table 11-5A-72).

Through-Delta

Given the improved OMR flows and the range of Delta outflows under Alternative 5A that could be refined to avoid negative impacts to green sturgeon (see NEPA Effects discussion above), the potential impact of Alternative 5A on in-Delta conditions for white sturgeon is considered less than significant, and no mitigation would be required.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade migration conditions for white sturgeon. Under Alternative 5A, exceedances of both the 31,000 cfs and 17,700 cfs flow thresholds in the Sacramento River would be small. Exceedance of Delta outflow thresholds would be lower under Alternative 5A, but there is high uncertainty that year class strength is due to Delta outflow or if both year class strength and Delta outflows are co-varying with another unknown factor. Juvenile migration flows in the Sacramento River at Verona would be up to 27% lower in several months relative to Existing Conditions. These reduced flows could have a substantial effect on the ability to migrate downstream, delaying or slowing rates of successful migration downstream and increasing the risk of mortality.

However, this interpretation of the biological modeling is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison in results between the alternative and NAA_ELT, is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, there would be negligible effects on upstream flows. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-151: Effects of Construction of Restoration Measures on White Sturgeon

Impact AQUA-152: Effects of Contaminants Associated with Restoration Measures on White Sturgeon

Impact AQUA-153: Effects of Restored Habitat Conditions on White Sturgeon

Impact AQUA-154: Effects of Methylmercury Management on White Sturgeon (Environmental Commitment 12)

Impact AQUA-157: Effects of Localized Reduction of Predatory Fish on White Sturgeon (Environmental Commitment 15)

Impact AQUA-158: Effects of Nonphysical Fish Barriers on White Sturgeon (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on white sturgeon for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Pacific Lamprey

Construction and Maintenance of Water Maintenance Facilities

Impact AQUA-163: Effects of Construction of Water Conveyance Facilities on Pacific Lamprey

The potential effects of construction of the water conveyance facilities on Pacific lamprey would be similar to those described for Alternative 4A (Impact AQUA-163) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to Pacific lamprey.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-163, and as discussed above, the effect would not be adverse for Pacific lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-163, and as discussed above, the impact of the construction of water conveyance facilities on Pacific lamprey would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-164: Effects of Maintenance of Water Conveyance Facilities on Pacific Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-164 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-164 would not be adverse for Pacific lamprey under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-164 for Pacific lamprey under Alternative 4A, the impact of the maintenance of water conveyance facilities on Pacific lamprey would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-165: Effects of Water Operations on Entrainment of Pacific Lamprey

Water Exports

The potential entrainment impacts of Alternative 5A on Pacific lamprey would be the same as described above for Alternative 4A for operating a new SWP/CVP north Delta intake (Impact AQUA-165). State of the art fish screens would limit potential entrainment and the effect would not be adverse.

The analysis of Pacific lamprey and river lamprey entrainment at the SWP/CVP south Delta facilities is combined because the salvage facilities do not distinguish between the two lamprey species. Under Alternative 5A, average annual entrainment of lamprey at the south Delta export facilities, as estimated by the salvage-density method, would be reduced by about 9% (288 fish) (Table 11-5A-74) across all water year types compared to NAA_ELT. Therefore, Alternative 5A would not have adverse effects on lamprey.

Predation Associated with Entrainment

Lamprey predation loss at the south Delta facilities is assumed to be proportional to entrainment loss. Average pre-screen predation loss for fish entrained at the south Delta is 75% at Clifton Court Forebay and 15% at the CVP. Lamprey entrainment to the south Delta would be reduced by 9% compared to NAA and predation losses would be expected to be reduced at a similar proportion.

Predation at the north Delta would be increased due to the construction of the proposed water export facilities on the Sacramento River. The effect on lamprey from predation loss at the north Delta is unknown because of the lack of knowledge about their distribution and population abundances in the Delta. The overall effect of predation loss on lamprey is considered not adverse.

CEQA Conclusion: As described above, annual entrainment losses of lamprey would be decreased by 9% (311 fish) under Alternative 5A (A5A_ELT) relative to Existing Conditions. Impacts on Pacific lamprey are expected to be considered less than significant due to expected reductions in entrainment, and no mitigation would be required.

Table 11-5A-74. Lamprey Annual Entrainment Index[a] at the SWP and CVP Salvage Facilities for Alternative 5

	Absolute Difference (Percent Difference)	
Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
All Years	-311 (-9%)	-288 (-9%)
	Shading indicates entrainment increase of 10% or more.	

[a] Number of fish lost, based on non-normalized data, for all months.

The impact and conclusion for predation associated with entrainment would be the same as described immediately above because the additional predation losses associated with the proposed north Delta intake would be partially offset by the reduction in predation loss at the south Delta. The relative impact of predation loss on the lamprey population is unknown since there is little available knowledge on their distribution and abundance in the Delta. The impact is considered to be less than significant. No mitigation would be required.

Impact AQUA-166: Effects of Water Operations on Spawning and Egg Incubation Habitat for Pacific Lamprey

In general, effects of Alternative 5A would not affect the quantity and quality of Pacific lamprey spawning and egg incubation habitat relative to NAA_ELT.

Flow-related impacts on Pacific lamprey spawning habitat were evaluated by estimating effects of flow alterations on egg exposure, called redd dewatering risk, and effects on water temperature. A redd is a gravel-covered nest of eggs; Pacific lamprey eggs take between 18 and 49 days to incubate and must remain covered by sufficient water for that time. Rapid reductions in flow can dewater redds leading to mortality. Locations for each river used in the dewatering risk analysis were based on available literature, personal conversations with agency experts, and spatial limitations of the CALSIM II model, and include the Sacramento River at Keswick, Sacramento River at Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and American River at Nimbus Dam and at the confluence with the Sacramento River. Pacific lamprey spawn in these rivers between January and August so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage). Water temperature results from the SRWQM and the Reclamation Temperature Model were used to assess the exceedances of water temperatures under all model scenarios in the upper Sacramento, Trinity, Feather, American, and Stanislaus rivers.

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, substrate) of Pacific lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, the change in month-over-month flows (i.e., changes in flow levels expressed with respect to the previous month) is used as a surrogate for a more formal analysis, and a month-over-month flow reduction of 50% was chosen as a best professional estimate of flow conditions in which redd dewatering is expected to begin to occur, but does not estimate empirically derived redd dewatering events. As such, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, January to August.

Flows in all rivers evaluated indicate an increase in redd cohorts exposed to month-over-month flow reductions between January and August for Alternative 5A compared to NAA_ELT would only occur in the Feather River (24 cohorts or 21% greater), American River at Nimbus Dam (7 cohorts or 7% greater and American River at the Sacramento River confluence (14 cohorts or 12% greater) (Table 11-5A-75). However, because the total number of cohorts would be 656 in the each river, these effects would be negligible (<4%) to the Pacific lamprey populations in these rivers. Therefore, these results indicate that there would be no effect of Alternative 5A on the number of Pacific lamprey redd cohorts predicted to experience a month-over-month change in flow of greater than 50% in all rivers.

Table 11-5A-75. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts[a]

Location	Comparison[b]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River at Keswick	Difference	14	2
	Percent Difference	25%	3%
Sacramento River at Red Bluff	Difference	12	2
	Percent Difference	22%	3%
Trinity River down-stream of Lewiston	Difference	-1	1
	Percent Difference	-1%	1%
Feather River at Thermalito Afterbay	Difference	-13	24
	Percent Difference	-9%	21%
American River at Nimbus Dam	Difference	29	7
	Percent Difference	35%	7%
American River at Sacramento River confluence	Difference	37	14
	Percent Difference	39%	12%
Stanislaus River at Sacramento River confluence	Difference	3	-1
	Percent Difference	5%	-2%

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.

[b] Positive values indicate a higher value in A5A_ELT than in the baseline.

Significant reduction in survival of eggs and embryos of Pacific lamprey have been observed at 22°C (71.6°F; Meeuwig et al. 2005). Therefore, in the Sacramento River, this analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive 2 month periods during which at least one month exceeds 22°C (71.6°F) using monthly averaged data from the Reclamation temperature model. Each individual day or month starts a new "egg cohort" such that there are 19,928 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from January 1 through August 31, and 648 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Exact spawning locations of Pacific lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In most locations, egg cohort exposure would not differ between NAA_ELT and Alternative 5A (Table 11-5A-76). However, the number of cohorts exposed to 22°C (71.6°F) or greater under Alternative 5A compared to NAA_ELT would be 63% higher in the Feather River below Thermalito Afterbay, 100% higher in the Trinity River at North Fork and 10% higher in the American River at Sacramento River Confluence. The increase in the Sacramento River is negligible considering that it represents a difference of <0.1% of the total number of egg cohorts evaluated (19,928 cohorts). Additionally, the increase in the Trinity River is negligible considering that it represents a difference of <2% of the total number of egg cohorts evaluated (648 cohorts).

Table 11-5A-76. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Egg Cohort Temperature Exposure[a]

Location	EXISTING CONDITIONS vs. 5A_ELT	NAA_ELT vs. 5A_ELT
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	464 (NA)	-19 (-4%)
Trinity River at Lewiston	2 (NA)	0 (0%)
Trinity River at North Fork	-2 (NA)	2 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	41 (171%)	25 (63%)
American River at Nimbus	35 (318%)	-5 (-10%)
American River at Sacramento River Confluence	109 (195%)	15 (10%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	22 (1,100%)	-1 (-4%)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F during January to August on at least one day during a 49-Day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for each model scenario in other rivers. Positive values indicate a higher value in the proposed project than in EXISTING CONDITIONS or NAA_ELT.

NEPA Effects: Collectively, these modeling results indicate that, during the ELT, the effect is not adverse because Alternative 5A does not have the potential to substantially degrade suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. Flow reductions that increase redd dewatering risk would be of similar or lower frequency under Alternative 5A relative to the NEPA baseline, or would be higher but not at a biologically relevant level, in all locations. There would be increased exposure risk of eggs to elevated temperatures in the Feather River below Thermalito Afterbay and American River at the Sacramento River confluence, but these isolated results are not expected to cause a biologically meaningful effect to the Pacific lamprey population.

During the LLT, there would be an increased risk of dewatering of Pacific lamprey eggs and increased exposure to water temperatures above their thermal limit in the Feather River relative to the NEPA baseline in the LLT to a level that is considered adverse. This effect is described in detail in the evaluation of Impact AQUA-166 in Alternative 5.

CEQA Conclusion: In general, Alternative 5A would not affect the quantity and quality of Pacific lamprey spawning and egg incubation habitat relative to the Existing Conditions.

Rapid reductions in flow can dewater redds leading to mortality. In the Sacramento American Rivers, Alternative 5A would increase in the number of redd cohorts predicted to experience a month-over-month change in flow of greater than 50% relative to Existing Conditions (Table 11-5A-75). The small values (12 and 14 cohorts) in the Sacramento River would not translate into biologically meaningful effects considering the total number of redd cohorts evaluated (up to 14 of 656 cohorts, or <2%). Changes would be most substantial for the American River (increased risk of dewatering exposure to 29 cohorts or 35% at Nimbus Dam, and 37 cohorts or 39% at the confluence). For the Feather River, there are 13 fewer redd cohorts (-9%) predicted to experience a month-over-month change in flow of greater than 50% for Alternative 5A relative to Existing Conditions. Minimal effects are predicted for the Trinity River (-1%) and Stanislaus River (5%). These results indicate that Alternative 5A would not have biologically meaningful effects on Pacific lamprey redd dewatering risk in the Sacramento, Feather, and Trinity Rivers; but would affect dewatering risk in the American River (maximum increases of 29 cohorts or 35% at Nimbus Dam and 37 cohorts or 39% at the Sacramento River confluence).

The number of egg cohorts exposed to 22°C (71.6°F) under Alternative 5A would be greater than that under Existing Conditions in most locations (Table 11-5A-76). This would cause a substantial reduction in habitat conditions for Pacific lamprey relative to Existing Conditions.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the modeling results of the Impact AQUA-166 CEQA analysis indicate that the difference between the CEQA baseline and Alternative 5A could be significant because, under the CEQA baseline, the alternative could substantially degrade suitable spawning habitat and substantially reduce the number of fish as a result of egg mortality. Redd dewatering risk and elevated water temperature exposure under Alternative 5A would be higher relative to Existing Conditions, reducing spawning and egg incubation habitat conditions.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on Pacific lamprey spawning and egg incubation habitat conditions would be less than significant and no mitigation is necessary.

During the LLT, there would be an increased risk of dewatering of Pacific lamprey eggs and increased exposure to water temperatures above their thermal limit in the Feather River relative to the CEQA baseline to a level that is considered adverse. This effect is described in detail in the evaluation of Impact AQUA-166 in Alternative 5.

Impact AQUA-167: Effects of Water Operations on Rearing Habitat for Pacific Lamprey

In general, Alternative 5A would have negligible effects on Pacific lamprey rearing habitat conditions relative to NAA_ELT.

Flow-related impacts to Pacific lamprey rearing habitat were evaluated by estimating effects of flow alterations on ammocoete exposure, called ammocoete stranding risk. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of effects were made for ammocoete cohorts in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. An ammocoete is the filter-feeding larval stage of the lamprey that remains relatively immobile in the sediment in the same location for 5 to 7 years, after which it migrates downstream. During the upstream rearing period there is potential for ammocoete stranding from rapid reductions in flow.

The analysis of ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (January through August) and spend 7 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period.

Effects of Alternative 5A on Pacific lamprey ammocoete stranding were analyzed by calculating month-over-month flow reductions for the Sacramento River at Keswick for January through August (Table 11-5A-77). Results indicate either no effect (0%) or negligible effects (<5%) in the occurrence of flow reductions attributable solely to the project.

Table 11-5A-77. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	0	4
-65%	0	-2
-70%	4	0
-75%	1	2
-80%	1	0
-85%	0	0
-90%	NA	NA

NA = all values were 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

Results of comparisons for the Sacramento River at Red Bluff provide similar conclusions, with slightly more variability in results (Table 11-5A-78). Results for Alternative 5A compared to

NAA_ELT indicate no change (0%), negligible increases (<5%), and small decreases (-1%) attributable to the project that would not have biologically meaningful effects on stranding risk.

Table 11-5A-78. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	4	4
-60%	1	-1
-65%	2	1
-70%	3	0
-75%	10	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

Comparisons for the Trinity River indicate no effect (0%) or small increases (1 to 9%) attributable to the project (Table 11-5A-79).

Table 11-5A-79. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	21	0
-80%	20	1
-85%	18	0
-90%	38	9

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

In the Feather River, all comparisons resulted in no difference (0%), negligible increases (2%), small increases (11%) or reductions in the occurrence of flow reductions between 50-90% (Table 11-5A-80).

Table 11-5A-80. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	28	11
-90%	-20	-20

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

Comparisons for the American River at Nimbus Dam (Table 11-5A-81) and at the confluence with the Sacramento River (Table 11-5A-82) indicate negligible increases (0 to 2%), small to moderate increases (12 to 41%) or negligible decreases (-3%) attributable to the project.

Table 11-5A-81. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	2	1
-70%	26	-3
-75%	101	22
-80%	273	36
-85%	104	0
-90%	-100	N/A

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

Table 11-5A-82. Percent Difference between Model Scenarios in the Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	1
-70%	8	2
-75%	31	12
-80%	220	13
-85%	243	41
-90%	143	19

[a] Negative values indicate reduced cohort exposure, a benefit of Alternative 5A.

These results indicate that Alternative 5A would primarily have no effect (0%), negligible effects (<5%), or decreases in stranding risk that would be beneficial to on rearing success. Isolated occurrences of small increases in dewatering for some flow reduction categories would not have biologically meaningful effects. There would also be small to moderate beneficial effects in the Feather River (decreased occurrence of flow reductions to -20%) due to project-related effects of Alternative 5A.

To evaluate water temperature-related effects of Alternative 5A on Pacific lamprey ammocoetes, we examined the predicted number of ammocoete "cohorts" that experience water temperatures greater than 71.6°F for at least one day in the Sacramento River (because daily water temperature data are available) or for at least one month in the Feather, American, Stanislaus, and Trinity rivers over a 7 year period, the maximum likely duration of the ammocoete life stage (Moyle 2002). Each individual day or month starts a new "cohort" such that there are 18,244 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being "born" every day each year from January 1 through August 31, and 593 cohorts for the other rivers using monthly data over the same period.

In general, there would be no differences in the number of ammocoete cohorts exposed to temperatures greater than 71.6°F in each river (Table 11-5A-83).There would be no difference in exposure between NAA_ELT and Alternative 5A in the Trinity River at Lewiston, but there would be 56 more cohorts (100% increase) exposed at North Fork. In addition, there would be 6 more cohorts (1% increase) exposed under Alternative 5A in the Feather River below Thermalito Afterbay, and there would be no change in cohorts exposed at Fish Barrier Dam. There would be 38 fewer cohorts (-8%) exposed under Alternative 5A in the American River at Nimbus Dam and 17 more cohorts (3%) exposed at the Sacramento River Confluence. Overall, the range of increases and decreases will balance out within rivers such that there would be no overall effect on Pacific lamprey ammocoetes.

Table 11-5A-83. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F in at Least One Day or Month

Location	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	7495 (NA)	250 (3%)
Trinity River at Lewiston	56 (NA)	0 (0%)
Trinity River at North Fork	112 (NA)	56 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	100 (26%)	6 (1%)
American River at Nimbus	241 (124%)	-38 (-8%)
American River at Sacramento River Confluence	159 (37%)	17 (3%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	282 (504%)	-1 (-0.3%)

NA = could not be calculated because the denominator was 0.

[a] Positive values indicate a higher value in Alternative 5A than in EXISTING CONDITIONS or NAA_ELT.

[b] Based on daily data; all other locations use monthly data; 1922–2003.

NEPA Effects: These modeling results indicate that the effect would not be adverse because it would not substantially degrade rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. There would be negligible effects on ammocoete cohort survival under Alternative 5A relative to the NEPA baseline for all locations. There would be increase and decreases in exposure risk of ammocoetes to elevated temperatures within each river evaluated that would balance out such that there would be no net effect on Pacific lamprey ammocoetes.

CEQA Conclusion: In general, under Alternative 5A water operations, the quantity and quality of Pacific lamprey rearing habitat would not be affected relative to the CEQA baseline.

Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of Alternative 5A to Existing Conditions for the Sacramento River at Keswick indicate negligible changes (<5%) in occurrence of flow reductions for all flow reduction categories (Table 11-5A-77). Comparisons for the Sacramento River at Red Bluff indicate no effect (0%) or negligible effects (<5%) for all flow reduction categories except for 75% and 80% flow reductions (increases of 10% and 23%, respectively) (Table 11-5A-78). Increases of 20–38% are predicted for flow reduction categories from 75% to 90% for the Trinity River (Table 11-5A-79) based on increases from approximately 83 to 132 ammocoete cohorts exposed to stranding risk. In the Feather River, all comparisons resulted in no difference (0%), moderate increases (28%) or reductions in the occurrence of flow reductions between 50-90% (Table 11-5A-80). In the American River, there would be large increases in the occurrence of flows reductions in the 75% to 90% range (Table 11-5A-81, Table 11-5A-82).

The number of Pacific lamprey ammocoete cohorts exposed to 71.6°F temperatures under Alternative 5A would be substantially higher than those under Existing Conditions in at least one location in all rivers evaluated (Table 11-5A-83).

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the modeling results of the Impact AQUA-167 CEQA analysis indicate that that the difference between the CEQA baseline and Alternative 5A could be significant because, under the CEQA baseline, the alternative could substantially degrade rearing habitat and substantially reduce the number of fish as a result of ammocoete mortality. Increased water temperatures would increase stress and reduce survival of lamprey ammocoetes. In the Trinity and American Rivers, there would be increases in the number of cohorts exposed to stranding risk due to increased flow reductions. Increased stranding risk in these rivers would increase the risk of desiccation and reduce survival of ammocoete cohorts. Exposure of ammocoetes to elevated temperatures under Alternative 5A would be substantially higher than those under Existing Conditions in most evaluated.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on Pacific lamprey rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-168: Effects of Water Operations on Migration Conditions for Pacific Lamprey

In general, effects of Alternative 5A would be negligible relative to NAA_ELT based on a prevalence of negligible effects or beneficial increases in mean monthly flow for most of the locations analyzed, which would have a beneficial effect on migration conditions.

After 5–7 years, Pacific lamprey ammocoetes migrate downstream and become macropthalmia (juveniles) once they reach the Delta. Migration generally is associated with large flow pulses in winter months (December through March) (USFWS unpubl. data) meaning alterations in flow have the potential to affect downstream migration conditions. The effects of Alternative 5A on seasonal migration flows for Pacific lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the migration pathways of Pacific lamprey during the likely migration period (December through May) were examined for the Sacramento River at Rio Vista and Red Bluff, the Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

CALSIM flow data form the basis for the summary of changes in adult lamprey migration flows.

Sacramento River

Macropthalmia

The difference in mean monthly flow rate for the Sacramento River at Rio Vista for December to May for Alternative 5A compared to NAA_ELT indicates reductions in flow for most months/water year types in the migration period with persistent flow reductions of up to -10% depending on the specific month and water year (Appendix B, *Supplemental Modeling for New Alternatives*). The project-related decreases in flow in the Sacramento River at Rio Vista could adversely affect outmigrating macropthalmia during these months if macropthalmia depend on flow to immigrate, but there is no scientific evidence of this.

For the Sacramento River at Red Bluff, the difference in mean monthly flow rate for Alternative 5A compared to NAA_ELT indicate negligible effects on flow attributable to the project for December and February through April and increases in flow attributable to the project during January and May of up to 6% (Appendix B, *Supplemental Modeling for New Alternatives)*. The project-related increases in flow in the Sacramento River at Red Bluff would have a beneficial effect on migration conditions.

These results indicate that project-related effects of Alternative 5A on flow consist of negligible effects (<5%), or small increases in flow that would have a beneficial effect on migration in the Sacramento River at Red Bluff, but that effects for Sacramento River at Rio Vista would consist primarily of reductions in flow, including during drier water years, for much of the macropthalmia migration period, although it is unknown whether these reductions would adversely affect outmigrating macropthalmia.

Adults

For the Sacramento River at Red Bluff for the time-frame January to June (Appendix B, *Supplemental Modeling for New Alternatives*), effects of Alternative 5A on mean monthly flow indicate effects would be negligible (<5%), except for one water year in January (5.7%) and May (5.9%). Increases in flow would have a beneficial effect on migration conditions.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) indicate negligible (<6%) project-related effects or small to moderate increases in flow (to 33%) for December through May. Increases in mean monthly flow may be beneficial for migration conditions although there is no scientific evidence that this is true. The project would not have adverse effects on macropthalmia in the Feather River at the confluence.

Adults

For the Feather River at the confluence with the Sacramento River, January to June (Appendix B, *Supplemental Modeling for New Alternatives*), mean monthly flows under Alternative 5A are variable, with primarily negligible changes (<5%) for most months and water year types, with the exception of moderate increases for most water year types for December (7-33%) and June (11-28%) that would have beneficial effects on migration conditions.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) indicate negligible effects (<5%) or small to moderate increases in flows in most months, with the exception of small decreases during January in below normal (-5.8%) years that would not have biologically meaningful effects on migration conditions.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River for January to June (Appendix B, *Supplemental Modeling for New Alternatives*) indicate predominantly negligible effects (<5%) attributable to the project with the exception of increased flows in April (9%), May (6%) and June (15–36%) which would enhance migration especially during drier water year types, and small decreases in flow (-6%) during January in below normal years that would not have biologically meaningful effects on migration conditions.

NEPA Effects: Collectively, these modeling results indicate that the effect is not adverse because it would not substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish. Flows in the Sacramento River at Rio Vista under Alternative 5A would be reduced relative to NAA_ELT, with persistent flow reductions to -30% throughout the migration period that could affect conditions for outmigrating macropthalmia at that location. The degree to which this reduction would affect lamprey is unknown, but given the predominance of negligible effects in other locations, it is not likely that reduced flows at this location would affect the Pacific lamprey population. Effects of Alternative 5A in the other locations analyzed would consist primarily of negligible effects (<5%), infrequent, small decreases in flow (to -7%) that would not have biologically meaningful effects, and small to substantial (to 73%) increases in flow that would have beneficial effects on migration conditions.

CEQA Conclusion: In general, the effect of Alternative 5A on Pacific lamprey migration conditions would be negligible relative to the Existing Conditions.

Sacramento River

Macropthalmia

Comparisons of mean monthly flow rates in the Sacramento River at Rio Vista (Appendix B, *Supplemental Modeling for New Alternatives*) for December to May for Alternative 5A relative to Existing Conditions indicate reductions in flow ranging from -5% to -29% in most water years for each of these months. These results indicate that effects of Alternative 5A on flow could have negative effects on outmigrating macropthalmia in the Sacramento River. Comparisons for the Sacramento River at Red Bluff (Appendix B, *Supplemental Modeling for New Alternatives*) indicate negligible (<5%) effects or small increases or decreases in flow (± 10%) that would not have biologically meaningful effects on migration conditions. Therefore, Alternative 5A would not have biologically meaningful negative effects on outmigrating macropthalmia at this location.

Adults

Comparisons of mean monthly flow for the Sacramento River at Red Bluff (Appendix B, *Supplemental Modeling for New Alternatives*) during the Pacific lamprey adult migration period from January through June indicate that for most months and water year types, flows under Alternative 5A would be similar to (<5% difference) flows under Existing Conditions, with infrequent occurrences of small-scale (to 10%) increases or decreases in flow that would not have biologically meaningful effects on migration conditions. Therefore, effects of Alternative 5A consist of negligible effects or increases in flow that would have beneficial effects, and small reductions in flow that would not have biologically meaningful effects.

Feather River

Macropthalmia

Comparisons for the Feather River at the confluence (Appendix B, *Supplemental Modeling for New Alternatives*) for December to May indicate variable effects by month and water year type, with increases in flow during December in above normal, below normal, and dry years (to 16%) and negligible decreases in wet and critical years (to -4%), generally increases in flow during January through March in wetter years (to 12%) and decreases during some drier water year types (to -17%), and negligible effects during April and May except for a decrease (-10%) during May in wet years. Increases in flow would have beneficial effects on migration conditions, and decreases in wetter water years would not have significant effects on migration. Based on this limited occurrence of flow decreases at times that would be most critical for migration, and the prevalence of negligible effects or flow increases for most of the migration period, effects of Alternative 5A on flows would not have biologically meaningful effects on macropthalmia migration in the Feather River.

Adults

Comparisons of mean monthly flow for the Feather River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) for January to June indicate variable effects of Alternative 5A depending on the month and water year type, with primarily negligible effects (<5%) and small increases or decreases in flow (to about 13%) that would not have biologically meaningful effects on migration conditions, with the exception of more substantial increases in flow during June in below normal (23%) years. These flow increases would have a beneficial effect on migration conditions. There would be more substantial decreases in flow during January in below normal years (-17%) and February in below normal years (-16%). These flow reductions are isolated occurrences of relatively small magnitude and would therefore not have biologically meaningful effects on migration conditions. Therefore, effects of Alternative 5A on flow would not affect migration conditions in the Feather River.

American River

Macropthalmia

Comparisons for the American River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) for December to May indicate negligible effects (<5%) or decreases in flow during December and April, increases in flow during January through March for some wetter water year types (to 15%) and decreases for some drier water year types (to -22%), and decreases to -21% during May in all water year types.

Adults

Comparisons of mean monthly flow for the American River at the confluence with the Sacramento River (Appendix B, *Supplemental Modeling for New Alternatives*) for January to June indicate variable effects of Alternative 5A depending on the month and water year type, with meaningful changes in flow (±>5%) consisting of increases up to 14% (February, above normal years) that would have beneficial effects on migration conditions, and decreases to -36% in drier years. There would be primarily negligible effects (<5%) or small decreases (to -9%) during April. There would be decreases (to 21%) in all but critical years (increase of 11%) during May, and decreases during June in wet (-24%) and critical (-36%) years, negligible effects in above normal years, and increases (to 17%) in the remaining water years.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact is not significant because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish, and no mitigation is necessary. Effects of Alternative 5A compared to Existing Conditions during the January to June adult Pacific lamprey migration period consist predominantly of negligible effects (<5%), increases in flow, or small, isolated occurrences of decreases in flow for some water year types that would not have biologically meaningful effects on migration conditions. Flows at Rio Vista would decrease for much of the period. However, the degree to which this reduction would affect lamprey is unknown, but given the predominance of negligible effects in other locations, it is not likely that reduced flows at this location would affect the Pacific lamprey population.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-169: Effects of Construction of Restoration Measures on Pacific Lamprey

Impact AQUA-170: Effects of Contaminants Associated with Restoration Measures on Pacific Lamprey

Impact AQUA-171: Effects of Restored Habitat Conditions on Pacific Lamprey

Impact AQUA-172: Effects of Methylmercury Management on Pacific Lamprey (Environmental Commitments 12)

Impact AQUA-175: Effects of Localized Reduction of Predatory Fish on Pacific Lamprey (Environmental Commitments 15)

Impact AQUA-176: Effects of Nonphysical Fish Barriers on Pacific Lamprey (Environmental Commitments 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on Pacific lamprey for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

River Lamprey

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-181: Effects of Construction of Water Conveyance Facilities on River Lamprey

The potential effects of construction of the water conveyance facilities on river lamprey would be similar to those described for Alternative 4A (Impact AQUA-181) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to river lamprey.

NEPA Effects: As concluded for Alternative 4A, Impact AQUA-181, and as discussed above, the effect would not be adverse for river lamprey.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-181, and as discussed above, the impact of the construction of water conveyance facilities on river lamprey would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-182: Effects of Maintenance of Water Conveyance Facilities on River Lamprey

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-182 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-182 would not be adverse for river lamprey under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: Compared to Alternative 5A, Alternative 4A has a greater extent of infrastructure related to the conveyance facilities (see NEPA Effects conclusion above). As described in the discussion of Impact AQUA-182 for river lamprey under Alternative 4A, the impact of the maintenance of water conveyance facilities on river lamprey would be less than significant and no mitigation is required.

Water Operations of Water Conveyance Facilities

Impact AQUA-183: Effects of Water Operations on Entrainment of River Lamprey

Water Exports

The potential effects of water operations on river lamprey entrainment would be similar to those discussed above for Pacific lamprey. South Delta entrainment and associated predation would be reduced around 9% (Table 11-5A-48). Entrainment potential at the north Delta intake would be limited because of the fish screens, while there would be some risk of predation near the screens. As discussed for Pacific lamprey, Alternative 5A would not have adverse effects on lamprey.

CEQA Conclusion: As described above for Pacific lamprey, annual south Delta entrainment losses of lamprey would be decreased by 9% under Alternative 5A (A5A_ELT) relative to Existing Conditions. Associated predation loss would also be expected to decrease. Entrainment at the north Delta intake would be limited by the fish screens, with some predation possibly occurring. Impacts of water operations on entrainment of river lamprey are considered less than significant due to expected reductions in entrainment and no mitigation would be required.

Impact AQUA-184: Effects of Water Operations on Spawning and Egg Incubation Habitat for River Lamprey

In general, Alternative 5A would not affect the quantity and quality of river lamprey spawning habitat relative to NAA_ELT.

Flow-related impacts to river lamprey spawning habitat were evaluated by estimating effects of flow alterations on redd dewatering risk as described for Pacific lamprey with appropriate time-frames for river lamprey incorporated into the analysis. Lower flows can reduce the instream area available for spawning and rapid reductions in flow can dewater redds leading to mortality. The same locations were analyzed as for Pacific lamprey: the Sacramento River at Keswick and Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and American River at Nimbus Dam and at the confluence with the Sacramento River. River lamprey spawn in these rivers between February and June so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage).

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, as described for Pacific lamprey, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, February to June.

Flows in all rivers evaluated indicated no change (0%) or negligible change (<5%) in redd cohorts exposed (Table 11-5A-85). There would be no biologically meaningful effects on spawning success attributable to the project.

Table 11-5A-85. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd Cohorts[a]

Location	Comparison[b]	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Sacramento River at Keswick	Difference	3	0
	Percent Difference	9.4%	0.0%
Sacramento River at Red Bluff	Difference	4	1
	Percent Difference	10.8%	2.5%
Trinity River downstream of Lewiston	Difference	-2	0
	Percent Difference	-2.8%	0.0%
Feather River Below Thermalito Afterbay	Difference	-2	-2
	Percent Difference	-2.9%	-2.9%
American River at Nimbus	Difference	7	-2
	Percent Difference	12.7%	-3.1%
American River at Sacramento River confluence	Difference	14	2
	Percent Difference	23.7%	2.8%
Stanislaus River at Sacramento River confluence	Difference	2	-1
	Percent Difference	3.6%	-1.7%

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%.
[b] Positive values indicate a higher value in A5A_ELT than in EXISTING CONDITIONS or NAA_ELT).

River lamprey generally spawn between February and June (Beamish 1980, Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey “adults need… temperatures [that] do not exceed 25°C,” although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from USRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau’s temperature model. Each individual day or month starts a new “egg cohort” such that there are 12,320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

For both thresholds, there would be few differences in egg cohort exposure between NAA_ELT and A5A_ELT among all sites (Table 11-5A-86). Differences of 2 cohorts in the Sacramento River at Hamilton City are negligible to the population considering the total number of cohorts is 12,320. In the Feather River below Thermalito Afterbay, there would be 5 more cohorts (38% increase) exposed to the 71.6°F threshold under Alternative 5A relative to NAA_ELT, although differences at the 77°F threshold would be negligible. In addition, there would be no differences between NAA_ELT and Alternative 5A in egg exposure at the Fish Barrier Dam in the Feather River. Overall, except at one location in the Feather River for the more conservative threshold temperature (71.6°F), these results indicate that there would be no differences in egg exposure to elevated temperatures under Alternative 5A.

Table 11-5A-86. Differences (Percent Differences) between Model Scenarios in River Lamprey Egg Cohort Temperature Exposure

Location	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
71.6°F Threshold		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	99 (NA)	-2 (-2%)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	2 (NA)	1 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	9 (100%)	5 (38%)
American River at Nimbus	11 (220%)	-3 (-16%)
American River at Sacramento River Confluence	26 (93%)	-3 (-5%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	11 (1,100%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	0 (NA)	0 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	2 (NA)	2 (NA)
American River at Nimbus	1 (NA)	0 (0%)
American River at Sacramento River Confluence	3 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F and 77°F during February to June on at least one day during a 49-Day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for each model scenario in other rivers. Positive values indicate a higher value in the proposed project than in EXISTING CONDITIONS or NAA_ELT.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially degrade rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. Alternative 5A would cause minor effects to river lamprey redd dewatering and exposure to elevated water temperatures that would not be substantial.

CEQA Conclusion: In general, Alternative 5A would not affect the quantity and quality of river lamprey spawning habitat relative to the Existing Conditions.

Lower flows can reduce the instream area available for spawning and rapid reductions in flow can dewater redds leading to mortality. Effects of Alternative 5A on flow reductions during the river lamprey spawning period from February to June in the Sacramento River and American River consist of increases in river lamprey redd cohort dewatering risk relative to Existing Conditions (Table 11-5A-85). Changes would be most substantial for the American River (increased risk of dewatering exposure to 7 cohorts or 13% at Nimbus Dam, and 14 cohorts or 24% at the confluence). For the Trinity River there are 2 fewer redd cohorts (-3%), and for the Feather River there are 2 fewer redd cohorts (-3%), predicted to experience a month-over-month change in flow of greater than 50% for Alternative 5A relative to Existing Conditions.

In most locations, the number of ammocoete cohorts exposed to each water temperature threshold under Alternative 5A would be similar to or lower than those under NAA_ELT (Table 11-5A-86). Biologically meaningful exceptions include the American River for the more conservative 71.6°F threshold. However, there would be no effect at the 77°F that would have similar or lower exceedances under Alternative 5A.

Summary of CEQA Conclusion

Collectively, the modeling results of the Impact AQUA-184 CEQA analysis indicate that there would be less than significant effects to river lamprey spawning conditions. There would be minor effects of the alternative on redd dewatering risk and temperature exposure in all rivers. No mitigation is necessary.

Impact AQUA-185: Effects of Water Operations on Rearing Habitat for River Lamprey

In general, Alternative 5A would not affect the quantity and quality of river lamprey rearing habitat relative to NAA_ELT.

Flow-related effects on river lamprey rearing habitat were evaluated by estimating effects of flow alterations on ammocoete exposure, or stranding risk, as described for Pacific lamprey. Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Effects of Alternative 5A on flow were evaluated in the Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento River. As for Pacific lamprey, the analysis of river lamprey ammocoete stranding was conducted by analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during their spawning period (February through June) and spend 5 years rearing upstream. Therefore, a cohort was considered stranded if at least one month-over-month flow reduction was greater than the flow reduction at any time during the period. Comparisons of flow reductions for A5A_ELT relative to NAA_ELT for the Sacramento River at Keswick (Table 11-5A-87) predicted either no effect (0%) or negligible effects (±5%) in the occurrence of flow reductions attributable solely to the project, which would have beneficial effects on rearing success.

Table 11-5A-87. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Keswick

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	2	4
-65%	1	-3
-70%	5	0
-75%	1	2
-80%	2	0
-85%	2	0
-90%	0	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

Results of comparisons for the Sacramento River at Red Bluff (Table 11-5A-88) provided similar conclusions. A5A_ELT compared to NAA_ELT indicated no change (0%) and negligible effects (±5%).

Table 11-5A-88. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red Bluff

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	2
-55%	0	4
-60%	4	-2
-65%	1	3
-70%	5	0
-75%	2	0
-80%	10	0
-85%	15	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

Comparisons for the Trinity River indicate small increases in occurrence 90% flow reductions under Alternative 5A relative to NAA_ELT (Table 11-5A-89). Occurrences of 50 to 85% flow reductions indicates no effect (0%) or (negligible changes ±5%) attributable to the project.

Table 11-5A-89. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	0	0
-90%	-1	11

[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

In the Feather River, there would be no difference (0%) or negligible decreases (<-5%) in the occurrence of flow reductions between 50–80%, moderate increases (22%) in the occurrence of flow reductions at 85%, and moderate decreases (-25%) in the occurrence of flow reductions at 90% (Table 11-5A-90).

Table 11-5A-90. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito Afterbay

	Percent Difference[a]	
Percent Flow Reduction	EXISTING CONDITIONS vs. A5A_ELT_	NAA_ELT vs. A5A_ELT_
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	5
-85%	0	22
-90%	0	-25

[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

Flow reduction comparisons for the American River at Nimbus Dam (Table 11-5A-91) and at the confluence with the Sacramento River (Table 11-5A-92) indicated no effect (0%), negligible increases (<5%), and moderate to substantial increases (up to 43%). Based on the general decrease in frequency of most of the flow reduction categories, the predicted increases would not have biologically meaningful effects.

Table 11-5A-91. Percent Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus Dam

Percent Flow Reduction	Percent Difference[a]	
	EXISTING CONDITIONS vs. A5A_ELT_	NAA_ELT vs. A5A_ELT_
-50%	0	0
-55%	0	0
-60%	0	1
-65%	0	4
-70%	6	-2
-75%	3	26
-80%	62	37
-85%	32	0
-90%	348	N/A

NA = could not be calculated because the denominator was 0.
[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

Table 11-5A-92. Relative Difference between Model Scenarios in the Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the Confluence with the Sacramento River

Percent Flow Reduction	Percent Difference[a]	
	EXISTING CONDITIONS vs. A5A_ELT_	NAA_ELT vs. A5A_ELT_
-50%	0	0
-55%	0	0
-60%	0	1
-65%	0	3
-70%	4	8
-75%	2	14
-80%	27	19
-85%	10	43
-90%	300	30

[a] Negative values indicate reduced cohort exposure, a benefit of A5A_ELT.

River lamprey generally spawn between February and June (Beamish 1980, Moyle 2002). Using Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same period and locations as spawners. Moyle et al. (1995) indicate that river lamprey "adults need… temperatures [that] do not exceed 25°C," although there is no mention of thermal requirements for eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs, significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs. The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data from the Bureau's temperature model. Each individual day or month starts a new "egg cohort" such that there are 12.320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from February 1 through June 30, and 405 cohorts for the other rivers using monthly data over the same period. The incubation periods used in this analysis are conservative and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited because the extreme temperatures are masked; however, no better analytical tools are currently available for this analysis. Spawning locations of river lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

In the Sacramento River at Hamilton City, there would be 237 fewer cohorts (-4%) exposed to the 71.6°F threshold under Alternative 5A relative to NAA_ELT, although there would be 2,458 more exposed to the 77°F threshold (Table 11-5A-93). There would be 25 more (100% increase) and 30 more (12% increase) cohorts exposed to the 71.6°F threshold in the Trinity River at North Fork and in the Feather River below Thermalito Afterbay, respectively. There would also be increase in exposure to the 77°F threshold in the Feather and American Rivers. However, none of these increases is expected to be biologically meaningful due to the relatively small magnitude relative to the total number of cohorts and the lack of effect in the majority of locations.

Table 11-5A-93. Differences (Percent Differences) between Model Scenarios in River Lamprey Ammocoete Cohorts Exposed to Temperatures Greater than 71.6°F and 77°F in at Least One Month

Location	EXISTING CONDITIONS vs. A5A_ELT_	NAA_ELT vs. A5A_ELT_
71.6°F Threshold		
Sacramento River at Keswick[b]	0 (NA)	0 (NA)
Sacramento River at Hamilton City[b]	5549 (NA)	-237 (-4%)
Trinity River at Lewiston	25 (NA)	0 (0%)
Trinity River at North Fork	50 (NA)	25 (100%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	100 (53%)	30 (12%)
American River at Nimbus	160 (178%)	-20 (-7%)
American River at Sacramento River Confluence	135 (55%)	20 (6%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	155 (620%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick[b]	0 (0%)	0 (NA)
Sacramento River at Hamilton City[b]	0 (0%)	2458 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	50 (NA)	25 (100%)
American River at Nimbus	75 (NA)	25 (50%)
American River at Sacramento River Confluence	105 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.
[a] Positive values indicate a higher value in the preliminary proposal than in EXISTING CONDITIONS or NAA_ELT.
[b] Based on daily data; all other locations use monthly data; 1922–2003.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because it does not have the potential to substantially degrade rearing habitat or substantially reduce the number of fish as a result of ammocoete mortality. Alternative 5A would not affect river lamprey ammocoete stranding relative to the NEPA baseline. Further, increases in exposure to water temperatures under Alternative 5A would not be biologically meaningful.

CEQA Conclusion: In general, Alternative 5A would not affect the quantity and quality of river lamprey rearing habitat relative to the Existing Conditions

Lower flows can reduce the instream area available for rearing and rapid reductions in flow can strand ammocoetes leading to mortality. Comparisons of Alternative 5A to Existing Conditions for the Sacramento River at Keswick indicate negligible increases (<5%) in the occurrence of flow reductions for all flow reduction categories (Table 11-5A-87).Comparisons for the Sacramento River at Red Bluff indicate slightly more variable results with no effect (0%) or negligible effects (<5%) for all flow reduction categories except for increases (10% and 15%) in the 75% and 80% flow reduction categories, respectively (Table 11-5A-88).

Comparisons for the Trinity River indicated no effect (0%) or negligible decreases (-1%) for all flow reduction categories (Table 11-5A-89).

Comparisons for the Feather River indicated no change (0%) in frequency of occurrence for all flow reduction categories (Table 11-5A-90).

Comparisons for the American River at Nimbus Dam (Table 11-5A-91) and at the confluence with the Sacramento River (Table 11-5A-92) indicated increased chance of occurrence of flow reductions between 80 and 90% for Alternative 5A compared to Existing Condition; meaningful (>5%) predicted increases are from 62 to 348% for Nimbus Dam and from 27 to 300% for the confluence.

The number of ammocoete cohorts exposed to 71.6°F under Alternative 5A would be substantially higher than those under Existing Conditions in most locations examined (Table 11-5A-93). The number of ammocoete cohorts exposed to 77°F under Alternative 5A would be similar at all locations except the Feather River below Thermalito Afterbay and at both locations in the American River, at which exposure would increase by 50 to 105 cohorts.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the modeling results of the Impact AQUA-185 CEQA analysis indicate that that the difference between the CEQA baseline and Alternative 5A could be significant because, under the CEQA baseline, the alternative could substantially degrade rearing habitat and substantially reduce the number of fish as a result of ammocoete mortality. There would be no substantial increases in stranding risk in any river under Alternative 5A relative to the Existing Conditions. However, the risk of exposure to elevated water temperatures in the Sacramento, Feather, American, and Stanislaus Rivers would increase under Alternative 5A relative to the Existing Conditions. Increased water temperatures would increase stress and reduce survival of lamprey ammocoetes.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the

CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on river lamprey rearing habitat conditions would be less than significant and no mitigation is necessary.

Impact AQUA-186: Effects of Water Operations on Migration Conditions for River Lamprey

In general, Alternative 5A would have negligible effects on river lamprey migration conditions relative to NAA_ELT due to negligible effects on mean monthly flows.

Macropthalmia

After 3 to 5 years river lamprey ammocoetes migrate downstream and become macropthalmia once they reach the Delta. River lamprey migration generally occurs September through November (USFWS unpubl. data). The effects of water operations on seasonal migration flows for river lamprey macropthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration pathways of river lamprey during the likely migration period (September through November) were examined to predict how Alternative 5A may affect migration flows for outmigrating macropthalmia.

Analyses were conducted for the Sacramento River at Red Bluff, Feather River at the confluence with the Sacramento River, and the American River at the confluence with the Sacramento River.

Sacramento River

Comparisons for the Sacramento River at Red Bluff for September through November indicate variable effects of Alternative 5A depending on the month and the water year type. Alternative 5A indicates variable effects, with project-related decreases (-5% and -9%) for September in all water year types except wet years indicate negligible effects, negligible effects (with <5% difference) in all water year types in October, and decreases in flows for all year types (-7% to -17%) in November. Decreases in wetter years in September would be less detrimental because flows are higher; the decreases in drier water years would be more detrimental for outmigration. Decreases (to 17%) in November would affect migration conditions during that month, which is the last month in the relatively short migration period.

Feather River

Comparisons for the Feather River at the confluence with the Sacramento River for September through November indicate decreases in flow during most water year types in September (-29, -34, -41, and -14% for wet, above normal, below normal and dry years respectively) and increases in flow during critical years (12%). The increases in flow during critical years for September would have a positive effect on migration when flow conditions are most critical. There would also be project-related increases in flow during October in all water years, ranging from 9 to 13% depending on water year type. Project-related effects during November would be negligible (<5%) in all water year types. These results indicate Alternative 5A would not affect migration in the Feather River.

American River

Comparisons for the American River at the confluence with the Sacramento River for September through November indicate decreased flows for September in generally all water year types (-13% to -23% depending on year type) except dry years indicate negligible effects critical years indicate increases (21%), negligible effects during October in all water year types except critical years indicate increased flows (17%), and negligible project-related changes during critical years during November and decreased flows (to 12%) for wetter years. These results indicate Alternative 5A would not affect migration conditions in the American River.

Overall conclusions are that, with some variation in results by location, month, and water year type, Alternative 5A would generally not have biologically meaningful effects on macropthalmia migration based on negligible effects (<5%), decreases in flow during wetter water year types that would not have biologically meaningful effects, and increases in flow during drier water years that would have a beneficial effect on migration.

Adults

Effects of Alternative 5A on flow during the adult migration period, September through November, would be the same as described for the macropthalmia migration period, September through November, above.

NEPA Effects: Collectively, these modeling results indicate that is not adverse because it would not substantially reduce the amount of suitable habitat or substantially interfere with the movement of fish. Flows under Alternative 5A would not be reduced from NAA_ELT in any waterway analyzed that would affect river lamprey macropthalmia or adults in a biologically meaningful way. There would be small to moderate increases in mean monthly flow for some months and water year types that would have beneficial effects on migration conditions.

CEQA Conclusion: In general, under Alternative 5A water operations, the quantity and quality of suitable migration habitat for river lamprey would not be affected relative to the CEQA baseline.

Macropthalmia

Sacramento River

Comparisons for the Sacramento River at Red Bluff for September through November indicate variable effects of Alternative 5A during September, with increases in mean monthly flow for wetter water year types (26 to 44%) that would have beneficial effects on migration conditions, and decreases for drier water year types (-6 to -22% for below normal, dry, and critical years). Alternative 5A would result in decreases (-6% to -15%) for October in all water year types.

Alternative 5A would result in small decreases in mean monthly flows compared to Existing Conditions for below normal, dry and critical years in November (-6 to -12%). Persistent small to moderate reductions in flow in drier water years for two of the three months in the migration period could affect migration conditions in the Sacramento River.

Feather River

Comparisons for the Feather River at the confluence with the Sacramento River for September through November indicate variable results by month and water year type, with increases for wetter years and decreases in drier years in September except critical years indicates increases (12%), increases in dry years (14%) in October that would have a small beneficial effect on migration, and negligible effects for all water year types in November. Increases in these water year types in September would have a beneficial effect.

American River

Comparisons for the American River at the confluence with the Sacramento River for September through November indicate reductions in flow for most months and most water year types, ranging from -9 to -40%, with the exception of negligible effects in above normal, below normal, and dry years and 7% increases in mean monthly flow for critical water years during October. The predominance of decreased flows for Alternative 5A compared to Existing Conditions would affect migration conditions, with substantial decreases for dry and critical years in September (-31 and -30%, respectively) and November (-28 and -18%, respectively).

Overall, these results indicate that Alternative 5A would cause decreases in mean monthly flow during all or portions of the river lamprey macropthalmia migration period in the Sacramento River (to -22% in dry years), Feather River (to -33%), and American River (to -31%).

Adults

Effects of Alternative 5A on flow during the adult migration period, September through November, would be the same as described for the macropthalmia migration period, September through November, above.

Summary of CEQA Conclusion

Contrary to the NEPA conclusion set forth above, the modeling results of the Impact AQUA-186 CEQA analysis indicate that the difference between the CEQA baseline and Alternative 5A could be significant because, under the CEQA baseline, the alternative could substantially reduce the amount of suitable habitat and substantially interfere with the movement of fish,. Reductions in flows during the macropthalmia and adult migration periods would reduce migration ability of both life stages. For macropthalmia, reduced migration ability could increase straying risk and delay initiation of the oceanic life stage. For adults, reduced flows could reduce the ability to sense olfactory cues if adults use such cues to return to natal spawning grounds.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between the alternative and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 5A on flows, reservoir storage, and water temperatures during the months and locations analyzed would be minimal. These results represent the increment of change attributable to the alternative, demonstrating the similarities in flows and water temperatures under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, the effects of Alternative 5A on river lamprey migration habitat conditions would be less than significant and no mitigation is necessary.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-187: Effects of Construction of Restoration Measures on River Lamprey

Impact AQUA-188: Effects of Contaminants Associated with Restoration Measures on River Lamprey

Impact AQUA-189: Effects of Restored Habitat Conditions on River Lamprey

Impact AQUA-190: Effects of Methylmercury Management on River Lamprey (Environmental Commitments 12)

Impact AQUA-193: Effects of Localized Reduction of Predatory Fish on River Lamprey (Environmental Commitments 15)

Impact AQUA-194: Effects of Nonphysical Fish Barriers on River Lamprey (Environmental Commitments 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on river lamprey for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Non-Covered Aquatic Species of Primary Management Concern

Construction and Maintenance of Water Conveyance Facilities

The effects of construction and maintenance of water conveyance facilities under Alternative 5A would be sufficiently similar for all non-covered species to treat them as one; therefore, the analysis below is combined for all non-covered species instead of analyzed by individual species.

Impact AQUA-199: Effects of Construction of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

The potential effects of construction of the water conveyance facilities on non-covered species of primary management concern would be similar to those described for Alternative 4A (Impact AQUA-199) except that Alternative 5A would include only a single north Delta intake and would not include a Head of Old River operable barrier, with the result that the effects (e.g., pile driving; see Table pile_driving_alt5A) would be proportionally less. The same mitigation measures and environmental commitments applied to Alternative 4A would be applied to Alternative 5A in order to avoid and minimize the effects to non-covered species of primary management concern.

NEPA Effect: As concluded for Alternative 4A, Impact AQUA-199, and as discussed above, the effect would not be adverse for non-covered species of primary management concern.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-199, and as discussed above, the impact of the construction of water conveyance facilities on non-covered species of primary management concern would be less than significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA 1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1a under Alternative 1A, Impact AQUA-1.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Please refer to Mitigation Measure AQUA-1b under Alternative 1A, Impact AQUA-1.

Impact AQUA-200: Effects of Maintenance of Water Conveyance Facilities on Non-Covered Aquatic Species of Primary Management Concern

NEPA Effects: The potential effects of the maintenance of water conveyance facilities under Alternative 5A would be less than the potential effects of the maintenance of water conveyance facilities under Alternative 4A. Alternative 4A includes three north Delta intakes (compared to one under Alternative 5A), Clifton Court Forebay modifications (which are also part of Alternative 5A), and a Head of Old River operable barrier (which is not included in Alternative 5A). Therefore, given that Impact AQUA-200 was concluded to not be adverse for Alternative 4A, it is also concluded that Impact AQUA-200 would not be adverse for non-covered aquatic species of primary management concern under Alternative 5A, given its lesser extent of water conveyance facilities to maintain.

CEQA Conclusion: As described in Alternative 4A, Impact AQUA-200 for non-covered aquatic species of primary management concern, the impact of the maintenance of water conveyance facilities on non-covered aquatic species of primary management concern would be less than significant and no mitigation is required.

Operations of Water Conveyance Facilities

The effects of operations of water conveyance facilities under Alternative 5A include a detailed analysis of the following species:

- Striped Bass
- American Shad
- Threadfin Shad
- Largemouth Bass
- Sacramento tule perch
- Sacramento-San Joaquin roach – California species of special concern
- Hardhead – California species of special concern
- California bay shrimp

Impact AQUA-201: Effects of Water Operations on Entrainment of Non-Covered Aquatic Species of Primary Management Concern

A revised analysis of Impact AQUA-201 for all alternatives, including Alternative 5A, is provided in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 5A draws on that analysis.

Striped Bass

NEPA Effects: Under Existing Conditions, striped bass are observed in salvage operations of the south Delta facilities throughout the year, with the majority of juvenile striped bass entrainment occurring during the summer (May through July). As described in Chapter 11, Section 11.3.5, in Appendix A, operation of the north Delta intakes under Alternative 5A would be expected to reduce overall entrainment of screenable life stages (i.e., early juveniles and older, around 20 mm long) because of the reduction in use of the south Delta facilities, which do not have the state of the art fish screens proposed for the north Delta intakes. Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile striped bass. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval striped bass are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of striped bass originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A). For Alternative 5A, the mean entrainment was increased from 6.5% of particles to 13.3% of particles, a 106% increase. Note that entrainment of the early life stages of striped bass at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 5A during the spring to benefit listed fishes such as spring-run Chinook salmon. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A, density-dependence during the juvenile stages of the striped bass life cycle means that losses of early life stages do not necessarily translate into proportional reductions in abundance of older individuals, and entrainment has not recently been identified as a significant driver of juvenile abundance (Mac Nally et al. 2010; Thomson et al. 2010). Therefore it is concluded with some uncertainty that there would be an adverse effect on striped bass.

CEQA Conclusion: The impact of water operations on entrainment of striped bass would be the same as described immediately above. Relative to Existing Conditions, particle tracking modeling for Alternative 5A showed mean entrainment was increased by around 69% (from 8% to 13%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A). As described in the NEPA Effects section above, increased losses of striped bass eggs and larvae need not necessarily translate into reductions in abundance of later life stages. Nevertheless it is concluded that the impact is significant and unavoidable because there is no feasible mitigation that would reduce this potential impact for this alternative.

American Shad

American shad eggs and larvae would be vulnerable to entrainment at the proposed north SWP/CVP Delta intakes as these life stages are passively transported downstream to the north Delta. Most American shad spawning though takes place well upstream of the Delta and juveniles may rear to sufficiently large size to avoid entrainment as state-of-the-art fish screens on the proposed north Delta intakes would exclude juvenile and adult American shad.

NEPA Effects: Differences in potential entrainment as a function of exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early summer reductions in entrainment that could occur for juvenile American shad. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval American shad are susceptible to entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly periods during March-June suggested that overall entrainment of eggs and larvae of American shad originating in the Sacramento River upstream of the Delta and moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A). For Alternative 5A, scenario NAA_ELT, and as discussed above for striped bass, the mean entrainment was increased from 6.5% of particles to 13.3% of particles, a 106% increase. As noted for striped bass, entrainment of the early life stages of American shad at the north Delta intakes may be moderated by real-time operational adjustments being made under Alternative 5A during the spring to benefit listed fishes such as spring-run Chinook salmon. Note also that although the north Delta intake screens are estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A, although American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment, they could also be entrained in appreciably greater magnitude than currently occurs and therefore it is also concluded that the effects of entrainment on American shad would be adverse.

CEQA Conclusion: The impact of water operations on entrainment of American shad would be the same as described immediately above. Relative to Existing Conditions and as described above for striped bass, particle tracking modeling for Alternative 5A scenario NAA_ELT showed mean entrainment was increased by around 69% (from 8% to 13%); Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A). As described in the NEPA Effects section above, American shad early life stages may rear to sufficiently large size above the Delta to avoid entrainment. Nevertheless it is concluded that the impact is significant and unavoidable because there is no feasible mitigation that would reduce this potential impact for this alternative.

Threadfin Shad

NEPA Effects: The impact and conclusion would be the same as discussed for Alternative 1A (Impact AQUA-201 for Threadfin Shad) because they are most abundance in the south Delta, and entrainment at the south delta would be reduced due to overall decreased exports from the SWP/CVP south Delta facilities. There would be potential entrainment of threadfin shad eggs and larvae to the north Delta intakes, although this risk is minimal because threadfin shad are most abundant in the south Delta (Baxter et al. 2010; see also discussion in Chapter 11, Section 11.3.5, in Appendix A). Overall, threadfin shad entrainment would be reduced because they are most abundant in the southern Delta and would particularly benefit from reduced south Delta exports. The effect would not be adverse.

CEQA Conclusion: The impact of water operations on entrainment of threadfin shad would be the same as described immediately above in the NEPA Effects section. The impact would be less than significant and no mitigation would be required.

Largemouth Bass

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect would not be adverse.

CEQA Conclusion: Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The impact would be less than significant and no mitigation would be required.

Impact AQUA-202: Effects of Water Operations on Spawning and Egg Incubation Habitat for Non-Covered Aquatic Species of Primary Management Concern

Also, see Alternative 1A, Impact AQUA-202 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

In general, the effects of Alternative 5A on the quality and quantity of spawning, egg incubation, and initial rearing habitat conditions for striped bass would not be adverse relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or slightly greater than flows under NAA_ELT during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during April through June regardless of water year type (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would be moderately greater than flows under NAA_ELT during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-5A-138).

Table 11-5A-138. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay are outside the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and Initial Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	5 (12%)	0 (0%)
Above Normal	6 (13%)	-3 (-6%)
Below Normal	0 (0%)	-2 (-5%)
Dry	4 (8%)	-6 (-10%)
Critical	11 (29%)	0 (0%)
All	5 (11%)	-2 (-4%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in striped bass spawning, incubation, or initial rearing habitat. Flows in all rivers examined during the April through June spawning, incubation, and initial rearing period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 5A in any river examined.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for striped bass relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June striped bass spawning, embryo incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream habitat available for spawning, egg incubation, and rearing.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower), wet years during May (15% lower) and wet years during June (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to flows under Existing Conditions during April, but lower during May and June (up to 30% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during April through June.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 14% lower than those under Existing Conditions during April through June.

Water Temperature

The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside of the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation, and initial rearing during April through June would be the same as or lower than the percentage under Existing Conditions in all water years except critical years (29% higher on a relative scale; 11% higher on an absolute scale) (Table 11-5A-138). This is a relatively small effect that would not have biologically meaningful negative effects on the striped bass population because it only occurs in one water year type.

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 5A would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of striped bass relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 5A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to striped bass. There would be no substantial temperature effects under Alternative 5A on striped bass.

American Shad

In general, the effects of Alternative 5A on the quality and quantity of spawning and egg incubation habitat conditions for American shad would not be adverse relative to the NEPA point of comparison.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to flows under NAA_ELT during April through June, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during April through June, regardless of water year type (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A would generally be moderately to substantially greater than flows under NAA_ELT during April through June, except in dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be moderately greater than flows under NAA_ELT during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT during April through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside the 60°F to 70°F water temperature range would be lower than the percentage under NAA_ELT regardless of water year type (Table 11-58-140).

Table 11-58-140. Difference and Percent Difference in the Percentage of Months during April–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-5 (-11%)	-1 (-3%)
Above Normal	6 (17%)	-6 (-13%)
Below Normal	-2 (-8%)	-7 (-20%)
Dry	-2 (-5%)	-4 (-9%)
Critical	3 (8%)	0 (0%)
All	-1 (-3%)	-3 (-8%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in American shad spawning or adult migration. Flows in all rivers examined during the April through June adult migration and spawning period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 5A in any river examined5A.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for American shad relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through June American shad adult migration and spawning period. Lower flows could reduce migration ability and instream habitat quantity and quality for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in wet years and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through June, except in critical years during May (6% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during April through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through June, except in below normal years in April (6% lower) wet years during May (15% lower), and wet years during June (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to flows under Existing Conditions during April, but lower during May and June (up to 30% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar or slightly lower than those under Existing Conditions during April through June. In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 14% lower than those under Existing Conditions during April through June.

Water Temperature

The percentage of months outside of the 60°F to 70°F water temperature range for American shad adult migration and spawning during April through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased adult migrant stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside of the 60°F to 70°F water temperature range would be lower than the percentage under Existing Conditions in all water year types, except in above normal years (17% higher on a relative scale; 6% higher on an absolute scale) and in critical years (8% higher on a relative scale; 3% higher on an absolute scale) (Table 11-5A-140).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 5A would not cause a substantial reduction in spawning, incubation, and initial rearing habitat of American shad relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning, incubation, or initial rearing period under Alternative 5A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to American shad. There would be no substantial temperature effects under Alternative 5A on American shad.

Threadfin Shad

In general, the effects of Alternative 5A on the quality and quantity of spawning habitat conditions for threadfin shad would not be adverse relative to the NEPA point of comparison

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August threadfin shad spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during April through August, except in dry years during August (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to flows under NAA_ELT during April through August, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during April through August (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be moderately greater than flows under NAA_ELT during April through June (to 40% greater), and moderately to substantially lower than flows under NAA_ELT during July and August (to 35% lower), except during above normal years in August (13% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Based on occurrence late in the spawning period, these flow reductions are not expected to have biologically meaningful effects.

In the American River below Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during April through July, except in July during below normal years (7%) and lower flows under NAA_ELT during August (to 21% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). These flow reductions are small to moderate in magnitude and limited to late in the spawning period and, therefore, would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would be similar to those under NAA_ELT during April through August, regardless of water year type.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT below 68°F would be greater than those under NAA_ELT (8% to 11% greater) in all but wet and critical years (Table 11-58-142). On an absolute scale, there are small increases (≤4%) in above normal, below normal, and dry water years that would not have biologically meaningful effects.

Table 11-58-142. Difference and Percent Difference in the Percentage of Months during April–August in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-3 (-5%)	-2 (-3%)
Above Normal	-5 (-7%)	7 (11%)
Below Normal	-9 (-12%)	4 (8%)
Dry	-18 (-24%)	6 (11%)
Critical	-23 (-36%)	-3 (-7%)
All	-11 (-15%)	2 (4%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in threadfin shad spawning habitat. Flows in all rivers examined during the April through August spawning period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. Some flow reductions would occur late in the spawning season in the Feather and American Rivers that would be too small in magnitude and frequency to have a biologically meaningful effect on threadfin shad. The percentage of years below the spawning temperature threshold would be similar or lower under Alternative 5A relative to the NAA_ELT, except in below normal years, but this increase is not expected to have a biologically meaningful effect on the threadfin shad population because it occurs in only one water year type and is isolated to the Feather River.5A

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for threadfin shad relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during April through August spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in wet and below normal years during May (11% and 7% lower, respectively) and in dry and critical years during August (7% and 14%lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). These are relatively small-magnitude and infrequent flow reductions and would not have biologically meaningful effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through August, except in critical years during May and August (6% and 8% lower, respectively) and in wet years during July (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during April through August, except in critical years in August (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, except in below normal years during April (6% lower) and in wet years during May and June (15% and 10% lower, respectively), and would be lower than flows under Existing Conditions in critical years during July (40%) and in dry and critical years during August (32% and 23% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to flows under Existing Conditions during April and July and lower flows under Existing Conditions during May, June and August (up to 46% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during April and May, and would be up to 23% lower than flows under Existing Conditions during June through August.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would be similar to or up to 14% lower than to those under Existing Conditions during April through August, except for 11% greater flow during June of wet years.

Water Temperature

The percentage of months below 68°F water temperature threshold for the April through August adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months below the 68°F water temperature threshold for threadfin shad spawning under A5A_ELT would be similar to or 5% to 36% lower than the percentage under Existing Conditions, depending on water year type (Table 11-5A-142).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 5A during the threadfin shad spawning period relative to Existing Conditions. Flows would be moderately to substantially lower in the Feather, American, Stanislaus, and San Joaquin rivers during substantial portions of the spawning period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable spawning habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the

alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Largemouth Bass

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for largemouth bass relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (7% lower) and in dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that in the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside the 59°F to 75°F water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-5A-144).

Table 11-5A-144. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-2 (-4%)	0 (0%)
Above Normal	-2 (-5%)	0 (0%)
Below Normal	0 (0%)	0 (0%)
Dry	-4 (-9%)	1 (3%)
Critical	-6 (-14%)	0 (0%)
All	-3 (-6%)	0 (1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in largemouth bass spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 5A in any river examined.

CEQA Conclusion: In general, Alternative 5A would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June largemouth bass spawning period. Lower flows could reduce the quantity and quality of instream spawning habitat.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (6% lower) and in critical years during May (6% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (35% and 8% lower, respectively), in below normal years during April (6% lower), and in wet years during May and June (15% and 10% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (5% lower), above normal and dry years during April (5% lower), and in wet and critical years during June (22% and 30% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be lower than flows under Existing Conditions during May (to 18% lower) except in critical years (12% greater). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or lower (up to 16%) than those under Existing Conditions during March through June, except in wet years during March to May, when flows under A5A ELT would range from 2% to 9% greater.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June.

Water Temperature

The percentage of months outside of the 59°F to 75°F suitable water temperature range for largemouth bass spawning during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside of the 59°F to 75°F water temperature range for largemouth bass spawning would be the same or lower than the percentage under Existing Conditions in all water year types (Table 11-5A-144).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 5A would not cause a substantial reduction in largemouth bass spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 5A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to largemouth bass. There would be no substantial temperature effects under Alternative 5A on largemouth bass.

Sacramento Tule Perch

NEPA Effects: The effects of water operations on spawning habitat for Sacramento tule perch under Alternative 5A would be similar to that described for Alternative 1A. For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: As described under Alternative 1A, Impact AQUA-202 the impacts on Sacramento tule perch spawning would be not be significant and no mitigation is required.

Sacramento-San Joaquin Roach – California species of special concern

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during March through June, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be moderately to substantially greater than flows under NAA_ELT during March through June, except in below normal years during March (7% lower) and in dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during March through June, except in May during critically dry years (20% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT during March through June, regardless of water year type (Appendix B, *Supplemental Modeling for New Alternatives*).

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation under A5A_ELT would be similar to the percentage under NAA_ELT in all water year types (Table 11-5A-146).

Table 11-5A-146. Difference and Percent Difference in the Percentage of Months during March–June in Which Water Temperatures in the Feather River below Thermalito Afterbay Fall below the 60.8°F Water Temperature Threshold for the Initiation of Sacramento-San Joaquin Roach Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-8 (-12%)	0 (0%)
Above Normal	-5 (-8%)	0 (0%)
Below Normal	-2 (-4%)	0 (0%)
Dry	-7 (-13%)	-1 (-3%)
Critical	-8 (-15%)	0 (0%)
All	-6 (-11%)	0 (-1%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat. Flows in all rivers examined during the March through June spawning period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. The occurrence of flow reductions would not be of sufficient magnitude or frequency to have a biologically meaningful effect on roach. There would be no substantial temperature effects under Alternative 5A in any river examined.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal years during March (8% lower) and in wet and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (6% lower) and in critical years during May (6% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during March through June (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during March through June, except in below normal and dry years during March (35% and 8% lower, respectively), in below normal years during April (6% lower), and in wet years during May and June (15% and 10% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during March, April and June, except in critical years during March (5% lower), above normal and dry years during April (5% lower), and in wet and critical years during June (22% and 30% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be lower than flows under Existing Conditions during May (to 18% lower), except in critical years (12% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water year types, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude throughout the spawning period and would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or lower than those under Existing Conditions during March through June, except during March of below normal and dry water years, when flow under A5A_ELT would be 11% and 12% lower, respectively, and during June of wet and dry water years, when flows would be 16% and 11% lower, respectively.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or lower (up to 16%) than those under Existing Conditions during March through June, except during March to May in wet years, when flows under A5A ELT would range from 2% to 9% greater.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 23% lower than to those under Existing Conditions during March through June.

Water Temperature

The percentage of months below the 60.8°F water temperature threshold for Sacramento-San Joaquin roach spawning initiation during March through June was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers.

In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT in which temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation would be lower than the percentage under Existing Conditions in all water year types (Table 11-5A-146).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the impact would not be significant because Alternative 5A would not cause a substantial reduction in Sacramento-San Joaquin roach spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 5A would generally be similar to or greater than flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to Sacramento-San Joaquin roach. There would be no substantial temperature effects under Alternative 5A on Sacramento-San Joaquin roach.

Hardhead – California Species of Special Concern

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during April and May) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to flows under NAA_ELT during April and May, except in above normal years during April (17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during April and May (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be similar to flows under NAA_ELT during April and May, except in dry years in April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during April and May (Appendix B, *Supplemental Modeling for New Alternatives*).

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT during April and May, regardless of water year type.

Water Temperature

The percentage of years outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature-related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of years under A5A_ELT outside the 59°F to 64°F suitable water temperature range would be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-5A-148).

Table 11-5A-148. Difference and Percent Difference in the Percentage of Months during April–May in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside the 59°F to 64°F Water Temperature Range for Hardhead Spawning[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	2 (3%)	0 (0%)
Above Normal	9 (14%)	0 (0%)
Below Normal	18 (42%)	4 (6%)
Dry	6 (10%)	-6 (-8%)
Critical	-4 (-8%)	-4 (-8%)
All	6 (10%)	-1 (-2%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in hardhead spawning habitat. Flows in all rivers examined during the April through May spawning period under Alternative 5A would generally be similar to or greater than flows under the NAA_ELT. There would be no substantial temperature effects under Alternative 5A in any river examined.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through May hardhead spawning period. Lower flows could reduce the quantity and quality of instream habitat available for spawning.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to flows under Existing Conditions during April through May, except in wet and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through May, except in critical years during May (6% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under Existing Conditions during April through May, except in critical years during April and May (10% and 6% higher, respectively)(Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through May, except in below normal years during April (6% lower) and in wet years during May (15% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or slightly lower than flows under Existing Conditions during April. Flows under A5A_ELT would generally be lower than flows under Existing Conditions during May (to 18% lower), except in critical years (12% greater). (Appendix B, *Supplemental Modeling for New Alternatives*). These few flow reductions are relatively small in magnitude and, therefore would not have biologically meaningful negative effects.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower (up to 8%) than those under Existing Conditions during April and May.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be lower (up to 23%) than to those under Existing Conditions during April and May.

Water Temperature

The percentage of months outside of the 59°F to 64°F suitable water temperature range for hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning success and increased egg and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions, this analysis was not conducted and it was concluded that there would be no temperature related effects in these rivers. In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside of the 59°F to 64°F water temperature range for hardhead spawning would be greater than the percentage under Existing Conditions in all water years types, except critical years (8% lower) (Table 11-5A-148).

Summary of CEQA Conclusion

Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in hardhead spawning habitat, and no mitigation is necessary. Flows in most rivers examined during the April through May spawning period under Alternative 5A would generally be similar to or greater than flows under Existing Conditions. Flows in the San Joaquin and Stanislaus Rivers would be lower under Alternative 5A, although these reductions would not have population-level effects on hardhead. There would be no substantial temperature effects under Alternative 5A on hardhead.

California Bay Shrimp

NEPA Effects: The effect of water operations on spawning habitat of California bay shrimp under Alternative 5A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-202). For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be adverse.

CEQA Conclusion: The impact of water operations on spawning habitat of California bay shrimp would be the same as described immediately above. The impacts would be less than significant and no mitigation would be required.

Impact AQUA-203: Effects of Water Operations on Rearing Habitat for Non-Covered Aquatic Species of Primary Management Concern

Also, see Alternative 1A, Impact AQUA-203 for additional background information relevant to non-covered species of primary management concern. The analysis for striped bass, American shad, and bay shrimp includes new analysis across all alternatives that is described in detail in Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 5A draws on that analysis.

Striped Bass

NEPA Effects: The discussion under Alternative 5A, Impact AQUA-202 for striped bass also addressed the embryo incubation and initial rearing period. That analysis indicates that there is no adverse effect on striped bass rearing during that period. As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect striped bass juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Several X2-abundance index or X2-survival index relationships from Kimmerer et al. (2009) were applied to striped bass in order to assess the potential effects on abundance or survival through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there generally would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 5A scenarios NAA ELT (See Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A). The exception was the mean bay midwater trawl abundance index (7% reduction; Table 11-mult-9). This result- indicates that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for striped bass.

CEQA Conclusion: The analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions (see Table 11-mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A), there could be significant impacts of Alternative 5A on survival or abundance of striped bass, in contrast to the conclusion presented above in the NEPA Effects section. As described in Chapter 11, Section 11.3.5, in Appendix A, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both Alternative 5A and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in the ELT, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands. Because Alternative 5A modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for striped bass, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would be necessary.

American Shad

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect American shad juvenile abundance through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Two X2-abundance index relationships from Kimmerer et al. (2009) were applied to American shad in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance index (<5%) as a result of change in rearing habitat under Alternative 5A scenario NAA_ELT (See Table 11-mult-11, Table 11-mult-12 Chapter 11, Section 11.3.5, in Appendix A). These results indicate that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for American shad.

CEQA Conclusion: Similar to striped bass, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 5A on abundance of American shad (Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A), than found in the NEPA Effects section. As noted for striped bass, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Threadfin Shad

NEPA Effects: The effects of water operations on rearing habitat for threadfin shad under Alternative 5A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-203). For a detailed discussion, please see Alternative 1A, Impact AQUA-203. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on threadfin shad rearing habitat would be less than significant and no mitigation would be required.

Largemouth Bass

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during April through October with some exceptions (to 9% lower), and would be lower in all water year types during November (to 17% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to flows under NAA_ELT with isolated exceptions, including flow reduction in above normal years during April (to 17% lower) and in wet years during November (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT during April through November (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be similar to flows under NAA ELT during April, May and November and moderately to substantially greater than flows under NAA_ELT during June through July (to 40% greater), except in critical years during July (to 35% lower); moderately to substantially lower flows under NAA_ELT during August through September (to 64% lower), except in critical years during September (17% greater); and slightly greater than flows under NAA_ELT during October (to 14% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions during July through September would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during April through July and October, except in below normal years during July (7% lower), and would be lower than flows under NAA_ELT during August, September, and November (to 21% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT during April through November, regardless of water year type.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 88°F under NAA_ELT or A5A_ELT. As a result, there would be no difference between NAA_ELT and A5A_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-5A-150).

Table 11-5A-150. Difference and Percent Difference in the Percentage of Months during April–November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT January through August, October and December with some exceptions (up to 5% lower), and would generally be lower in September and November (up to 14% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April (17%

lower), and in wet years during November (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be lower than flows under NAA_ELT during January, August and September (up to 64%), except in critical years in September (17%greater); would generally be similar to or greater than flows under NAA_ELT during February through July and October through December, except for below normal years during February and March (18% and 7% lower, respectively) and critical years during July (35% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (6% lower), and would be similar to or lower than flows under NAA_ELT (up to 21% lower) during August through November, except in critical years during October (15% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT and A5A_ELT (Table 11-5A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and A5A_ELT.

Table 11-5A-151. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass Survival[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in juvenile largemouth bass rearing and adult residency habitat. Flows in all rivers examined during the year under Alternative 5A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Regardless of these small changes to flows, water temperatures under Alternative 5A would not increase above the 86°F threshold at a higher frequency than would occur under NAA_ELT. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the largemouth bass population.

CEQA Conclusion: In general, Alternative 5A would not reduce the quality and quantity of upstream habitat conditions for largemouth bass relative to Existing Conditions.

Juveniles

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the April through November juvenile largemouth bass rearing period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile rearing.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through July, except in wet and below normal years during May (11% and 7% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (to 44% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some drier water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during April through September, except in critical years during May, August, and September (6%, 8% and 17% lower, respectively) and in wet years during July (10% lower), and similar to or lower than flows under Existing Conditions during October through November (to 8% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). The persistent, small to moderate flow reductions years during August through November would have a localized effect on rearing conditions.

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions during April through November, except in critical years during August and September (10% and 9% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). This flow reduction is a relatively small, isolated effect limited to a single water year type and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, and October, with a few isolated exceptions (to 40% lower)(Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be moderately to substantially lower than flows under Existing Conditions during August, September, and November (to 57% lower), except in wet and above normal years during July and August (to 136% greater) and in above normal years during November (5% greater).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be slightly to moderately lower than flows under Existing Conditions during April to November, by up to 46%, and during all water years in August, September, and November (Appendix B, *Supplemental Modeling for New Alternatives*). There would be moderate flow reductions in drier water year types, when effects would be most critical for habitat conditions, for some months/water year types from May through November that would affect rearing conditions at this location.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be slightly lower than those under Existing Conditions during April through September, and would be similar to flows under Existing Conditions during October through November.

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 14% lower than to those under Existing Conditions during April through July, except for 11% greater flow during June of wet years, and would be similar to or slightly lower than flows under Existing Conditions during August through November.

Water Temperature

The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass rearing during April through November was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of instream habitat available for juvenile rearing and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during the April through November period.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 88°F water temperature threshold for juvenile largemouth bass during the April through November rearing period under Existing Conditions or A5A_ELT (Table 11-5A-150). As a result, there would be no difference in the percentage of months in which the 88°F water temperature threshold is exceeded between A5A_ELT and Existing Conditions.

Adults

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round adult largemouth bass residency period. Lower flows could reduce the quantity and quality of instream habitat available for adults.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March and May (8% and 7% lower, respectively), and in wet years during May (11%), (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (26% and 44% greater, respectively). (Appendix B, *Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively). Flows under A5A_ELTwould generally be similar to or lower (up to 8%) than flows under Existing Conditions during October and November (Appendix B, *Supplemental Modeling for New Alternatives*). These small flow reductions in some water year types during October and November would not be persistent enough or of a magnitude that would have biologically meaningful negative effects.

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during August and September (10% and 9% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, October, and December except in below normal years during April (6% lower), in wet years during May, June, and December (15%, 10%, and 22% lower, respectively), in critical years during July (40% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, August, and September, except in wet years during February, August and September (6%, 50%, and 136% greater, respectively), in above normal years during August and September (30% and 82% greater, respectively), and in critical years during September (20% greater).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through March, except in dry and critical years during February (5% and 12% lower, respectively), in critical years during March (5% lower), and in above normal and dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (12% greater), in below normal and dry years during June (18% greater), and in critical years during October (8% greater). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during February through September (up to 23% lower), and would be similar or slightly higher than flows under Existing Conditions during January, and October through December (up to 12% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 29% lower than to those under Existing Conditions during January through July, except for 17%, 10% and 11% greater flow in wet years during February, March and June, respectively, and in above normal years in January and February (8% and 7% greater, respectively), and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round adult largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat for adults and increased stress and mortality of adults. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for adult largemouth bass under Existing Conditions or A5A_ELT (Table 11-5A-151). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between A5A_ELT and Existing Conditions.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 5A during the adult largemouth bass residency period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially reduce the quantity and quality of habitat for adults as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento Tule Perch

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for rearing.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT January through August, October and December with some exceptions (up to 5% lower), and would generally be lower in September and November (up to 14% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April (17% lower), and in wet years during November (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be lower than flows under NAA_ELT during January, August and September (up to 64%), except in critical years in September (17%greater); would generally be similar to or greater than flows under NAA_ELT during February through July and October through December, except for below normal years during February and March (18% and 7% lower, respectively) and critical years during July (35% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (6% lower), and would be similar to or lower than flows under NAA_ELT (up to 21% lower) during August through November, except in critical years during October (15% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

The analysis for Alternative 5A indicates that there would be no substantial differences in flows between A5A and NAA.

Water Temperature

The percentage of months exceeding water temperature thresholds of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced rearing habitat quantity and quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of years under A5A_ELT exceeding the 72°F threshold would be higher than the percentage under NAA_ELT by up to 133% depending on water year type (Table 11-5A-154). Although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤2%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

The percentage of months under A5A_ELT exceeding the 75°F threshold would be similar to or up to 100% lower than the percentage under NAA_ELT (Table 11-5A-154). As with the 72°F threshold, although relative differences are large due to small values in the divisor, the absolute differences in percent exceedance are negligible (≤1%) and, therefore, do not represent biologically meaningful effects to Sacramento tule perch.

Table 11-5A-154. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule Perch Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
72°F Threshold		
Wet	0 (14%)	1 (33%)
Above Normal	0 (NA)	0 (NA)
Below Normal	1 (NA)	1 (NA)
Dry	3 (NA)	2 (133%)
Critical	6 (133%)	2 (27%)
All	2 (131%)	1 (50%)
75°F Threshold		
Wet	0 (NA)	0 (-100%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	2 (300%)	-2 (-43%)
All	0 (300%)	0 (-50%)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in the quantity or quality of Sacramento tule perch habitat. Flows in all rivers examined during the year under Alternative 5A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento tule perch population. There would be no substantial differences in water temperature between Alternative 5A and NAA_ELT in any river examined that would cause a biologically meaningful effect to Sacramento tule perch.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento tule perch relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for tule perch.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March and May (8% and 7% lower, respectively), and in wet years during May (11%) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (26% and 44% greater, respectively). (Appendix B, *Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively). Flows under A5A_ELTwould generally be similar to or lower (up to 8%) than flows under Existing Conditions during October and November (Appendix B, *Supplemental Modeling for New Alternatives*). These small flow reductions in some water year types during October and November would not be persistent enough or of a magnitude that would have biologically meaningful negative effects.

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during August and September (10% and 9% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, October, and December except in below normal years during April (6% lower), in wet years during May, June, and December (15%, 10%, and 22% lower, respectively), in critical years during July (40% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, August, and September, except in wet years during February, August and September (6%, 50%, and 136% greater, respectively), in above normal years during August and September (30% and 82% greater, respectively), and in critical years during September (20% greater).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through March, except in dry and critical years during February (5% and 12% lower, respectively), in critical years during March (5% lower), and in above normal and dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (12% greater), in below normal and dry years during June (18% greater), and in critical years during October (8% greater). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during February through September (up to 23% lower), and would be similar or slightly higher than flows under Existing Conditions during January, and October through December (up to 12% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 29% lower than to those under Existing Conditions during January through July, except for 17%, 10% and 11% greater flow in wet years during February, March and June, respectively, and in above normal years in January and February (8% and 7% greater, respectively), and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months exceeding water temperatures of 72°F and 75°F for the year-round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds could lead to reduced habitat quality and increased stress and mortality. Water temperatures were not modeled in Clear Creek or the San Joaquin River.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month. In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT exceeding 72°F relative to the percentage under Existing Conditions would be similar to or greater, by up to 133% (Table 11-5A-154). However, these relative increases correspond to small absolute increases (≤6%) that are not expected to have biologically meaningful effects.

The percentage of years under A5A_ELT exceeding 75°F would be similar to the percentage under Existing Conditions in all water years except critical years (300% higher) (Table 11-5A-154). As with the 72°F threshold, this increase corresponds to a small absolute increase (2%) that is not expected to have biologically meaningful negative effects.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 5A during the juvenile and adult Sacramento tule perch occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Sacramento-San Joaquin Roach

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT January through August, October and December with some exceptions (up to 5% lower), and would generally be lower in September and November (up to 14% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April (17% lower), and in wet years during November (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be lower than flows under NAA_ELT during January, August and September (up to 64%), except in critical years in September (17%greater); would generally be similar to or greater than flows under NAA_ELT during February through July and October through December, except for below normal years during February and March (18% and 7% lower, respectively) and critical years during July (35% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (6% lower), and would be similar to or lower than flows under NAA_ELT (up to 21% lower) during August through November, except in critical years during October (15% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to degraded rearing habitat quality and increased stress and mortality. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A _ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A _ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under NAA_ELT or A5A_ELT (Table 11-5A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and A5A_ELT.

Table 11-5A-156. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in quantity and quality of habitat for juvenile and adult Sacramento-San Joaquin roach. Flows in all rivers examined during the year under Alternative 5A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on the Sacramento-San Joaquin roach population.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult Sacramento-San Joaquin roach.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March and May (8% and 7% lower, respectively), and in wet years during May (11%) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (26% and 44% greater, respectively). (Appendix B, *Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively). Flows under A5A_ELTwould generally be similar to or lower (up to 8%) than flows under Existing Conditions during October and November (Appendix B, *Supplemental Modeling for New Alternatives*). These small flow reductions in some water year types during October and November would not be persistent enough or of a magnitude that would have biologically meaningful negative effects.

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to or greater than flows under Existing Conditions throughout the year, except in critical years during August and September (10% and 9% lower, respectively) (Appendix B, *Supplemental Modeling for New Alternatives*). This flow reduction is a relatively isolated effect limited to a single water year type in each month and would not be expected to have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, October, and December except in below normal years during April (6% lower), in wet years during May, June, and December (15%, 10%, and 22% lower, respectively), in critical years during July (40% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, August, and September, except in wet years during February, August and September (6%, 50%, and 136% greater, respectively), in above normal years during August and September (30% and 82% greater, respectively), and in critical years during September (20% greater).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through March, except in dry and critical years during February (5% and 12% lower, respectively), in critical years during March (5% lower), and in above normal and dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (12% greater), in below normal and dry years during June (18% greater), and in critical years during October (8% greater). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during February through September (up to 23% lower), and would be similar or slightly higher than flows under Existing Conditions during January, and October through December (up to 12% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 29% lower than to those under Existing Conditions during January through July, except for 17%, 10% and 11% greater flow in wet years during February, March and June, respectively, and in above normal years in January and February (8% and 7% greater, respectively), and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months above the 86°F water temperature threshold for year-round juvenile and adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat and increased stress and mortality for juvenile and adult Sacramento-San Joaquin roach. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F water temperature threshold for Sacramento-San Joaquin roach under Existing Conditions or A5A_ELT (Table 11-5A-156). As a result, there would be no difference in the percentage of months in which the 86°F water temperature threshold is exceeded between A5A_ELT and Existing Conditions.

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 5A during the year-round juvenile and adult Sacramento-San Joaquin roach occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade suitable rearing habitat as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

Hardhead

In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for hardhead relative to the NAA_ELT.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT January through August, October and December with some exceptions (up to 5% lower), and would generally be lower in September and November (up to 14% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions in drier water years, when effects on habitat conditions would be more critical, would be inconsistent and/or of small magnitude for all months during the rearing period and, therefore, would not have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under NAA_ELT during the period, except in above normal years in April (17% lower), and in wet years during November (10% lower) (Appendix B, *Supplemental Modeling for New Alternatives*).

In Clear Creek at Whiskeytown Dam, flows under A5A_ELT would be similar to flows under NAA_ELT throughout the year (Appendix B, *Supplemental Modeling for New Alternatives*).

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would generally be lower than flows under NAA_ELT during January, August and September (up to 64%), except in critical years in September (17% greater); would generally be similar to or greater than flows under NAA_ELT during February through July and October through December, except for below normal years during February and March (18% and 7% lower, respectively) and critical years during July (35% lower)

(Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be partially offset by increases in flow in the adjoining months.

In the American River at Nimbus Dam, flows under A5A_ELT would be similar to or greater than flows under NAA_ELT during January through July and December, except in below normal years during January (6% lower), and would be similar to or lower than flows under NAA_ELT (up to 21% lower) during August through November, except in critical years during October (15% greater) (Appendix B, *Supplemental Modeling for New Alternatives*). Flow reductions would be offset by increases in some months and/or not persistent within a single water year type. Effects would not be biologically meaningful.

In the San Joaquin River at Vernalis, flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

In the Stanislaus River at the confluence with the San Joaquin River flows under A5A_ELT would be similar to those under NAA_ELT throughout the year, regardless of water year type.

Water Temperature

The percentage of months outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to degraded rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under NAA_ELT. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside the range would be similar to or lower than the percentage under NAA_ELT in all water year except below normal years (7% greater) (Table 11-5A-158).

Table 11-5A-158. Difference and Percent Difference in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence[a]

Water Year Type	EXISTING CONDITIONS vs. A5A_ELT	NAA_ELT vs. A5A_ELT
Wet	-3 (-4%)	-2 (-3%)
Above Normal	-2 (-3%)	-2 (-3%)
Below Normal	1 (1%)	5 (7%)
Dry	0 (0%)	0 (1%)
Critical	-3 (-4%)	0 (0%)
All	-2 (-2%)	0 (0%)

[a] A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

NEPA Effects: Collectively, these modeling results indicate that the effect would not be adverse because Alternative 5A would not cause a substantial reduction in the quantity or quality of habitat for juvenile and adult hardhead. Flows in all rivers examined during the year under Alternative 5A are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through November are more likely to be lower for some water year types in some of the locations analyzed, however they are generally of small magnitude, not consistent from month to month within a specific water year type, and/or would be offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected to have biologically meaningful negative effects on hardhead. 5AThere are no temperature-related effects in any rivers examined.

CEQA Conclusion: In general, Alternative 5A would not affect the quality and quantity of upstream habitat conditions for juvenile and adult hardhead relative to Existing Conditions.

Flows

Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period. Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult hardhead.

In the Sacramento River upstream of Red Bluff, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through July and December, except in below normal years during March and May (8% and 7% lower, respectively), and in wet years during May (11%) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows would generally be similar to or lower than flows under Existing Conditions during August through November (to 22% lower), except in wet and above normal years during September (26% and 44% greater, respectively). (Appendix B, *Supplemental Modeling for New Alternatives*). There would be primarily small flow reductions in some water year types for some months, but not persistent enough and of a magnitude that would not be expected to have biologically meaningful negative effects.

In the Trinity River below Lewiston Reservoir, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions during January through September and December, except in below normal years during January (16% lower), in below normal years during March (6% lower), and in critical years during May (6% lower), and critical years in August and September (8% and 17% lower, respectively). Flows under A5A_ELTwould generally be similar to or lower (up to 8%) than flows under Existing Conditions during October and November (Appendix B, *Supplemental Modeling for New Alternatives*). These small flow reductions in some water year types during October and November would not be persistent enough or of a magnitude that would have biologically meaningful negative effects.

In the Feather River at Thermalito Afterbay, flows under A5A_ELT would be greater than flows under Existing Conditions during April through July, October, and December except in below normal years during April (6% lower), in wet years during May, June, and December (15%, 10%, and 22% lower, respectively), in critical years during July (40% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be moderately to substantially lower than flows under Existing Conditions in January, February, August, and September, except in wet years during February, August and September (6%, 50%, and 136% greater, respectively), in above normal years during August and September (30% and 82% greater, respectively), and in critical years during September (20% greater).

In the American River at Nimbus Dam, flows under A5A_ELT would generally be similar to or greater than flows under Existing Conditions in wetter years during January, in wet and below normal years during December, and in most water year types during February through March, except in dry and critical years during February (5% and 12% lower, respectively), in critical years during March (5% lower), and in above normal and dry years during April (5% lower) (Appendix B, *Supplemental Modeling for New Alternatives*). Flows under A5A_ELT would generally be similar to or lower than flows under Existing Conditions during May through November, except in critical years during May (12% greater), in below normal and dry years during June (18% greater), and in critical years during October (8% greater). There would be persistent small to substantial flow reductions that would affect conditions for adults at this location.

In the San Joaquin River at Vernalis, flows under A5A_ELT would generally be similar to or slightly lower than those under Existing Conditions during February through September (up to 23% lower), and would be similar or slightly higher than flows under Existing Conditions during January, and October through December (up to 12% greater).

In the Stanislaus River at the confluence with the San Joaquin River, flows under A5A_ELT would generally be up to 29% lower than to those under Existing Conditions during January through July, except for 17%, 10%, and 11% greater flow in wet years during February, March and June, respectively, and in above normal years in January and February (8% and 7% greater, respectively), and would be similar to or slightly lower than flows under Existing Conditions during August through December.

Water Temperature

The percentage of months in which year-round in-stream temperatures would be outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to degraded rearing habitat quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under A5A_ELT would generally be the same as those under Existing Conditions. Therefore, there would be no temperature related effects of A5A_ELT in these rivers during any month.

In the Feather River below Thermalito Afterbay, the percentage of months under A5A_ELT outside of the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead would be similar to or lower than the percentage under Existing Conditions in all water years (Table 11-5A-158).

Summary of CEQA Conclusion

Collectively, flows would be lower under Alternative 5A during the juvenile and adult hardhead occurrence period relative to Existing Conditions. Flows would be persistently and moderately to substantially lower in several rivers during substantial portions of the rearing period. Therefore, these modeling results indicate that the difference between Existing Conditions and Alternative 5A could be significant because the alternative could substantially degrade habitat for juvenile and adult hardhead as a result of flow reductions.

As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, flows and water temperatures in all rivers would generally be similar between NAA_ELT and Alternative 5A. These results represent the increment of change attributable to the alternative, demonstrating the general similarities in flows and water temperature under Alternative 5A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

California Bay Shrimp

NEPA Effects: As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations have the potential to affect California bay shrimp juvenile abundance through an increase in residual circulation in the estuary with increasing outflow (as indexed by X2) that could translate to more rapid or more complete entrainment into the estuary, or more rapid transport to rearing grounds, both of which presumably could increase survival from hatching to settlement (Kimmerer et al. 2009). An X2-abundance index relationship from Kimmerer et al. (2009) was applied to bay shrimp in order to assess the potential effects on abundance through changes in rearing habitat. Application of these relationships suggested that, in relation to NAA_ELT, there would be a 6% decrease in mean abundance index as a result of change in rearing habitat under Alternative 5A scenario A5A_ELT (See Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A). This result indicates that the operational effects would not be adverse, because they would not result in a substantial reduction in the rearing habitat for California bay shrimp.

CEQA Conclusion: Similar to striped bass and American shad, the analysis of potential water operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of Alternative 5A on abundance of California bay shrimp (Table 11-mult-13 in Chapter 11, Section 11.3.5, in Appendix A), than found in the NEPA Effects section. As noted for striped bass and American shad, the comparison to the NAA_ELT is a better approach than comparison to Existing Conditions because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands. In the case of the X2-related analyses of rearing habitat for California bay shrimp and as noted for striped bass and American shad, the effect of sea level rise in particular confounds the interpretation of the effects of the alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing habitat would be less than significant. No mitigation would necessary.

Impact AQUA-204: Effects of Water Operations on Migration Conditions for Non-Covered Aquatic Species of Primary Management Concern

Also, see Alternative 1A, Impact AQUA-204 for additional background information relevant to non-covered species of primary management concern.

Striped Bass

NEPA Effects: Under Alternative 5A Scenario A5A_ELT, average spring (March–May) monthly flows in the Sacramento River downstream of the north Delta intake would be reduced 2–16% during the adult striped bass migration compared to baseline (NAA_ELT). Sacramento River flows are highly variable inter-annually, but striped bass are still able to migrate upstream the Sacramento River during years of lower flows. The effect of reduced Sacramento flows under Alternative 2D would not be adverse.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because the changes in spring flow under Scenarios A5A_ELT (0–21% lower compared to Existing Conditions) would not interfere substantially with movement of pre-spawning striped bass through the Delta. No mitigation would be required.

American Shad

NEPA Effects: Flows in the Sacramento River below the north Delta diversion facilities under Scenario A5A_ELT would be reduced 2–16% relative to NAA_ELT during March–May, as described above for striped bass. River flows are highly variable inter-annually, and American shad are still able to migrate upstream the Sacramento River during lower flow years. Overall, the impact to American shad migration habitat conditions would not be adverse under Alternative 5A.

CEQA Conclusion: Impacts would be as described immediately above for striped bass and would be less than significant because the changes in flow under Scenario A5A_ELT would be 0–21% lower compared to Existing Conditions would not interfere substantially with movement of American shad from the Delta to upstream spawning habitat. No mitigation would be required.

Threadfin Shad

NEPA Effects: Threadfin shad are semi-anadromous, moving between freshwater and brackish water habitats. Threadfin shad found in the Delta do not actively migrate upstream to spawn. Therefore there is no effect on migration habitat conditions.

CEQA Conclusion: Impacts would be as described immediately above and would be less than significant because flow changes in the Delta under Alternative 5A would not alter movement patterns for threadfin shad. No mitigation would be required.

Largemouth Bass

NEPA Effects: Largemouth bass are non-migratory fish within the Delta. Therefore they do not use the Delta as a migration habitat corridor. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes under Alternative 5A would not affect largemouth movements within the Delta. No mitigation would be required.

Sacramento Tule Perch

NEPA Effects: Similar with largemouth bass, Sacramento tule perch are a non-migratory species and do not use the Delta as a migration corridor as they are a resident Delta species. There would be no effect.

CEQA Conclusion: As described immediately above, flow changes would not affect Sacramento tule perch movements within the Delta. No mitigation would be required.

Sacramento-San Joaquin Roach

NEPA Effects: For Sacramento-San Joaquin roach, the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 5A, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to the NEPA baseline. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for Sacramento-San Joaquin roach would be less than significant and no mitigation would be required.

Hardhead

NEPA Effects: For hardhead the overall flows and temperature in upstream rivers during migration to their spawning grounds would be similar to those described under Alternative 5A, Impact AQUA-202 for spawning. As described there, the flows would slightly improve the upstream conditions relative to the NEPA point of comparison. These conditions would not be adverse.

CEQA Conclusion: As described immediately above, the impacts of water operations on migration conditions for hardhead would be less than significant and no mitigation would be required.

California Bay Shrimp

NEPA Effects: The effect of water operations on migration conditions of California bay shrimp under Alternative 5A would be similar to that described for Alternative 1A (see Alternative 1A, Impact AQUA-204). For a detailed discussion, please see Alternative 1A, Impact AQUA-204. The effects would not be adverse.

CEQA Conclusion: As described above the impacts on California bay shrimp migration conditions would be less than significant and no mitigation would be required.

Restoration Measures and Environmental Commitments

Alternative 5A has the same type of restoration and environmental commitments as Alternative 4A, although with a proportionally lesser extent of restoration (up to 55 acres of tidal wetlands, for example) because there is only one north Delta intake under Alternative 5A compared to three under Alternative 4A. Nevertheless, the effect mechanisms are sufficiently similar that the following impacts are those presented under Alternative 4A that also apply to Alternative 5A.

Impact AQUA-205: Effects of Construction of Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-206: Effects of Contaminants Associated with Restoration Measures on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-207: Effects of Restored Habitat Conditions on Non-Covered Aquatic Species of Primary Management Concern

Impact AQUA-208: Effects of Methylmercury Management on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 12)

Impact AQUA-211: Effects of Localized Reduction of Predatory Fish on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 15)

Impact AQUA-212: Effects of Nonphysical Fish Barriers on Non-Covered Aquatic Species of Primary Management Concern (Environmental Commitment 16)

NEPA Effects: All of these restoration and environmental commitment impact mechanisms have been determined to result in no adverse effects on non-covered aquatic species of primary management concern for the reasons identified for Alternative 4A.

CEQA Conclusion: All of these restoration and environmental commitment impact mechanisms would be considered less than significant, for the reasons identified for Alternative 4A, and no mitigation would be required.

Upstream Reservoirs

Impact AQUA-217: Effects of Water Operations on Reservoir Coldwater Fish Habitat

NEPA Effects: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, this effect would not be adverse because coldwater fish habitat in the CVP and SWP upstream reservoirs under Alternative 5A would not be substantially reduced when compared to the No Action Alternative. Carryover storage thresholds for all CVP and SWP reservoirs would be similar between the No Action Alternative and Alternative 5A.

CEQA Conclusion: As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102, Alternative 5A would reduce the quantity of coldwater fish habitat in the CVP and SWP relative to Existing Conditions. There would be 6 fewer years (7% lower) that exceed the 250 TAF carryover storage threshold in Folsom Reservoir under Alternative 5A relative to Existing Conditions, which could result in a significant impact.

However, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of results between the alternative and NAA is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA and informed by the NEPA analysis above, there would be negligible effects on reservoir storage. These modeling results represent the increment of change attributable to the alternative, demonstrating the similarities in reservoir storage under Alternative 5A and the

NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

4.5.8 Terrestrial Biological Resources

Alternative 5A is generally similar to Alternative 4A except that it has only one intake (Intake 2) along the Sacramento River compared with the three under Alternative 4 A (Intakes 2, 3, and 5) and operates under a different operational scenario. Like Alternative 4A, this alternative would not serve as an NCCP/HCP and thus the analysis below only considers the conveyance facilities and operations and only includes the environmental commitments necessary to fully mitigate the projects impacts under CEQA and NEPA. Other than the decreased impacts from the intakes and associated restoration actions, the effects from Alternative 5A are relatively the same as those under Alternative 4A and therefore Alternative 5A is considered here in a summary fashion. The reader is referred to the discussion of Alternative 4A for a detailed analysis of impacts that would be associated with implementing Alternative 5A. The impacts associated with Alternatives 5A and 4A were derived by comparing the alternative with the No Action Alternative for NEPA purposes, and with Existing Conditions for CEQA purposes.

Operational components of the water conveyance facilities under Alternative 5A would be similar, but not identical, to those described under Scenario C in Chapter 3, Section 3.6.4.2, *North Delta and South Delta Water Conveyance Operational Criteria*, of the Draft EIR/EIS. These operations would include both new and existing water conveyance facilities once the new north Delta facilities are completed and become operational, thereby enabling joint management of north and south Delta diversions. Alternative 5A operations include a preference for south Delta pumping in July through September to provide limited flushing for improving general water quality conditions and reduced residence times. The operational scenario under Alternative 5A would have less operational capacity compared to Alternative 4A (3,000 cfs compared to 9,000 cfs).

Comparative Differences in Effects for Alternatives 5A and 4A

The principal differences in effect between these two alternatives would be related to the differing construction footprints of the water conveyance facilities and the differences in proposed restoration efforts. The Alternative 5A water conveyance facilities would entail construction of one north Delta intake (Intake 2). Intake 2 is located southeast of Clarksburg on the east side of the river, which is the same location of Intake 2 under Alternative 4A. The operational scenario for Alternative 5A (Scenario C) is also different from Alternative 4A (Scenario H3–H4), but the difference in water operations would not significantly change the operational effects on terrestrial biological resources in the study area.

As a result of fewer impacts from Alternative 5A less restoration and protection acreages would be required under the environmental commitments to achieve the applicable regulatory standards under ESA Section 7 and CESA Section 2081(b). These restoration actions would themselves result in affects on natural communities where they are likely to occur. Specific locations for implementing many of the restoration commitments have not been identified at this time. Therefore, the analysis considers typical activities that would be undertaken for implementation of the habitat restoration and provides an estimate of what acreages of natural communities would be lost or converted by these activities. These activities under Alternative 5A would generally be the same as those under Alternative 4A but would result in fewer impacts on valley foothill riparian and cultivated lands. The effects from these activities are summarized below in Table 4.5.8-1.

Due to having fewer intakes and associated infrastructure and the decreased restoration under the environmental commitments, Alternative 5A would have fewer permanent and temporary losses of natural communities and cultivated lands when compared with Alternative 4A (Table 4.5.8-1). Alternative 5A would permanently remove 4 less acres of valley/foothill riparian habitat along the Sacramento River, 13 acres less of grassland, 4 less acres of tidal perennial aquatic, and 232 acres less of cultivated land when compared to Alternative 4A.

During the water conveyance facilities construction process, Alternative 5A would involve less temporary loss of habitat when compared with Alternative 4A. The differences would include fewer impacts on cultivated lands east of the river (100 acres less), grassland along the river levee (3 acres less), tidal perennial aquatic within the river channel (17 acres less), and valley/foothill riparian along the river levee (5 acres less). No temporary impacts from restoration actions are anticipated because all restoration activities will take place within in the footprint of the proposed restoration site.

These differences in permanent loss of habitat associated with water conveyance construction and restoration would create relatively minor differences in effects on wildlife. The decrease in permanent loss of cultivated lands creates the largest difference between the two alternatives' impacts on wildlife. Alternative 5A would result in less loss of foraging habitat for sandhill cranes, tricolored blackbird, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark. The reduction in impacts on valley/foothill riparian habitat would result less impacts on breeding habitat for raptors, herons and egrets, Swainson's hawk, Cooper's hawk, white-tailed kite, and migratory habitat for species that use the river corridor, such as western yellow-billed cuckoo.

Alternative 5A would also have slightly fewer temporary losses of cultivated land, grassland and valley/foothill riparian natural communities and thus decrease the impacts on the species that use these areas relative to Alternative 4A. There would be fewer acres of foraging habitat temporarily lost for sandhill cranes, tricolored blackbird, Swainson's hawk, white-tailed kite, short-eared owl, loggerhead shrike, northern harrier, and California horned lark.

Alternative 5A would also permanently affect 25 less acres of jurisdictional wetlands and waters as regulated by Section 404 of the CWA, when compared to Alternative 4A (Table 4.5.8-2). Refer to Table 12-4A-68 for a summary of Alternative 4A permanent and temporary jurisdictional waters and wetlands impacts. The majority of this difference is due to fewer impacts on tidal channel (21 fewer acres) with a small difference in impacts on scrub-shrub wetlands (3 fewer acres) by having fewer intakes along the Sacramento River.

The environmental commitments described in Section 4.1.4.3 and the acreages of these commitments presented in Table 4.1-7 would provide for protection, enhancement and restoration of habitats affected under Alternative 5A. In addition, the Resource Restoration and Performance Principles in Table 4.1-8 would further guide the environmental commitments in mitigating the effects on terrestrial biological resources, AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37-39 described in Appendix 3.C, *Avoidance and Minimization Measures*, of the Draft BDCP and in Appendix D*, Substantive BDCP Revisions,* of this RDEIR/SEIS would be available to further avoid and minimize impacts, and preparation of an adaptive management and monitoring program as would likely be required during the ESA Section 7 and CESA Section 2081(b) process would further avoid, minimize, and mitigate the effects of Alternative 5A.

Table 4.5.8-1. Alternative 5A Effects on Natural Communities Relative to Alternative 4A (acres)

Natural Community	Permanent Impacts from Alt. 5A						Permanent Impact Difference from Alternative 4A	Temporary Impacts Alt. 5A	Temporary Impact Difference from Alternative 4A
	Water Conveyance	EC 4 – Tidal Restoration	EC 7 – Riparian Restoration	EC8 – Grassland Restoration	EC 10 – Nontidal Restoration	Permanent Impact Total			
Tidal perennial aquatic	203	0	0	0	0	*203*	-4	*2,081*	-17
Tidal brackish emergent wetland	0	0	0	0	0	*0*	0	*0*	0
Tidal freshwater emergent wetland	3	0	0	0	0	*3*	0	*15*	0
Valley/foothill riparian	38	5	0	0	0	*43*	-4	*26*	-5
Nontidal perennial aquatic	59	0	0	0	0	*59*	0	*9*	0
Nontidal freshwater perennial emergent wetland	2	0	0	0	0	*2*	0	*6*	0
Alkali seasonal wetland complex	2	0	0	0	0	*2*	0	*0*	0
Vernal pool complex	28	0	0	0	0	*28*	0	*3*	0
Managed wetland	22	0	0	0	0	*22*	0	*29*	0
Other natural seasonal wetland	0	0	0	0	0	*0*	0	*0*	0
Grassland	493	0	0	0	0	*493*	-13	*148*	-3
Inland dune scrub	0	0	0	0	0	*0*	0	*0*	0
Cultivated lands	3,601	50	222	1,044	826	*5,743*	-232	*1,239*	-100

Table 4.5.8-2 Alternative 5A Effects on Jurisdictional Wetlands and Waters Relative to Alternative 4A (acres)

Habitat Type	Alternative 5A Impacts on Jurisdictional Wetlands and Waters				Difference from 4A[d]
	Permanent Impact	Temporary Impacts Treated as Permanent[a]	Temporary Impact[b]	Total Impact[c]	
Agricultural Ditch	45.0	17.0	0	62.0	-0.9
Alkaline Wetland	20.3	0.1	0	20.4	0.0
Clifton Court Forebay	258.0	0	1,931.0	258.0	0.0
Conveyance Channel	8.0	2.9	0	10.8	0.0
Depression	29.3	7.2	0	36.5	0.1
Emergent Wetland	57.2	31.7	0	89.0	0.2
Forest	8.3	8.3	0	16.6	-0.3
Lake	23.2	0	0	23.2	0.0
Scrub-Shrub	11.2	3.6	0	14.8	-3.3
Seasonal Wetland	114.6	25.1	0	139.7	0.0
Tidal Channel	15.5	63.5	0	79.0	-20.9
Vernal Pool	0.3	0	0	0.3	0
Total	591	159	1,931	750	-25

[a] Temporary impacts treated as permanent are temporary impacts expected to last over one year. These impact sites will eventually be restored to pre-project conditions; however, due to the duration of effect, compensatory mitigation will be included for these areas.

[b] Temporary impacts would result from dredging Clifton Court Forebay.

[c] Total does not include temporary impacts on Clifton Court Forebay because these would be temporary disturbance to open water, which typically does not require compensatory mitigation.

[d] Difference in total impacts between 5A and 4A.

NEPA Effects: Alternative 5A would not have adverse effects on the terrestrial natural communities, special-status species and common species that occupy the study area. As with Alternative 4A, this alternative also would not substantially disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, Alternative 5A would result in existing habitat converted by water conveyance construction and restoration actions but to a slightly smaller degree. The temporarily-affected habitat would be restored to its pre-project condition and the restoration under the environmental commitments (Environmental Commitments 3, 4, 6–10) would permanently replace primarily cultivated land with tidal and nontidal marsh, grassland, and riparian vegetation. The environmental commitments would result in the protection of 12,724 acres and restoration of 2,181 acres of natural communities to offset effects. Where environmental commitments would not fully offset effects, AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37–39, and in some cases specific mitigation measures have been developed to avoid and minimize adverse effects. Alternative 5A would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

CEQA Conclusion: Alternative 5A would not have significant and unavoidable impacts on the terrestrial natural communities, special-status species and common species that occupy the study area. As with Alternative 4A, this alternative also would not significantly disrupt wildlife movement corridors, significantly increase the risk of introducing invasive species, reduce the value of habitat for waterfowl and shorebirds, or conflict with plans and policies that affect the study area. As with Alternative 4A, existing habitat would be converted construction of water conveyance facilities and the associated restoration to offset these impacts. The temporarily-affected habitat would be restored to its pre-project condition and the restoration conservation measures (Environmental Commitments 3, 4, 6–10) would permanently replace primarily cultivated land a with tidal and nontidal marsh, grassland, and riparian vegetation. The environmental commitments would result in the protection of 12,724 acres and restoration of 2,181 acres of natural communities and, together with the AMMs 1–7, 10, 12–15, 18, 20–25, 27, 30, and 37–39, and some cases specific mitigation measures would mitigate the projects impacts to a less-than-significant level. Alternative 5A would not require mitigation measures beyond what is proposed for Alternative 4A to offset effects.

As with Alternative 4A, Alternative 5A would require several mitigation measures to be adopted to reduce all effects on terrestrial biological resources to less-than-significant levels. These mitigation measures would be needed beyond the Environmental Commitments provided and AMMs provided by Alternative 5A. The relevant mitigation measures, which are included in detail in the analysis of Alternative 4A, are as follows:

- Mitigation Measure BIO-42: Avoid Impacts on Delta Green Ground Beetle and its Habitat
- Mitigation Measure BIO-43: Avoid and Minimize Loss of Callippe Silverspot Butterfly Habitat
- Mitigation Measure BIO-55: Conduct Preconstruction Surveys for Noncovered Special-Status Reptiles and Implement Applicable AMMs
- Mitigation Measure BIO-66: California Least Tern Nesting Colonies Shall Be Avoided and Indirect Effects on Colonies Will Be Minimized
- Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds
- Mitigation Measure BIO-117: Avoid Impacts on Rookeries

- Mitigation Measure BIO-146: Active Bank Swallow Colonies Shall Be Avoided and Indirect Effects on Bank Swallow Will Be Minimized
- Mitigation Measure BIO-147: Monitor Bank Swallow Colonies and Evaluate Winter and Spring Flows Upstream of the Study Area
- Mitigation Measure BIO-162: Conduct Preconstruction Survey for American Badger
- Mitigation Measure BIO-166: Conduct Preconstruction Surveys for Roosting Bats and Implement Protective Measures
- Mitigation Measure BIO-170: Avoid, Minimize, or Compensate for Impacts on Noncovered Special-Status Plant Species
- Mitigation Measure BIO-176: Compensatory Mitigation for Fill of Waters of the U.S.

4.5.9 Land Use

Impact LU-1: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The nature of impacts related to incompatibility with land use regulations stemming from the construction of water conveyance structures under Alternative 5A would be of a similar nature but of slightly less magnitude than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because the alignments are the same. However, whereas Alternative 4 includes Intakes 2, 3, and 5, Alternative 5A only includes Intake 2. Alternative 5A would include the same physical/structural components as Alternative 4 but would only include one rather than three intakes.

Like Alternative 4, Alternative 5A would place temporary and permanent structures on lands designated for other uses by the general plans of Sacramento, San Joaquin, Contra Costa, and Alameda Counties. However, because Alternative 5A includes only one intake, it is anticipated that fewer acres would be impacted than under Alternative 4.The construction of the water conveyance facilities would require land use activities that would be incompatible with land use designations, goals and policies ascribed to the study area and for the purposes of reducing environmental impacts. To the extent that constructing Alternative 5A would result in incompatibilities with land use designations, goals and policies designed to avoid or reduce environmental effects, these potential incompatibilities are described under Alternative 4 of Chapter 13, *Land Use*, Section 13.3.3.9, Impact LU-1 in Appendix A of this RDEIR/SDEIS. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, to the extent that alternatives are incompatible with such land use designations, goals, and policies, any related environmental effects are discussed in other chapters.

CEQA Conclusion: These incompatibilities indicate the potential for a physical consequence to the environment. As discussed in Section 13.3.2, *Determination of Effects*, the physical effects they suggest are discussed in other chapters throughout this document. The relationship between plans, policies, and regulations and impacts on the physical environment is discussed in Section 13.3.1, *Methods for Analysis*, of the Draft EIR/EIS.

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The nature of effects related to conflicts with existing land uses under Alternative 5A would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because the alignments are the same. However, whereas Alternative 4 includes Intakes 2, 3, and 5, Alternative 5A only includes Intake 2. Because this alternative includes fewer intakes, effects related to conflicts with existing land uses under Alternative 5A would be slightly less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS due to construction of only one intake. As for Alternative 4, construction and operation of physical facilities for water conveyance would create temporary or permanent conflicts with existing land uses (including displacement of existing structures and residences) because of the construction of permanent features of the facility. Because Alternative 5A includes only one intake, it is anticipated that fewer structures would be impacted than under Alternative 4. Indirect impacts would primarily happen as a result of incompatibility with adjacent land uses or the loss or increased difficultly of access to parcels. Table 13-12 in

Appendix A of this RDEIR/SDEIS, summarizes the estimated number of structures affected across structure type and alternative and Mapbook Figure M13-4 in the Mapbook Volume of the Draft EIR/EIS shows the distribution of these effects across the Modified Pipeline/Tunnel conveyance alignment.

The removal of a substantial number of existing permanent structures as a result of constructing the water conveyance facility would be considered a direct, adverse socioeconomic effect of this alternative under NEPA. When required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative, which would reduce the severity of economic effects related to this physical impact, but would not reduce the severity of the physical impact itself. Project conflicts with existing public structures under Alternative 5A are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential adverse effects on the environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential adverse effects on traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS.

CEQA Conclusion: Construction of the proposed water conveyance facility would necessitate the removal of a substantial number of existing permanent structures. The removal of existing structures is not, in itself, considered an environmental impact, though removal might entail economic impacts. Significant environmental impacts would only result if the structures qualified as "historical resources" or the removal of structures led to physical effects on certain other resources. As discussed in Section 13.3.2, *Determination of Effects*, of the Draft EIR/EIS, such effects are discussed in other sections throughout the document. Project conflicts with existing public structures under Alternative 5A are addressed in Section 4.3.16, *Public Services and Utilities*, of this RDEIR/SDEIS; potential impacts on the public and environment related to the potential release of hazardous materials contained in structures to be demolished are addressed in Section 4.3.20, *Hazards and Hazardous Materials*, of this RDEIR/SDEIS; and potential impacts on "historical resources" (including qualifying structures) and traditional cultural properties are addressed in Section 4.3.14, *Cultural Resources*, of this RDEIR/SDEIS. Where applicable, project proponents will provide compensation to property owners for losses due to implementation of Alternative 5A. This compensation would not constitute mitigation for any related physical impact; however, it would reduce the severity of economic effects.

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: Effects related to any potential division of an existing community as a result of the construction of water conveyance facilities under Alternative 5A would be similar in nature but slightly less in magnitude compared to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, due to construction of only one intake. Whereas Intake 4 includes Intakes 2, 3, and 5, Intake 5A only includes Intake 2. A tunnel carrying water south from Intake 2 to the intermediate forebay would be placed under the community of Hood. The tunnel would be constructed below the surface and would not interfere with the existing community; therefore, the alignment would not create a physical structure adjacent to or through the existing community. While construction activities for Intake 2 and the intermediate forebay would occur in the relative proximity of the community of Hood, the community would not be crossed by these alternatives. Although permanent physical structures adjacent to or through Hood are not anticipated to result from this alternative, activities associated with construction of Intake 2 could increase road traffic around

Hood in certain areas for a limited period of time. Mitigation Measures TRANS-1a and TRANS-1b are available to address this effect. Impacts would not be adverse.

CEQA Conclusion: During the construction of the tunnel between Intake 2 and the intermediate forebay, construction activities would occur to the north of the community of Hood. These impacts would be significant. Implementation of Mitigation Measures TRANS-1a and TRANS-1b would reduce the severity of this impact by supporting continued access to and from the community on transportation routes, and would reduce impacts to a less-than-significant level.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Chapter 19, *Transportation*, under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact LU-4: Incompatibility with Applicable Land Use Designations, Goals, and Policies as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 5A related to incompatibility with applicable land use designations, goals, and policies resulting from implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16 would be similar in mechanism to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, Alternative 5A would protect and restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, and 6–10, as compared with 83,800 acres under Alternative 4. Up to 3.1 miles of channel margin habitat would be enhanced under Alternative 5A with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 5A would be substantially smaller than those associated with Alternative 4. Because Alternative 5A doesn't include those Conservation Measures, the BDCP will be treated as a covered activity under the Delta Plan. The consistency between this alternative and the Delta Plan is discussed in detail in Appendix G of this RDEIR/SDEIS.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land use designations, goals, and policies. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, local designations, goals, and policies related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 12, *Terrestrial Biological Resources*, and Chapter 14, *Agricultural Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations for the implementation of many of these land-intensive actions are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 12, *Terrestrial Biological Resources*, and Chapter 14, *Agricultural Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-5: Conflicts with Existing Land Uses as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects related to conflicts with existing land uses under Alternative 5A would be similar in mechanism to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 5A (and as described in Section 4.1, *Introduction*, and under Impact LU-4, above). While the location of each restoration and/or enhancement action is not known at this time, it is possible that implementing these measures may result in temporary (e.g., construction activities that may conflict with land designated as open space) or permanent (e.g., displacement of existing residents and removal of existing structures) physical conflicts with existing land uses in or immediately adjacent to the study area.

Because the locations for the implementation of these environmental commitments are unknown at this time, there is some uncertainty about whether new land uses related to these environmental commitments would be incompatible with existing land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with land uses within and adjacent to the study area, which predominantly consists of agriculture and open space. Most activities would be anticipated to take place on land designated for agriculture, open space, natural preserve and recreation; therefore, land uses related to preservation of those attributes would likely be compatible with the restoration actions that would take place under these environmental commitments. Additionally, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 12, *Terrestrial Biological Resources*, and Chapter 14, *Agricultural Resources*. Therefore, implementation of this alternative is not anticipated to result in substantial incompatibilities with local land use regulations. Impacts would not be adverse.

CEQA Conclusion: Because specific locations and types of restoration to be implemented are unknown at this point, there is some uncertainty about whether new land uses related to these environmental commitments would conflict with existing land uses or result in the permanent conversion of land uses. However, the restoration associated with these environmental commitments would be consistent with open space, and would generally be compatible with the study area, which is a predominantly agricultural area. Specific impacts to agriculture or wildlife habitat are evaluated in Chapter 12, *Terrestrial Biological Resources*, and Chapter 14, *Agricultural Resources*. . Therefore, implementation of this alternative is not anticipated to conflict with existing land uses. Impacts would be less than significant because environmental commitment actions would be largely consistent with open space and agricultural uses, actions would be limited compared to other BDCP alternatives, and actions would be dispersed across the study area. No mitigation is required.

Impact LU-6: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and16

NEPA Effects: Effects related to the physical division of an existing community under Alternative 5A would be similar in mechanism to those described for Alternative 4, but to a substantially smaller magnitude based on the conservation activities proposed under Alternative 5A (and as described in Section 4.1, *Introduction*, and under Impact LU-4, above). Because the locations for the implementation of these habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is not anticipated to be adverse.

CEQA Conclusion: Because the locations for the implementation of habitat restoration and enhancement activities are unknown at this point, a conclusion about this alternative's potential to divide an existing community cannot be made; however, because, large-scale restoration actions that take place in areas suitable for open space, resource conservation, and habitat are not likely to create permanent physical divisions in existing communities, this impact is anticipated to be less than significant.

4.5.10 Agricultural Resources

Impact AG-1: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Constructing the Proposed Water Conveyance Facility

NEPA Effects: The temporary and short-term conversion and permanent conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses would be similar to those described under Alternative 4 (as described in Chapter 14, *Agricultural Resources,* Section 14.3.3.9 in Appendix A of this RDEIR/SDEIS) and would constitute an adverse effect on the physical environment. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower agricultural conversion effects when compared to Alternative 4. Disposal and reuse of RTM (described in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS), along with Mitigation Measure AG-1, would be available to reduce these effects.

CEQA Conclusion: Construction of physical structures associated with the water conveyance facility proposed under this alternative would occupy Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones, directly precluding agricultural use for the duration of construction. As described above and in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, it is anticipated that the RTM and dredged material would be removed from RTM storage areas (which represent a substantial portion of the permanent impact areas) and reused, as appropriate, as bulking material for levee maintenance, as fill material for habitat restoration projects, or other beneficial means of reuse identified for the material. Because these activities would convert a substantial amount of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones to nonagricultural uses, however, they are considered significant impacts on the environment. Implementation of Mitigation Measure AG-1 would reduce these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4. For further discussion of potential incompatibilities with land use designations, see Section 4.4.9, *Land Use*, in this RDEIR/SDEIS.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in the Draft EIR/EIS.

Impact AG-2: Other Effects on Agriculture as a Result of Constructing and Operating the Proposed Water Conveyance Facility

Effects associated with construction and operation of the water conveyance facility under this alternative would be similar to those described under Alternative 4 in terms of effects related to seepage from the operation of forebays and from disruption of drainage and irrigation facilities during construction of water conveyance facilities. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower effects related to disruption of agricultural infrastructure when compared to Alternative 4. These activities could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas adjacent to forebays and through disruption of drainage and irrigation facilities.

Effects of this alternative related to water quality would be adverse or beneficial, depending on the location. Under Alternative 5A, Operational Scenario C, the operation of new physical facilities combined with hydrodynamic effects of habitat restoration activities could indirectly affect agriculture by causing changes to the quality of irrigation water in parts of the study area. Relative to Existing Conditions, Alternative 5A would potentially result in an increase in the number of days the Bay-Delta WQCP EC objectives would be exceeded in the Sacramento River at Emmaton, in the San Joaquin River at San Andreas Landing, and in the San Joaquin River at Jersey Point (Table EC-9 in Appendix B of this RDEIR/SDEIS). However, as indicated in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, to understand and interpret these results, considerations must be made regarding uncertainty in the modeling, differing assumptions between the modeling and the alternative, and sensitivity analyses, as discussed at the below. These EC objectives and locations are addressed in the context of these considerations in detail in Section 4.5.4, *Water Quality* of this RDEIR/SDEIS. At all other locations, the level of exceedance and EC in the modeling results was approximately equivalent or lower than under Existing Conditions.

Modeling results indicated that the Emmaton EC objective would be exceeded more often under Alternative 5A than under Existing Conditions and the No Action Alternative (ELT), and that increases in EC could cause substantial water quality degradation in summer months of dry and critical water years. However, sensitivity analyses have shown that the level of effect would be less than presented in the modeling. Modeling results indicated that the percent of days the Emmaton EC objective would be exceeded for the entire period modeled (1976–1991) would increase from 6% under Existing Conditions, or 13% under the No Action Alternative (ELT), to 17%, and the percent of days out of compliance would increase from 11% under Existing Conditions, or 21% under the No Action Alternative, to 28%. Average EC levels at Emmaton would increase by 7% relative to Existing Conditions during the drought period modeled.

Alternative 5A is not expected to have adverse effects on EC in the San Joaquin River at San Andreas Landing, relative to Existing Conditions and the No Action Alternative (ELT). The percent of days the San Andreas Landing EC objective would be exceeded would increase by <1% under Alternative 5A relative to existing conditions, and the percent of days out of compliance with the EC objective for San Andreas Landing would increase from 1% under Existing Conditions to 2% (Table EC-9 in Appendix B of this RDEIR/SDEIS). Results relative to the No Action Alternative (ELT) were similar (Table EC-17 in Appendix B of this RDEIR/SDEIS).

The percent of days the Jersey Point EC objective would be exceeded would increase from 0% under Existing Conditions, or 3% under the No Action Alternative (ELT), to to 4%, and the percent of days out of compliance with the EC objective would increase from 0% under Existing Conditions, or 3% under the No Action Alternative (ELT) to 5% (Table EC-9 in Appendix B of this RDEIR/SDEIS) . As indicated in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, the incremental increase in the frequency of objective exceedance relative to the No Action Alternative (ELT), which reflects only the effects due to the alternative, and not the effects of climate change, sea level rise and water demands, would be 1%. This small incremental increase is within the model uncertainty and, thus, the alternative is not expected to contribute to exceedances during real-time operation of the alternative.

As described in Section 4.5.4, *Water* Quality, of this RDEIR/SDEIS, the analysis of EC under Alternative 5A is based on modeling for Alternative 5 in the ELT, which assumes implementation of Yolo Bypass improvements and 25,000 acres of tidal restoration. In addition, the modeling assumed that the Emmaton compliance point shifted to Threemile Slough. However, improvements to Yolo Bypass are not a component of Alternative 5A and this alternative does not include a change in compliance point from Emmaton to Threemile Slough. Furthermore, as discussed in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, sensitivity analyses suggest that many of the modeled exceedances are a result of modeling artifacts or a result of operating rules used by the CALSIM II model under extreme hydrologic and operational conditions where there is not enough water supply to meet all requirements. In these cases, CALSIM II uses a series of operating rules to reach a solution that is a simplified version of the very complex decision processes that SWP and CVP operators would use in actual extreme conditions. Thus, it is unlikely that the Emmaton objective would actually be violated due to dead pool conditions, as suggested by modeling results. In the case of San Andreas Landing, the small number of modeled exceedances not attributable to modeling artifacts would be small in magnitude, last only a few days, and could be addressed with real time operations of the SWP and CVP (see Chapter 8, *Water Quality,* Section 8.3.1.1, in Appendix A of this RDEIR/SDEIS for a description of real time operations of the SWP and CVP). However, the results at Emmaton indicate that water supply could be either under greater stress or under stress earlier in the year, and EC levels at Emmaton and in the western Delta may increase as a result, leading to EC degradation and increased possibility of adverse effects on agricultural beneficial uses.

NEPA Effects: Considered together, construction and operation of the water conveyance facility under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Relative to the No Action Alternative (ELT), the increases in EC in the Sacramento River at Emmaton, particularly during summer months of dry and critical water years, would constitute an adverse effect on water quality and, therefore, could adversely affect agricultural resources. Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 will reduce the severity of these adverse effects.

CEQA Conclusion: Water conveyance facility construction and operation could create a significant impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation in localized areas and disruption of drainage and irrigation facilities. Average EC levels at Emmaton would increase by 7% relative to Existing Conditions during the drought period modeled. The largest monthly average increases in EC would occur during the summer months of the drought period, and more generally in dry and critical water year types. The increases in drought period average EC levels could cause substantial water quality degradation that would potentially contribute to significant impacts on the agricultural beneficial uses in the western Delta. The western Delta is CWA Section 303(d) listed for elevated EC and the increased EC degradation that could occur in the western Delta could make beneficial use impairment measurably worse. The comparison to Existing Conditions reflects changes in EC due to both Alternative 5A operations and climate change/sea level rise.

Implementation of Mitigation Measures AG-1, GW-1, GW-5, and WQ-11 will reduce the severity of these impacts by implementing activities such as siting project footprints to encourage continued agricultural production; monitoring changes in groundwater levels during construction; offsetting water supply losses attributable to construction dewatering activities; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. Implementation of Mitigation Measure WQ-11 would be expected to reduce these effects to a less than significant level. However, impacts related to conversion of Important Farmland would remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-1: Maintain Water Supplies in Areas Affected by Construction Dewatering

Please see Mitigation Measure GW-1 under Impact GW-1 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

Mitigation Measure WQ-11: Avoid, Minimize, or Offset, as Feasible, Reduced Water Quality Conditions

Please see Mitigation Measure WQ-11 under Impact WQ-11 in the discussion of Alternative 1A in Chapter 8, *Water Quality*, of the Draft EIR/EIS.

Impact AG-3: Temporary Conversion, Short-Term Conversion, and Permanent Conversion of Important Farmland or of Land Subject to Williamson Act Contracts or in Farmland Security Zones as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6, 7, 9–12, 15, and16

Effects of Alternative 5A related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4A in Section 4.3.10, *Agricultural Resources*, of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, Alternative 5A would protect and restore up to 14,908 acres of habitat under Environmental Commitment 3, 4, and 6–10, as compared with 83,800 acres under Alternative 4. Up to 3.1 miles of channel margin habitat would be enhanced under Alternative 5A with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 5A would likely be substantially smaller than those associated with Alternative 4.

NEPA Effects: Because locations have not been selected for many of these habitat restoration and enhancement activities, the precise extent of this effect is unknown. However, based on the large proportion of land in the Conservation Zones designated as Important Farmland and/or subject to Williamson Act contracts or in Farmland Security Zones, it is anticipated that a substantial area of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones would be directly converted to habitat purposes under this alternative, resulting in an adverse effect on the environment. While conflicts with or cancellation of Williamson Act contracts would not—by itself—constitute an adverse effect on the quality of the human environment, the related conversion of the underlying agricultural resource would result in such an effect. Mitigation Measure AG-1 would be available to lessen the severity of these potential effects. Also, under the provisions of Government Code §51223, it may be feasible to rescind Williamson Act contracts for agricultural use, and enter into open space contracts under the Williamson Act, or open space easements pursuant to the Open Space Easement Act. To the extent this mechanism is used, it would eliminate the Williamson Act conflicts otherwise resulting from changes from agriculture to restoration and mitigation uses. For further discussion of potential incompatibilities with land use policies, see Section 4.4.9, *Land Use*, of this RDEIR/SDEIS.

CEQA Conclusion: Implementation of Environmental Commitments could result in conversion of a substantial amount of Important Farmland and conflict with land subject to Williamson Act contracts or in Farmland Security Zones, resulting in a significant impact on agricultural resources in the study area. Implementation of Mitigation Measure AG-1 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of this measure for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Impact AG-4: Other Effects on Agriculture as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

Effects of Alternative 5A related to the conversion of Important Farmland and land subject to Williamson Act contracts or in Farmland Security Zones associated with these environmental commitment activities would be similar to those described for Alternative 4A. However, the acreages associated with some of these commitments would be lower than those proposed under Alternative 4A, as described above in Impact AG-3.

NEPA Effects: Implementation of conservation actions under this alternative could create indirect but adverse effects on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. However, implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these adverse effects.

CEQA Conclusion: Implementation of Environmental Commitments under this alternative could create a significant impact on agriculture by converting substantial amounts of Important Farmland to other uses through changes to groundwater elevation and seepage or disruption of drainage and irrigation facilities. Further evaluation of these effects would depend on additional information relating to the location of these activities and other detailed information. Implementation of Mitigation Measures AG-1 and GW-5 will reduce the severity of these impacts by implementing activities such as siting features to encourage continued agricultural production; monitoring seepage effects; relocating or replacing agricultural infrastructure in support of continued agricultural activities; engaging counties, owners/operators, and other stakeholders in developing optional agricultural stewardship approaches; and/or preserving agricultural land through offsite easements or other agricultural land conservation interests. However, these impacts remain significant and unavoidable after implementation of these measures for the same reasons provided under Alternative 4.

Mitigation Measure AG-1: Develop an Agricultural Lands Stewardship Plan (ALSP) to Maintain Agricultural Productivity and Mitigate for Loss of Important Farmland and Land Subject to Williamson Act Contracts or in Farmland Security Zones

Please see Mitigation Measure AG-1 under Impact AG-1 in the discussion of Alternative 4 in Chapter 14, *Agricultural Resources*, of the Draft EIR/EIS.

Mitigation Measure GW-5: Agricultural Lands Seepage Minimization

Please see Mitigation Measure GW-5 under Impact GW-5 in the discussion of Alternative 1A in Chapter 7, *Groundwater*, of the Draft EIR/EIS.

4.5.11 Recreation

Impact REC-1: Permanent Displacement of Existing Well-Established Public Use or Private Commercial Recreation Facility Available for Public Access as a Result of the Location of Proposed Water Conveyance Facilities

NEPA Effects: The extent of the permanent displacement of public use or private commercial recreation areas located within the Delta occurring under Alternative 5A would be the same as described for Alternative 4, as described in Chapter 15, *Recreation,* Section 15.3.3.9 in Appendix A of this RDEIR/SDEIS. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. The recreation areas that could be adversely affected are the Cosumnes River Preserve and Clifton Court Forebay. Recreation could be disrupted at the Cosumnes River Preserve by placing an RTM area to the north of the preserve, constructing an east-west permanent transmission line adjacent to the northern boundary of the preserve, and locating permanent tunnel shafts on the preserve. Modifications made to Clifton Court Forebay would disrupt recreation activities occurring on and near the forebay's south embankment. Other potential impacts along the alignment of the water conveyance facility include disruption of use of portions of Staten Island and use of DWR ponds currently used for water ski instruction and hound racing. As described in detail under Alternative 4, construction of the water conveyance facilities under Alternative 5A would not result in an adverse effect on public use or private commercial recreation facilities because none of these facilities would be permanently displaced.

CEQA Conclusion: The extent of permanent displacement of public use or private commercial recreation areas under Alternative 5A would be the same as discussed for Alternative 4 because the type and alignment of the water conveyance facilities are similar between the two alternatives. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. This includes placing permanent facilities on or disrupting access to the Cosumnes River Preserve, including public access to portions of Staten Island. Similarly, recreation use of the Clifton Court Forebay embankments would be disrupted during construction. Specifically, public access to the forebay's south embankment, which supports fishing and hunting, would be disrupted during construction. Alternative 5A would not result in the permanent displacement of well-established public use or private commercial recreation facilities available for public access. The impact on these facilities would be less than significant and no mitigation is required.

Impact REC-2: Result in Long-Term Reduction of Recreation Opportunities and Experiences as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction of recreation experiences within the Delta as a result of construction the water conveyance facilities under Alternative 5A would be the same as described for Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Two recreation sites, Clifton Court Forebay and Cosumnes River Preserve, are within the construction footprint and six recreation sites or areas (Stone Lakes National Wildlife Refuge, Clarksburg Boat Launch, Wimpy's Marina, Delta Meadows, Bullfrog Landing Marina, and Lazy M Marina) are within the 1,200– to 1,400-foot indirect impact area. Potential indirect effects on recreation include loss of access, construction noise, and changes in the visual character of the area surrounding the recreation sites.

As discussed in detail under Alternative 4, impacts on recreation occurring within the Stone Lakes NWR would be attributable to noise and changes in visual character as a result of temporary work areas, RTM storage, geotechnical exploration, construction of Intake 2, and construction of the temporary transmission lines. Recreation activities that could be adversely affected include wildlife and environmental education.

As discussed under Alternative 4, impacts on recreation opportunities occurring within the Cosumnes River Preserve would include disruption of wildlife viewing and docent-guided tours. Although no recreation opportunities would be permanently displaced, recreation opportunities occurring within portions of the preserve could be adversely affected during construction as result of the introduction of noise, light, and temporary facilities such as access roads, safe haven work sites, and tunnel shaft with temporary work areas.

Wimpy's Marina is a private boating facility located on the south fork of the Mokelumne River southeast of Walnut Grove. Geotechnical exploration would occur along the tunnel corridor for approximately 2.5 years and would introduce noise that would adversely affect recreation occurring at the marina.

As discussed in detail under Alternative 4, recreation occurring at Delta Meadows could be affected by geotechnical testing and construction and operation of the intermediate forebay and spillway. These features would generate noise and introduce visual disturbances to the recreation site.

Recreation occurring at the Bullfrog Landing Marina on Middle River could be affected by noise and visual disturbance as a result of constructing the water conveyance across Bacon Island. This would include impacts from constructing a temporary access road on the island as well as a temporary safe haven work area. Anglers on the river between the marina and the construction area would also experience noise and visual disturbances during construction.

On-water recreation opportunities not associated with formal recreation sites could be affected by the introduction of noise and light during the construction period. The quality of recreation opportunities in the vicinity of construction sites may be adversely affected by noise and changes in visual character.

As discussed in detail under Alternative 4, recreation opportunities, including fishing and hunting, could be adversely affected by expanding Clifton Court Forebay. Recreation would be adversely affected because access to the forebay would not be allowed during construction.

Construction of Alternative 5A intakes and water conveyance facilities would result in disruption to recreational opportunities. Indirect effects on recreation experiences may occur as a result of impaired access, construction noise, or negative visual effects. Overall, construction and geotechnical exploration may occur year-round and last from 2.5 to 13.5 years at individual construction sites near recreation sites or areas and in-river construction would be primarily limited to June 1 through October 31 each year, which would result in a long-term reduction of recreational opportunities or experiences. Mitigation measures (REC-2, BIO-75, AES-1a, AES-1b, AES-1c, AES-1d, AES-1e, AES-1f, AES-1g, AES-5A, AES-4b, AES-4c, TRANS-1a, TRANS-1b, TRANS-1c, NOI-1a, and NOI-1b) are available to address adverse effects on recreation resulting from introduction of noise and light and the loss of access. However, due to the length of time that construction would occur and the dispersed effects across the Delta, the direct and indirect effects related to temporary disruption of existing recreational activities at facilities within the impact area would be adverse.

CEQA Conclusion: Construction of the Alternative 5A intakes and related water conveyance facilities would result in permanent and long-term (i.e., lasting over 2 years) impacts on well-established recreational opportunities and experiences in the study area because of access, noise, and visual setting disruptions that could result in loss of public use. These impacts would occur year-round. The mitigation measures described below, in combination with environmental commitments, would reduce some construction-related impacts by compensating for effects on wildlife habitat and species; minimizing the extent of changes to the visual setting, including nighttime light sources; manage construction-related traffic; and implementing noise reduction and complaint tracking measures. However, the level of impact would not be reduced to a less-than-significant level because it is not certain the mitigation would reduce the level of these impacts to less than significant in all the instances occurring within the entire study area. Therefore, these impacts are considered significant and unavoidable.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation*, of the Draft EIR/EIS.

Mitigation Measure BIO-75: Conduct Preconstruction Nesting Bird Surveys and Avoid Disturbance of Nesting Birds

Please see Mitigation Measure BIO-75 under Impact BIO-75 in the discussion of Alternative 4 in Chapter 12, *Terrestrial Biological Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see to Mitigation Measure AES-1c under Impact AES-1in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-5A: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Please see Mitigation Measure AES-5A under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please see Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please see Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please see Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please see Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact REC-3: Result in Long-Term Reduction of Recreational Navigation Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of the long-term reduction in recreational navigation opportunities as a result of constructing the proposed water conveyance facilities under Alternative 5A would be similar to Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Construction activities associated with constructing Intake 1 on the Sacramento River, siphons near Clifton Court Forebay, Head of Old River barrier and operating barges and constructing temporary barge unloading facilities at Snodgrass Slough, Potato Slough, San Joaquin River, Middle River, Connection Slough, Old River, and the West Canal would disrupt boat passage and navigation at and near these sites. Although implementing Mitigation Measure TRANS-1a and helping to fund measures to reduce aquatic weeds would reduce impacts on recreational navigation, these effects would remain adverse because of the long duration of construction which would continually reduce recreation opportunities and distract from experiences occurring near construction activity.

CEQA Conclusion: Impacts on recreational navigation during construction of the water conveyance facilities under Alternative 5A would be similar to those described under Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Impeding boat passage and navigation and resulting impacts on recreation would occur during construction of the intakes, temporary barge unloading facilities, and siphons. Although Mitigation Measure TRANS-1a would reduce impacts on navigation associated with barge unloading facilities and participating in the aquatic weed reduction program would help address impacts on navigation, the impact of constructing the water conveyance facilities would be considered significant and unavoidable.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact REC-4: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: The extent of changes in sport fishing opportunities occurring within the study area under Alternative 5A would be the same as Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Constructing one water intake, siphons, and operable barrier and placement and use of barge unloading facilities during tunnel/pipeline construction would result in temporary water quality effects (e.g., turbidity, accidental spills, disturbance of contaminated sediments); elevated underwater noise (associated with pile driving and other construction activities); fish exposure to stranding and direct physical injury; and temporary exclusion or degradation of spawning and rearing habitats. Expanding Clifton Court Forebay would restrict access to bank fishing sites during the construction period. Although fish populations likely would not be affected to the degree that the abundance of sport fish would be substantially reduced, construction conditions would introduce noise and visual disturbances that would affect the recreation experience for anglers.

Although construction would occur for more than 2 years and cause a long-term reduction in fishing opportunities at one recreational site, construction of the proposed water conveyance facilities would not affect most fishing opportunities throughout the Delta. Additionally, mitigation measures are available to enhance and ensure access to nearby fishing sites and to address noise and visual disturbances.

Construction of the water conveyance facilities would not result in a long-term adverse effect on fishing opportunities because the effects would be limited to construction sites and would not limit fishing opportunities occurring in other parts of the Delta. Mitigation Measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would help reduce or avoid impacts on recreational fishing occurring at construction sites.

CEQA Conclusion: The impact on recreational fishing opportunities as a result of constructing the water conveyance facilities under Alternative 5A would be the same as Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. The combined impact on recreational fishing opportunities would be considered significant. Implementing mitigation measures REC-2, NOI-1a, NOI-1b, AES-1a, AES-1b AES-1c AES-1d, AES-1e, AES-1f, and AES-1g would help reduce the impact on recreational fishing to a less-than-significant level by providing alternate fishing sites, reducing noise generated during construction activities, and limiting changes in the visual character of recreational fishing sites.

Mitigation Measure REC-2: Provide Alternative Bank Fishing Access Sites

Please see Mitigation Measure REC-2 under Impact REC-2 in the discussion of Alternative 4 in Chapter 15, *Recreation*, of the Draft EIR/EIS.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under, Alternative 1A in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under AES-1 in the discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, of the Draft EIR/EIS.

Impact REC-5: Result in Long-Term Reduction of Recreational Fishing Opportunities as a Result of the Operation of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of operating the water conveyance facilities on recreational fishing opportunities under Alternative 5A would be the same as described under Alternative 4, because the same type of conveyance facilities would be built under Alternative 5A as under Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Operation of Alternative 5A may result in changes in entrainment, spawning, rearing, and migration. However, effects on fish species that are popular for recreational fishing are not of a nature/level that will adversely affect recreational fishing. While there are some significant impacts on specific non-listed species, as discussed in Section 4.3.7, *Fish and Aquatic Resources*, of this RDEIR/SDEIS they are typically limited to specific rivers and not the population of that species as a whole. The effect is not adverse because it would not result in a substantial long-term reduction in recreational fishing opportunities.

CEQA Conclusion: The potential impact on covered and non-covered sport fish species from operation of Alternative 5A would be considered less than significant because any impacts on fish and, as a result, impacts on recreational fishing, are anticipated to be isolated to certain areas and would not affect the abundance of popular sport fish.

Impact REC-6: Cause a Change in Reservoir or Lake Elevations Resulting in Substantial Reductions in Water-Based Recreation Opportunities and Experiences at North- and South-of-Delta Reservoirs

NEPA Effects: The methodology for assessing effects on recreation at major upstream storage reservoirs for Alternative 5A is the same as applied to Alternative 5 with the exception that Alternative 5A is evaluated at ELT and compared to the No Action Alternative at ELT (2025), whereas Alternative 5 was evaluated at LLT and compared to the No Action Alternative at LLT (2060). The results of this assessment are shown in Tables 4.3.11-1 and 4.3.11-2 below.

Existing Conditions (CEQA Baseline) Compared to Alternative 5A ELT (2025)

Under Alternative 5A Operational Scenario B recreation thresholds would be exceeded more frequently at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs relative to Existing Conditions. These changes represent a greater than 10% increase in the frequency the recreation thresholds are exceeded at Trinity, Shasta, Oroville, Folsom, and San Luis Reservoirs. However, as discussed in Section 15.3.1, *Methods for Analysis*, of the Draft EIR/EIS these changes in SWP/CVP reservoir elevations are primarily attributable to change in demand and other external factors such as sea level rise and climate change. It is not possible to specifically define the exact extent of the changes due to implementation of the action alternative using these model simulation results. Thus, the precise contributions of the external factors to the total differences between Existing Conditions and Alternative 5A ELT results cannot be isolated in this comparison. Please refer to the comparison of the No Action Alternative (ELT) to Alternative 5A for a discussion of the potential effects on end-of-September reservoir and lake elevations attributable to operation of Alternative 5A.

Existing Conditions (CEQA Baseline) Compared to Alternative 5A LLT (2060)

Existing Conditions compared to Alternative 5A LLT (2060) results are the same as described under Alternative 5.

No Action Alternative (ELT) Compared to Alternative 5A ELT (2025)

The comparison of Alternative 5A ELT results to the No Action Alternative (ELT) condition most closely represents changes in reservoir elevations that may occur as a result of operation of Alternative 5A because both conditions show external factors such as change in demand and sea level rise and climate change (see Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, of the Draft EIR/EIS). As shown in Table 4.3.11-1 and Table 4.3.11-2, below, Alternative 5A would result in ELT changes in the frequency with which the end-of-September reservoir levels at Trinity, Shasta, Oroville, Folsom, New Melones, and San Luis Reservoirs would fall below levels identified as important water-dependent recreation thresholds. The CALSIM II modeling results indicate that reservoir levels under Alternative 5A operations would either not change or would fall below the individual reservoir recreation thresholds less frequently than under No Action Alternative (ELT) conditions at Trinity, Shasta and Oroville Reservoirs. Operation of Alternative 5A would not adversely affect water-dependent or water-enhanced recreation at these reservoirs. Overall, these conditions represent improved recreation conditions under operation of Alternative 5A because there would be slightly fewer years in which end-of-September reservoir levels would fall below the recreation thresholds thus indicating better boating opportunities, when compared to No Action Alternative (ELT) conditions.

The modeling result for Folsom Reservoir indicates there could be up to 4 additional years under Alternative 5A, during which the reservoir level would fall below the reservoir's boating threshold at the end of September. This is a greater than 10% change and would be considered a substantial reduction in recreational boating opportunities at Folsom Reservoir. Shoreline fishing would still be possible, and other recreation activities at the reservoir—picnicking, biking, hiking, and fishing—would be available. The reduction in surface elevations at Folsom Reservoir would result in an adverse impact on recreation occurring at the reservoir by restricting access by boaters. Mitigation Measure REC-6 would be available to address this effect.

The modeling result for New Melones Reservoir indicates that there could be up to 1 additional year under Alternative 5A, during which the reservoir level would fall below the reservoir's boating threshold at the end of September. This is a greater than 10% change and would be considered a substantial reduction in recreational boating opportunities at New Melones Reservoir. Shoreline fishing would still be possible, and other recreation activities at the reservoir—picnicking, biking, hiking, and fishing—would be available. The reduction in surface elevations at New Melones Reservoir would result in an adverse impact on recreation occurring at the reservoir by restricting access by boaters. Mitigation Measure REC-6 would be available to address this effect.

The modeling results for San Luis Reservoir indicate there could be up to 13 additional years under Alternative 5A, during which the reservoir level would fall below the reservoir boating threshold at the end of September relative to the No Action Alternative (ELT) condition. This is a greater than 10% change and would be considered a substantial reduction in recreational boating opportunities at San Luis Reservoir. Shoreline fishing would still be possible, and other recreation activities at the reservoir—picnicking, biking, hiking, and fishing—would be available. The reduction in surface elevations at San Luis Reservoir would result in an adverse impact on recreation occurring at the reservoir by restricting access by boaters. Mitigation Measure REC-6 would be available to address this effect.

CEQA Conclusion: This impact on water-dependent and water-enhanced recreation opportunities at north- and south-of-Delta reservoirs would be less than significant because, with the exception of Folsom, New Melones, and San Luis Reservoirs, the CALSIM II modeling results indicate that reservoir levels attributable to Alternative 5A operations would stay the same (Shasta Reservoir) or would fall below the individual reservoir thresholds less frequently than under No Action Alternative (ELT). These changes in reservoir and lake elevations would result in a less-than-significant impact on recreation opportunities and experiences at Trinity, Shasta, and Oroville Reservoirs. At Folsom, New Melones, and San Luis Reservoirs, the reduction in reservoir access by boaters would be significant because they represent a greater than 10% change and could result in a significant impact on recreation. Mitigation Measure REC-6 would reduce this impact to less than significant.

Mitigation Measure REC-6: Provide a Temporary Alternative Boat Launch to Ensure Access to San Luis Reservoir

Consistent with applicable recreation management plans, DWR and Reclamation will work with DPR to establish a boat ramp extension at or near the Basalt boat launch or other alternative boat ramp site at San Luis Reservoir to maintain reservoir access in years when access becomes unavailable.

Table 4.3.11-1. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 5A

	Recreation Threshold[a]								
	Trinity Lake			Shasta Lake			Lake Oroville		
	<2,270 ft elevation			<967 ft elevation			<700 ft elevation		
Scenario	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative (ELT) (CEQA/NEPA)	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative (ELT) (CEQA/NEPA)	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative (ELT) (CEQA/NEPA)
Existing Condition (CEQA)	21			17			17		
No Action Alternative (ELT)	32	11		22	5		26	9	
Alternative 5A (ELT)									
Operational Scenario B	29	8	-3	22	5	0	21	4	-5
Alternative 5A (LLT)									
Operational Scenario B	43	22		29	12		26	9	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action Alternative ELT). A positive change would indicate more years with reduced recreation opportunities.

Table 4.3.11-2. Summary of Years with Reduced SWP and CVP Reservoir Recreation Opportunities (End-of September Elevations below Recreation Thresholds) for Alternative 5A

	Recreation Threshold[a]								
	Folsom Lake			New Melones Lake			San Luis Reservoir		
	<405 ft elevation			<900 ft elevation			<360 ft elevation		
Scenario	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative ELT (CEQA/ NEPA)	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative ELT (CEQA/ NEPA)	Years[b]	Change relative to Existing Condition (CEQA)[c]	Change relative to No Action Alternative ELT (CEQA/ NEPA)
Existing Condition (CEQA)	22			9			3		
No Action (ELT)	33	11		8	-1		9	6	
Alternative 5A (ELT)									
Operational Scenario B	37	15	4	9	0	1	22	19	13
Alternative 5A (LLT)									
Operational Scenario B	44	22		12	3		31	27	

[a] Recreation thresholds selected for the analysis represent the reservoir surface water elevation at which recreation opportunities become diminished due to restricted access to boat ramps, exposure of previously submerged islands or shoals that affect boater safety, and shoreline degradation.

[b] The number of years out of the 82 simulated when the September end-of-month elevation is less than the recreation elevation threshold for the selected project alternative scenario. An elevation less than the recreation threshold indicates occurrences during which recreation opportunities may be diminished (see note a, above).

[c] The change values are the number of years of the simulated conditions that the selected alternative differs from the comparison condition (i.e., the Existing Condition or No Action ELT). A positive change indicates more years with reduced recreation opportunities relative to the comparison condition. A negative change indicates fewer years with reduced recreation opportunities relative to the comparison condition.

Impact REC-7: Result in Long-Term Reduction in Water-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on water-based recreation under Alternative 5A would be the same as described under Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. These potential effects would occur as a result of regular maintenance activities of the intakes. The effect on boating is not considered adverse because the boat passage around the intakes would be maintained and disruption of boat access in the immediate vicinity of the intakes would be short-term.

CEQA Conclusion: Effects on recreation resulting from the maintenance of intake facilities would be short-term and intermittent and would not result in significant impacts on boat passage, navigation, or water-based recreation within the vicinity of the intakes.

Impact REC-8: Result in Long-Term Reduction in Land-Based Recreation Opportunities as a Result of Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The effects of maintaining the water conveyance facilities on land-based recreation under Alternative 5A would be the same as described under Alternative 4. However, impacts would be of slightly less magnitude because Alternative 5A would only include construction of Intake 2, rather than Intakes 2, 3, and 5 as under Alternative 4. Maintenance activities would be short-term and intermittent, occur within the immediate vicinity of water conveyance facility, and are not expected to generate noise that would distract from adjacent recreation opportunities. Therefore, there would be no effects on recreation opportunities as a result of maintenance of the proposed water conveyance facilities.

CEQA Conclusion: Maintenance of conveyance facilities would be short-term and intermittent and would not result in any changes to land-based recreational opportunities. Therefore, there would be no impact and no mitigation would be required.

Impact REC-9: Result in Long-Term Reduction in Fishing Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6, 7–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 5A would result in effects on fishing opportunities similar to those described for Alternative 4. The magnitude of the effects occurring under Alternative 5A would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions (Environmental Commitments 3, 4, 6, 7–12, 15, and16) occurring in the Plan Area would be much less than the conservation measures proposed under Alternative 4. Construction, operation, and maintenance of the conservation and stressor reduction components could have affects that would be similar in nature to those discussed above for construction, operation, and maintenance of proposed water conveyance facilities. Although similar in nature, the potential intensity of any effects would likely be substantially lower because the nature of the activities associated with implementing the conservation and stressor reduction components would be much less when compared to Alternative 4. In addition, the conservation and stressor reduction components would be expected to result in long-term benefits to aquatic species.

During the implementation stage, construction activity associated with the conservation and stressor reduction components could result in adverse effects on recreation by temporarily or permanently limiting access to fishing sites and disturbing fish habitat. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would not be considered adverse because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance.

CEQA Conclusion: Conservation and stressor reduction components would be expected to improve fishing opportunities within the Plan Area. The adverse and beneficial impacts would be similar to those described under Alternative 4, however the extent of those impacts would be much less because the restoration actions occurring under Alternative 5A would include much less acreage and a smaller geographic scope than the conservation measures described under Alternative 4. The impact on fishing opportunities as the conservation and stressor reduction components are constructed would be considered less than significant because the actions would be small and localized. In the long term, the impact on fishing opportunities would be considered beneficial because the conservation and stressor reduction measures could benefit aquatic habitat and fish abundance.

Impact REC-10: Result in Long-Term Reduction in Boating-Related Recreation Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6, 7–12, 15, and 16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 5A would result in effects on boating-related recreation similar to the effects discussed under Alternative 4 for implementing conservation measures. However, the extent of the effects on boating under Alternative 5A would be much less because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less when compared to Alternative 4. Restoration of channel margin enhancement, riparian natural community, and nontidal marsh could provide increased boating opportunities within the study area.

CEQA Conclusion: Channel modification and other activities associated with implementation of some of the conservation and stressor reduction components may limit some opportunities for boating and boating-related recreation by reducing the extent of navigable water available to boaters. However, overall the conservation and stressor reduction components would also lead to an enhanced boating experience by expanding the extent of waterways available to boaters. Overall, these measures would not be anticipated to result in a long-term reduction in boating-related recreation activities; therefore, this impact is considered less than significant.

Impact REC-11: Result in Long-Term Reduction in Upland Recreational Opportunities as a Result of Implementing Environmental Commitments 3, 4, 6, 7–12, 15, and16

NEPA Effects: Implementing conservation and stressor reduction components as part of Alternative 5A would result in effects on upland recreational opportunities similar to Alternative 4. However, the extent of these effects occurring under Alternative 5A would be much less than under Alternative 4 because the total acreage that would be affected by the conservation and stressor reduction actions occurring in the Plan Area would be much less. The actions could benefit the same types of recreation opportunities (e.g., hunting, hiking, walking, wildlife viewing, botanical viewing, nature photography, picnicking, and sightseeing) as described for Alternative 4, however the recreational benefits accruing from these actions would be much less because of the smaller acreage that would be restored. Conversely, the conservation and stressor reduction actions could adversely affected established recreation activities that would no longer be possible or compatible with restoration. These potential adverse effects would be would be similar to those described under Alternative 4, however the effects are expected to be much less because of the smaller total acreage that would be restored.

Implementing the conservation and stressor reduction components could result in an adverse effect on recreation opportunities by reducing the extent of upland recreation sites and activities available to hiking, nature photography, or other similar activity. However, implementation of the measures would also restore or enhance new potential sites for upland recreation thereby potentially improving the quality of recreational opportunities.

CEQA Conclusion: Similar to Alternative 4, site preparation and earthwork activities occurring under Alternative 5A required to implement the conservation and stressor reduction components could temporarily limit or disrupt opportunities for upland recreational. These impacts on upland recreational opportunities would be considered less than significant because—similar to Alternative

4—environmental commitments incorporated into the project would require the project proponents to consult with CDFW to expand wildlife viewing, angling, and hunting opportunities as an element of the conservation and stressor reduction components. These components would not be anticipated to result in a substantial long-term disruption of upland recreational activities; thus, this impact is considered less than significant.

Impact REC-12: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Recreation Resources

NEPA Effects: Similar to Alternative 5A, constructing the water conveyance facilities and implementing the conservation and stressor reduction components under Alternative 5A could result in incompatibilities with plans and policies that address recreation. A number of plans and policies that coincide with the study area provide guidance for recreation resource issues are overviewed in Chapter 15, *Recreation*, Section 15.2, *Regulatory Setting*, of the Draft EIR/EIS. This overview of plan and policy compatibility evaluates whether Alternative 5A is compatible or incompatible with such enactments, rather than whether impacts are adverse or not adverse or significant or less than significant. If the incompatibility relates to an applicable plan, policy, or regulation adopted to avoid or mitigate recreation effects, then an incompatibility might be indicative of a related significant or adverse effect under CEQA and NEPA, respectively. Such physical effects of Alternative 5A on recreation resources are addressed in Impacts REC-1 through REC-11, and in other sections, such as Section 4.3.13, *Aesthetics and Visual Resources*, and Section 4.3.19, *Noise*, of this RDEIR/SDEIS. A summary of the compatibility evaluations related to recreation resources for plans and policies is contained in the analysis of Alternative 4 and is applicable to Alternative 5A. Generally the evaluation found that implementing Alternative 5A would not be compatible with some provisions of The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992 and some policies of the Sacramento, San Joaquin, Contra Costa, and Alameda Counties general plans that address recreation.

CEQA Conclusion: The incompatibilities identified in the analysis indicate the potential for a physical consequence to the environment. The physical effects are discussed in Alternative 5A, impacts REC-1 through REC-11, and no additional CEQA conclusion is required related to the compatibility of the alternative with relevant plans and polices.

4.5.12 Socioeconomics

Impact ECON-1: Temporary Effects on Regional Economics and Employment in the Delta Region during Construction of the Proposed Water Conveyance Facilities

The regional economic effects on employment and income in the Delta region during construction of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower project-related employment effects when compared to Alternative 4. Conversely, adverse effects associated with agricultural employment would also be somewhat lower due to the smaller acreages of agricultural land that would be affected by construction of one intake facility.

NEPA Effects: Because construction of water conveyance facilities would result in an increase in construction-related employment and labor income, this would be considered a beneficial effect. However, these activities would also be anticipated to result in a decrease in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would temporarily increase total employment and income in the Delta region. The change would result from expenditures on construction, increasing employment, and from changes in agricultural production, decreasing employment. Changes in recreational expenditures and natural gas well operations could also affect regional employment and income, but these have not been quantified. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other sections throughout this RDEIR/SDEIS. For example, removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources*, Impacts AG-1 and AG-2; changes in recreation related activities are addressed in Section 4.5.11, *Recreation,* Impacts REC-1 through REC-4; and abandonment of natural gas wells is addressed in Section 4.5.22, *Minerals*, Impact MIN-1. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-2: Effects on Population and Housing in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on population and housing in the Delta region during construction of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower project-related changes in population and housing demand when compared to Alternative 4. Construction of one intake under this alternative would also be anticipated to result in slightly lower effects associated with displacement of residential structures, which could create a smaller increase in demand for housing in localized areas.

The construction workforce would most likely commute daily to the work sites from within the five-county region; however, if needed, there are about 53,000 housing units available to accommodate workers who may choose to commute on a workweek basis or who may choose to temporarily relocate to the region for the duration of the construction period. In addition to the available housing units, there are recreational vehicle parks and hotels and motels within the five-county region to accommodate any construction workers. As a result, and as discussed in more detail in Section 4.5.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS, construction of the proposed conveyance facilities is not expected to substantially increase the demand for housing within the five-county region.

NEPA Effects: Within specific local communities, there could be localized effects on housing. However, given the availability of housing within the five-county region, predicting where this impact might fall would be speculative. In addition, new residents would likely be dispersed across the region, thereby not creating a burden on any one community. Because these activities would not result in permanent concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population. Therefore, the minor increase in demand for housing is not anticipated to lead to reasonably foreseeable adverse physical changes constituting a significant impact on the environment.

Impact ECON-3: Changes in Community Character as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in community character in the Delta region during construction of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would result in smaller localized effects on community character when compared to Alternative 4, particularly in and around the communities of Clarksburg, Hood, and Courtland.

Under Alternative 5A, additional regional employment and income could create net positive effects on the character of Delta communities. In addition to potential demographic effects associated with changes in employment, however, property values may decline in areas that become less desirable in which to live, work, shop, or participate in recreational activities. For instance, negative visual- or noise-related effects on residential property could lead to localized abandonment of buildings. While water conveyance construction could result in beneficial effects relating to the economic welfare of a community, adverse social effects could also arise as a result of declining economic stability in communities closest to construction effects and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS).

CEQA Conclusion: Construction of water conveyance facilities under Alternative 5A could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to physical impacts involving population growth, such impacts are described under Impact ECON-2 and in Section 4.5.26, *Growth Inducement and Other Indirect Effects*, of this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-4: Changes in Local Government Fiscal Conditions as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in local government fiscal conditions during construction of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives would be similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in lower project-related effects on property tax and assessment revenue when compared to Alternative 4. Typically, decreases in revenue could potentially result in the loss of a substantial share of some agencies' tax bases and particularly for smaller districts affected by a project. However, the California Water Code, Section 85089 subdivision (b), specifies that the entities constructing and operating a new Delta conveyance facility will fully mitigate for the loss of property tax revenue or assessments levied by local governments or special districts. The Water Code requirement will ensure that tax revenues forgone as a result of transferring land from private to public ownership will be fully offset. In addition, as discussed under Impact ECON-1, construction of the water conveyance facilities would be anticipated to result in a net temporary increase of income and employment in the Delta region. This would also create an indirect beneficial effect through increased sales tax revenue for local government entities that rely on sales taxes.

CEQA Conclusion: Under Alternative 5A, construction of water conveyance facilities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. The potential losses would be offset by the of the California Water Code which requires entities constructing or operating new Delta water conveyance facilities fully mitigate for the loss of property tax or assessment levied by local governments or special districts. It is anticipated that the Water Code requirement will ensure that forgone tax revenues will be fully offset. In addition, CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. The potential for a physical change to the environment as a result of changes in tax revenues would be avoided by offsetting the potential losses in tax revenues.

Impact ECON-5: Effects on Recreational Economics as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: As described and defined in Section 4.5.11, *Recreation*, of this RDEIR/SDEIS, Impacts REC-1 through REC-4, construction of water conveyance facilities under Alternative 5A would be similar to those under Alternative 4, and would include elements that would be permanently located in two existing recreation areas. Additionally, substantial disruption of other recreational activities considered temporary and permanent would occur in certain areas during the construction period. Were it to occur, a decline in visits to Delta recreational sites as a result of facility construction would be expected to reduce recreation-related spending, creating an adverse effect throughout the Delta region. Additionally, if construction activities shift the relative popularity of different recreational sites, implementation of Alternative 5A may carry localized beneficial or adverse effects.

Access would be maintained to all existing recreational facilities, including marinas, throughout construction. As part of Mitigation Measure REC-2, project proponents would enhance nearby fishing access sites and would incorporate public recreational access into design of the intakes along the Sacramento River. Implementation of this measure along with separate, non-environmental commitments as set forth in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS relating to the enhancement of recreational access and control of aquatic weeds in the Delta would reduce these effects. Environmental commitments would also be implemented to reduce some of the effects of construction activities on the recreational experience. Similarly, mitigation measures proposed throughout other sections of this document, and listed under Impact REC-2 in Section 4.5.11, *Recreation*, of this RDEIR/SDEIS would also contribute to reducing construction effects on recreational experiences in the study area. Overall, however, the multi-year schedule and geographic scale of construction activities and the anticipated decline in recreational spending would be considered an adverse effect. The commitments and mitigation measures cited above would contribute to the reduction of this effect.

CEQA Conclusion: Construction of the proposed water conveyance facilities under Alternative 5A could affect recreational revenue in the Delta region if construction activities result in fewer visits to the area. Fewer visits would be anticipated to result in decreased economic activity related to recreational activities. This section considers only the economic effects of recreational changes brought about by construction of the proposed water conveyance facilities. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.5.11, *Recreation,* Impacts REC-1 through REC-4, in this RDEIR/SDEIS.

Impact ECON-6: Effects on Agricultural Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Effects on agricultural economics related to construction of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives are similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower effects on agricultural economics when compared to Alternative 4.

NEPA Effects: Because construction of the proposed water conveyance facilities would lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural*

Resources, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Construction of the proposed water conveyance facilities would reduce the total value of agricultural production in the Delta region. The removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources,* Impacts AG-1 and AG-2, in this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-7: Permanent Regional Economic and Employment Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Permanent effects on regional economics during operation and maintenance of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar and, in the context of the regional economy, operational outcomes related to water supply, water quality, recreation, or fisheries would be similar between the two alternatives. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower effects on employment effects when compared to Alternative 4. Increased expenditures related to operation and maintenance of water conveyance facilities would be expected to result in a permanent increase in regional employment and income, while the permanent removal of agricultural land following construction would have lasting negative effects on agricultural employment and income.

NEPA Effects: Because continued operation and maintenance of water conveyance facilities would result in an increase in operations-related employment and labor income, this would be considered a beneficial effect. However, the long-term footprint of facilities would lead to a continued decline in agricultural-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would increase total employment and income in the Delta region. The net change would result from expenditures on operation and maintenance and from changes in agricultural production. The total change in income and employment is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. For example, removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources*, Impacts AG-1 and AG-2; and changes in recreation related activities are addressed in Section 4.5.11, *Recreation,* Impacts REC-5 through REC-8. When required, DWR would provide compensation to landowners as a result of acquiring lands for the proposed conveyance facilities. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-8: Permanent Effects on Population and Housing in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Permanent effects on population and housing during operation and maintenance of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar. It is anticipated that non-local workers would relocate to the five-county region, thus adding to the local population. However, this additional population would constitute a minor increase in the total 2020 projected regional population of 4.6 million and be distributed throughout the region. It is anticipated that most of the operational workforce would be drawn from within the five-county region. Consequently, operation of the conveyance facilities would not result in impacts on housing.

NEPA Effects: Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Operation and maintenance of the proposed water conveyance facilities would result in minor population increases in the Delta region with adequate housing supply to accommodate the change in population and therefore significant impacts on the physical environment are not anticipated.

Impact ECON-9: Changes in Community Character during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Under Alternative 5A, effects on community character would be similar in nature, location, and magnitude to those described under Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives are similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would result in smaller localized effects on community character when compared to Alternative 4, particularly in and around the communities of Clarksburg, Hood, and Courtland.

While water conveyance operation and maintenance could result in beneficial effects relating to the economic welfare of a community, lasting adverse social effects, including effects on community cohesion, could also arise in communities closest to physical features and in those most heavily influenced by agricultural and recreational activities. Implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation would reduce adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS).

CEQA Conclusion: Operation and maintenance of water conveyance facilities under Alternative 5A could affect community character in the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character would lead to physical impacts involving population growth, such impacts are described under Impact ECON-8 and in Section 4.5.26, *Growth Inducement and Other*

Indirect Effects, in this RDEIR/SDEIS*.* Furthermore, notable decreases in population or employment, even if limited to specific areas, sectors, or the vacancy of individual buildings, could result in alteration of community character stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-10: Changes in Local Government Fiscal Conditions during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to changes in local government fiscal conditions during operation and maintenance of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the water conveyance facilities proposed under these alternatives would be similar. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in lower project-related effects on property tax and assessment revenue when compared to Alternative 4. These decreases in revenue could potentially result in the loss of a substantial share of some agencies' tax bases, particularly for smaller districts affected by Alternative 5A, such as reclamation districts where conveyance facilities and associated work areas are proposed. However, the California Water Code Section 85089 subdivision (b) specifies that the entities constructing and operating a new Delta conveyance facility will fully mitigate for the loss of property tax revenues or assessments levied by local governments or special districts. The Water Code requirement will ensure that forgone tax revenues as a result of transferring land from private to public ownership will be fully offset. In addition, as discussed under Impact ECON-1, continued operation and maintenance of the water conveyance facilities would be anticipated to result in a net increase of income and employment in the Delta region. This would also create an indirect beneficial effect through increased sales tax revenue for local government entities that rely on sales taxes.

CEQA Conclusion: Under Alternative 5A, the ongoing operation and maintenance of water conveyance facilities would restrict property tax revenue levels for various local government entities in the Delta region. The potential losses would be offset by the provisions in the California Water code that requires entities constructing or operating new Delta water conveyance facilities to fully mitigate for the loss of property tax or assessment levied by local governments or special districts. It is anticipated that the Water Code requirements will ensure that forgone tax revenues would be fully offset. CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. The potential for a physical change to the environment as a result of changes in tax revenues would be avoided by offsetting the potential losses in tax revenues.

Impact ECON-11: Effects on Recreational Economics during Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: As discussed in Section 4.5.11, *Recreation,* Impacts REC-5 through REC-8, in this RDEIR/SDEIS, operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 5A are anticipated to create minor effects on recreational resources. Maintenance of conveyance facilities, including the intake, would result in periodic temporary but not substantial adverse effects on boat passage and water-based recreational activities. Because effects of facility maintenance would be short-term and intermittent, substantial economic effects are not anticipated to result from operation and maintenance of the facilities.

CEQA Conclusion: Operation and maintenance activities associated with the proposed water conveyance facilities under Alternative 5A are anticipated to create minor effects on recreational resources and therefore, are not expected to substantially reduce economic activity related to recreational activities. This section considers only the economic effects of recreational changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.5.11, *Recreation,* Impacts REC-5 through REC-8, in this RDEIR/SDEIS.

Impact ECON-12: Permanent Effects on Agricultural Economics in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Effects on agricultural economics during operation and maintenance of Alternative 5A would be similar to those described for Alternative 4 in Chapter 16, *Socioeconomics*, Section 16.3.3.9, in Appendix A of this RDEIR/SDEIS, because the physical water conveyance facilities proposed under these alternatives would be similar and, in the context of the regional agricultural economy, outcomes related to water quality would be similar between the two alternatives. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower effects on agricultural economics when compared to Alternative 4.

NEPA Effects: The footprint of water conveyance facilities would result in lasting reductions in crop acreage and in the value of agricultural production in the Delta region; therefore, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: During operation and maintenance of the proposed water conveyance facilities the value of agricultural production in the Delta region would be reduced. The permanent removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources,* Impacts AG-1 and AG-2 of this RDEIR/SDEIS. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause reasonably foreseeable physical impacts. Such physical effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, DWR would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical effect. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-13: Effects on the Delta Region's Economy and Employment Due to the Implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and16

The effects on the economy of the Delta region associated with implementation of these Environmental Commitments would be similar to those described for Alternative 4A in Section 4.3.12, *Socioeconomics*, of this RDEIR/SDEIS. However, the acreages associated with some of these commitments would be somewhat lower than those proposed under Alternative 4A.

NEPA Effects: Because implementation of these Environmental Commitments would be anticipated to result in an increase in construction and operation and maintenance-related employment and labor income, this would be considered a beneficial effect. However, implementation of these components would also be anticipated to result in a decrease in agricultural-related and natural gas production-related employment and labor income, which would be considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite. Additionally, measures to reduce impacts on natural gas wells are discussed in Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

CEQA Conclusion: Implementation of the proposed Environmental Commitments would affect total employment and income in the Delta region. The change in total employment and income in the Delta region is based on expenditures resulting from implementation of the habitat enhancement and restoration activities and any resulting changes in agricultural production, recreation, and natural gas production. The total change in employment and income is not, in itself, considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. For example, removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources*, Impacts AG-3 and AG-4; changes in recreation-related activities are addressed in Section 4.5.11, *Recreation,* Impacts REC-9 through REC-11; and abandonment of natural gas wells is addressed in Section 4.5.22, *Mineral Resources*, Impact MIN-5. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts and impacts on natural gas wells are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, and Chapter 26, *Mineral Resources*, Section 26.3.3.2, Impact MIN-5, in Appendix A of this RDEIR/SDEIS.

Impact ECON-14: Effects on Population and Housing in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: In the Delta region, implementation of habitat enhancement and restoration activities could increase employment and convert land from existing uses, including possible displacement of residential housing and business establishments. The effects on population and housing in the Delta region would be similar to those described for Alternative 4A. However, the acreages associated with some of these commitments would be somewhat lower than those proposed under Alternative 4A. In general, the changes in population and housing would include increases in population from the construction and operation and maintenance-related activity and declines in residential housing and business establishments as a result of lands converted or impaired. Because these activities would not result in concentrated, substantial increases in population or new housing, they would not be considered to have an adverse effect.

CEQA Conclusion: Implementation of the proposed habitat enhancement and restoration activities could affect total population and housing in the Delta region. The change in total population and housing in the Delta region is based on employment resulting from implementation of the proposed conservation activities. The change in population and housing is expected to be minor relative to the five-county Delta region, and dispersed throughout the region. Therefore, significant impacts on the physical environment are not anticipated to result.

Impact ECON-15: Changes in Community Character as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: As noted under Impacts ECON-13 and ECON-14, conservation activities designed to restore, conserve, or enhance natural habitat would be anticipated to create economic effects similar to, but slightly lower than those described for Alternative 4A, including increases to employment and changes in land use that could trigger the disruption of agricultural and recreational economies. They could also affect the possible displacement of residences and businesses. The effects these activities would create with regard to community character would depend on the nature of each measure along with its specific location, size, and other factors that are not yet defined.

Under Alternative 5A, temporary construction associated with implementation of these measures could lead to demographic changes and resulting effects on the composition and size of Delta communities. Earthwork and site preparation associated with environmental commitments could also detract from the rural qualities of the Delta region; however, their implementation would take place in phases over time, which would limit the extent of effects taking place at any one point in time.

Implementation of these measures could also alter community character over the long term. Conversion of agricultural land to restored habitat would result in the erosion of some economic and social contributions stemming from agriculture in Delta communities. However, in the context of the Delta region, a substantial proportion of land would not be converted. Additionally, restored habitat could support some rural qualities, particularly in terms of visual resources and recreational opportunities. These effects could attract more residents to some areas of the Delta, and could replace some agricultural economic activities with those related to recreation and tourism. To the extent that agricultural facilities and supportive businesses were affected and led to vacancy, alteration of community character could result from these activities. However, protection of cultivated lands would ensure the continuation of agricultural production on a substantial area of land in the Delta. If necessary, implementation of mitigation measures and environmental commitments related to transportation, agriculture, and recreation would be anticipated to reduce these adverse effects (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities under Alternative 5A could affect community character within the Delta region. However, because these impacts are social in nature, rather than physical, they are not considered impacts under CEQA. To the extent that changes to community character are related to physical impacts involving population growth, these impacts are described in Section 4.5.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS. Furthermore, notable decreases in population or employment, even if limited to certain areas, sectors, or the vacancy of individual buildings, could result in decay and blight stemming from a lack of maintenance, upkeep, and general investment. However, implementation of mitigation measures and environmental commitments related to noise, visual effects, transportation, agriculture, and recreation, would reduce the extent of these effects such that a significant impact would not occur (see Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS). Specifically, these include commitments to develop and implement erosion and sediment control plans, develop and implement hazardous materials management plans, provide notification of maintenance activities in waterways, develop and implement a noise abatement plan, develop and implement a fire prevention and control plan, and prepare and implement mosquito management plans.

Impact ECON-16: Changes in Local Government Fiscal Conditions as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

As discussed in relation to construction of water conveyance facilities, habitat restoration and enhancement activities under Alternative 5A would also take place, in part, on land held by private owners and from which local governments derive revenue through property taxes and assessments. In particular, environmental commitments related to protection and restoration of natural communities would require the acquisition of multiple parcels of land.

The loss of a substantial portion of an entity's tax base would represent an adverse effect on an agency, resulting in a decrease in local government's ability to provide public goods and services. Under Alternative 5A, property tax and assessment revenue forgone as a result of Environmental Commitment implementation would be similar to that described under Alternative 4A in Section 4.3.12, *Socioeconomics*, of this RDEIR/SDEIS. As described for Alternative 4A, impacts on tax revenues would be avoided as a result of the requirements stipulated in California Water Code that requires entities constructing or operating new Delta conveyance facilities to fully mitigate for the loss of property tax or assessments levied by local governments or special districts.

NEPA Effects: Overall, habitat enhancement and restoration activities would remove many acres of private land from local property tax and assessment rolls. This economic effect would be considered adverse; however, project proponents would offset forgone property tax and assessments levied by local governments and special districts on private lands converted to habitat. As previously described under Impact ECON-13, regional economic effects from the implementation of these activities would be mixed. While activities associated with construction and establishment of habitat areas could boost regional expenditures and sales tax revenue, reduced agricultural activities may offset these gains. Changes in recreation spending and related sales tax revenue could be positive or negative, depending on the implementation of the measures.

CEQA Conclusion: Under Alternative 5A, implementation of habitat enhancement and restoration activities would result in the removal of a portion of the property tax base for various local government entities in the Delta region. As discussed in Alternative 4A, these losses would be offset by the requirements stipulated in the California Water Code CEQA does not require a discussion of socioeconomic effects except where they would result in physical changes. The potential for a physical change to the environment would be avoided by offsetting the potential losses in revenue.

Impact ECON-17: Effects on Recreational Economics as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: Implementation of habitat enhancement and restoration activities under this alternative would be anticipated to create an adverse effect on recreational resources by limiting access to facilities, restricting boat navigation, and disturbing fish habitat while restoration activities are taking place. These measures may also permanently reduce the extent of upland recreation sites.

However, these components could also create beneficial effects by enhancing aquatic habitat and fish abundance, expanding the extent of navigable waterways available to boaters, and improving the quality of existing upland recreation opportunities. Therefore, the potential exists for the creation of adverse and beneficial effects related to recreational economics. Adverse effects would be anticipated to be primarily limited to areas close to restoration areas and during site preparation and earthwork phases. These effects could result in a decline in visits to the Delta and reduction in recreation-related spending, creating an adverse economic effect throughout the Delta. Beneficial recreational effects would generally result during later stages of restoration implementation as environmental conditions supporting recreational activities are enhanced. These effects could improve the quality of recreational experiences, leading to increased economic activities related to recreation, particularly in areas where habitat enhancement or restoration could create new recreational opportunities.

CEQA Conclusion: Site preparation and earthwork activities associated with a number of environmental commitments would limit opportunities for recreational activities where they occur in or near existing recreational areas. Noise, odors, and visual effects of construction activities would also temporarily compromise the quality of recreation in and around these areas, leading to potential economic impacts. However, over time, implementation could improve the quality of existing recreational opportunities, leading to increased economic activity. This section considers only the economic effects of recreational changes brought about by implementation of habitat enhancement and restoration activities. CEQA does not require a discussion of socioeconomic effects except where they would result in reasonably foreseeable physical changes. Potential physical changes to the environment relating to recreational resources are described and evaluated in Section 4.5.11, *Recreation,* Impacts REC-9 through REC-11 in this RDEIR/SDEIS.

Impact ECON-18: Effects on Agricultural Economics in the Delta Region as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: Habitat enhancement and restoration activities would convert land from existing agricultural uses. These direct effects on agricultural land are described qualitatively in Section 4.5.10, *Agricultural Resources,* Impacts AG-3 and AG-4 in this RDEIR/SDEIS. Effects on agricultural economics would include effects on crop production and agricultural investments resulting from restoration actions on agricultural lands. The effects would be similar in kind to those described for lands converted due to construction and operation of the conveyance features and facilities. The total acreage and crop mix of agricultural land potentially affected is not specified at this time, but when required, the project proponents would provide compensation to property owners for losses due to implementation of the alternative. Because implementation of habitat enhancement and restoration activities would be anticipated to lead to reductions in crop acreage and in the value of agricultural production in the Delta region, this is considered an adverse effect. Mitigation Measure AG-1, described in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS, would be available to reduce these effects by preserving agricultural productivity and compensating offsite.

CEQA Conclusion: Implementation of habitat enhancement and restoration activities would reduce the total value of agricultural production in the Delta region. The permanent removal of agricultural land from production is addressed in Section 4.5.10, *Agricultural Resources,* in this RDEIR/SDEIS, Impacts AG-3 and AG-4. The reduction in the value of agricultural production is not considered an environmental impact. Significant environmental impacts would only result if the changes in regional economics cause physical impacts. Such effects are discussed in other chapters throughout this RDEIR/SDEIS. When required, the project proponents would provide compensation to property owners for economic losses due to implementation of the alternative. While the compensation to property owners would reduce the severity of economic effects related to the loss of agricultural land, it would not constitute mitigation for any related physical impact. Measures to reduce these impacts are discussed in Chapter 14, *Agricultural Resources*, Section 14.3.3.2, Impact AG-1, in Appendix A of this RDEIR/SDEIS.

Impact ECON-19: Socioeconomic Effects in the South-of-Delta Hydrologic Regions

As described in Section 4.5.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS, the operational components of water conveyance facilities under Alternative 5A could result in a number of effects in areas receiving SWP and CVP water deliveries outside of the Delta. Generally, these effects would be similar to those described for Alternative 5 (Operational Scenario C) in Chapter 16, *Socioeconomics*, Section 16.3.3.10, of the Draft EIR/EIS, because the incremental change in Delta exports is similar, when compared to the relevant No Action condition.

Under Operational Scenario C as considered for Alternative 5A (at the ELT), Delta exports would increase by10% when compared to the No Action Alternative (ELT), as shown in Table B.1-6 in Appendix B of this RDEIR/SDEIS. Under Operational Scenario C as considered for Alternative 5 (LLT), Delta exports would also increase by 8% when compared to the No Action Alternative (LLT), as shown in Table 5-6 in Appendix A of this RDEIR/SDEIS.

Changes in the amount, cost, or reliability of water deliveries could create socioeconomic effects in the hydrologic regions. To the extent that unreliable or insufficient water supplies currently represent obstacles to agricultural production, Alternative 5A may support more stable agricultural activities by enabling broader crop selection or by reducing risk associated with uncertain water deliveries. As a result of an increase in water supply and supply reliability, farmers may choose to leave fewer acres fallow and/or plant higher-value crops. While the locations and extent of any increases in production would depend on local factors and individual economic decisions, a general increase in production would be anticipated to support growth in seasonal and permanent on-farm employment, along with the potential expansion of employment in industries closely associated with agricultural production. These include food processing, agricultural inputs, and transportation. Generally, these effects would be most concentrated in hydrologic regions where agriculture is a primary industry and where agricultural operations depend most heavily on SWP and CVP deliveries.

NEPA Effects: Changes in water deliveries associated with operation of Alternative 5A could result in beneficial socioeconomic effects in areas receiving water from the SWP and CVP. In hydrologic regions where water deliveries are predicted to increase when compared with the No Action Alternative, more stable agricultural activities could support employment and economic production associated with agriculture. Where M&I deliveries increase, population growth could lead to general economic growth and support water-intensive industries. Such changes could also lead to shifts in the character of communities in the hydrologic regions with resultant beneficial or adverse effects. Likewise, growth associated with deliveries could require additional expenditures for local governments while also supporting increases in revenue.

CEQA Conclusion: As described above, the operational components of the proposed water conveyance facilities could result in a number of socioeconomic effects in areas receiving SWP and CVP water deliveries outside of the Delta. However, because these impacts are social and economic in nature, rather than physical, they are not considered environmental impacts under CEQA. To the extent that changes in socioeconomic conditions in the hydrologic regions would lead to physical impacts, such impacts are described in Section 4.5.26, *Growth Inducement and Other Indirect Effects*, in this RDEIR/SDEIS.

4.5.13 Aesthetics and Visual Resources

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4 in Appendix A of this RDEIR/SDEIS, except that it would include one intake compared to three intakes under Alternative 4. The potential under Alternative 5A to create substantial alteration in visual quality or character during construction of conveyance facilities would be less than those impacts described under Alternative 4 and would constitute an adverse effect on existing visual character because of the long-term nature of construction, combined with the proximity to sensitive receptors, effects on residences and agricultural buildings, removal of vegetation, and changes to topography through grading. The primary features that would affect the existing visual quality and character under Alternative 5A, once the facility has been constructed, would be Intake 2 the intermediate forebay and expanded Clifton Court Forebay, resulting landscape effects left behind from spoil/borrow and RTM areas, the operable barrier and transmission lines. These changes would be most evident in the northern portion of the study area, which would undergo extensive changes from the permanent establishment of large industrial facilities and the supporting infrastructure along and surrounding Intake 2 on the Sacramento River. Mitigation Measures AES-1a through AES-1g are available to address visual effects resulting from construction of Alternative 4A water conveyance facilities.

CEQA Conclusion: Construction of Alternative 5A would substantially alter the existing visual quality and character present in the study area in a similar manner as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The long-term nature of construction of an intake, operable barrier, pipeline/tunnel, work areas, spoil/borrow and RTM areas, shaft sites, and barge unloading facilities; presence and visibility of heavy construction equipment; proximity to sensitive receptors; relocation of residences and agricultural buildings; removal of riparian vegetation and other mature vegetation or landscape plantings; earthmoving and grading that result in changes to topography in areas that are predominantly flat; addition of large-scale industrial structures (intakes and related facilities); remaining presence of large-scale borrow/spoil and RTM area landscape effects; and introduction of tall, steel transmission lines would all contribute to this impact. This impact would be significant because of the substantial visual changes that would result from conveyance facility construction. Mitigation Measures AES-1a through AES-1g would partially reduce impacts, but not to a less-than-significant level because not all of the visual changes could be eliminated and permanent changes would be made to the regional landscape. Thus, Alternative 5A would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please see Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please see Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please see Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please see Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please see Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please see Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please see Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4.

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

NEPA Effects: Effects related to scenic vistas under Alternative 5A would be similar to but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. During construction, the introduction of construction equipment and removal of vegetation would alter the scenic elements that contribute to the viewing experience from scenic vistas. Intake 2 would introduce visually dominant and discordant features in the foreground and middleground views in vistas that would be very noticeable to all viewer groups in areas of low to high landscape sensitivity levels. As described for Alternative 4, the effects of permanent access roads effects on scenic vistas would not be adverse. The effects of shaft site pads and access hatches on scenic vistas could be adverse. The large scale of intake, the visual presence of large-scale borrow/spoil and RTM area landscape effects, and transmission lines may result in adverse effects on scenic vistas (see discussions under 17.3.1.2 and 17.3.1.3 in the Draft EIR/EIS). Overall, effects on scenic vistas associated with Alternative 5A would be adverse because some elements of the conveyance facilities would permanently change views to scenic vistas. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 5A would have similar but less effect on scenic vistas as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Because proposed permanent access roads generally follow existing ROWs, they would have less-than-significant impacts on scenic vistas. The presence of the intake structure and facilities, large-scale borrow/spoil and RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vistas in the study area. Mitigation Measure AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level. Thus, impacts on scenic vistas associated with Alternative 5A would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

NEPA Effects: Effects on state scenic highways under Alternative 5A would be similar to but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Intake 2, the RTM area north of Intake 2, and the intermediate forebay would be immediately and prominently visible in the foreground from SR 160 and would result in an overall noticeable effect on viewers relative to their current experience of the study area's scenic resources along SR 160 and River Road, where the landscape sensitivity level is high. As described for Alternative 4, the visual elements introduced by the Intake 2, RTM area north of Intake 2, and intermediate forebay associated with Alternative 5A would conflict with the existing forms, patterns, colors, and textures along River Road and SR 160; would dominate riverfront available from SR 160; and would alter broad views and the general nature of the visual experience presently available from River Road and SR 160. These changes would reduce the visual quality near intake structure locations and result in noticeable changes in the visual character of scenic vista viewsheds in the study area. This effect would be adverse for the same reasons discussed for Alternative 4. Mitigation Measures AES-1a, AES-1c, and AES-1e are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 5A would have similar but less effects on scenic highways as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Because proposed permanent access roads generally follow existing ROWs, they would have less-than-significant impacts on scenic vistas. The presence of the intake structure and facilities, RTM area landscape effects, shaft site pads and access hatches, and transmission lines would result in significant impacts on scenic vistas because construction and operation would result in a reduction in the visual quality in some locations and introduce dominant visual elements that would result in noticeable changes in the visual character of scenic vista viewsheds in the study area. Mitigation Measures AES-1a, AES-1c, and AES-1e would partially reduce these impacts but not to a less-than-significant level for the same reasons identified for Alternative 4. Thus, impacts on scenic vistas associated with Alternative 5A would be significant and unavoidable.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

NEPA Effects: Effects resulting from light and glare under Alternative 5A would be similar to but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Intake 2 and associated facilities would create noticeable effects relating to light and glare (Figures 17-85). Overall, because the study area currently experiences low levels of light and because there are a larger number of viewers in and around the waterways, the intake structure, and forebay that would be affected by these noticeable changes that contrast with the existing rural character, effects associated with new sources of daytime and nighttime light and glare are considered adverse. Mitigation Measures AES-4a through AES-4c are available to address these effects.

CEQA Conclusion: Construction of conveyance facilities under Alternative 5A would have effects, related to light and glare similar to, but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The impacts associated with light and glare under Alternative 5A are significant because there are a larger number of viewers in and around the waterways, intake structure, and intermediate forebay; project facilities would increase the amount of nighttime lighting in the Delta above existing ambient light levels; and the study area currently experiences low levels of light because there are fewer light/glare producers than are typical in urban areas. Mitigation Measures AES-4a through AES-4c would partially reduce these impacts but not to a less than significant level because all instances of light and glare impacts would not be reduced by the available mitigation measures. Thus, the new sources of daytime and nighttime light and glare associated with Alternative 5A would result in significant and unavoidable impacts on public views in the project vicinity.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours Within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4.

Impact AES-5: Substantial Alteration in Existing Visual Quality or Character during Conveyance Facility Operation

NEPA Effects: Effects on the visual environment through operations and maintenance of the water conveyance facilities under Alternative 5A would be similar to but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. The greatest visual effects resulting from operations would be maintenance of the intake and dredging the forebays. However, all activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. These effects on the existing visual quality and character during operation would not be adverse because the activities would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features.

CEQA Conclusion: Operation of Alternative 5A would have visual quality effects similar to but less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Maintenance of the conveyance facilities (i.e., Intake 2, tunnels, forebays and transmission lines) would be required periodically and would involve painting, cleaning, and repair of structures; dredging at forebays; vegetation removal and care along embankments; tunnel inspection; and vegetation removal within transmission line ROWs. These activities could be visible from the water or land by sensitive viewers in proximity to these features. All activities would maintain the visual character of the facilities, once built, and would not act to further change the visual quality or character of the facilities or surrounding visual landscape during operation. Maintenance and operation of Alternative 5A once constructed, would not result in further substantial changes to the existing natural viewshed or terrain, alter existing visual quality of the region or eliminate visual resources, or obstruct or permanently reduce visually important features. Thus, overall, operation and maintenance of Alternative 5A would have a less-than-significant impact on existing visual quality and character in the study area because operations would not change the visual quality of the environment and maintenance activities would be minor and intermittent. No mitigation is required.

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of Environmental Commitments 3, 4, 6, 7, 8–12, 15, and 16

Effects of Alternative 5A related to the potential for alteration of existing visual quality or character from implementing these environmental commitments would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, Alternative 5A would restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, 6, 7, and 8–11 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitments 15 and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 5A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Effects on the existing visual character, scenic vistas, scenic highways, and light and glare would be similar to those under Alternative 4 (in Appendix A of this RDEIR/SDEIS) because restored/enhanced lands would result in incremental and site-specific changes to the landscape in a similar manner. Because only portions of the restoration environmental commitments and fewer of the other stressor reduction environmental commitments would be implemented under Alternative 5A, it is likely that the visual and aesthetic effects would be less than those presented for Alternative 4. However, these visual and aesthetic impacts are considered to be adverse because site-specific, localized adverse visual effects could occur at the sites of projects implemented under the Alternative 5A environmental commitments. Mitigation Measures AES-1a through AES-1g and Mitigation Measures AES-4a through AES-4c are available to address effects from implementation of the environmental commitments.

CEQA Conclusion: Implementation of environmental commitments under Alternative 5A would have similar but less impacts than identified for Alternative 4 in Appendix A of this RDEIR/SDEIS. Alternative 5A has the potential to affect existing visual quality and character, views of scenic vistas, views from scenic highways, and introduce new sources of light and glare in the study area. These potential impacts are considered to be significant because construction of environmental commitments could potentially change views from public areas, negatively affect sensitive receptors and require multiple year construction at specific locations that are currently unknown.

Implementing mitigation measures AES 1a–1g would partially reduce the significant impacts of Alternative 5A on aesthetic and visual resources but not to a less-than-significant level because restoration and other actions implemented under this alternative could create considerable changes to the visual character of sensitive receptors that may not be fully mitigated by these mitigation measures. Thus, implementation of environmental commitments under Alternative 5A would result in significant and unavoidable impacts on the existing visual quality and character in the study area.

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Please refer to Mitigation Measure AES-1a under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Please refer to Mitigation Measure AES-1b under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Please refer to Mitigation Measure AES-1c under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Please refer to Mitigation Measure AES-1d under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Please refer to Mitigation Measure AES-1e under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Please refer to Mitigation Measure AES-1f under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Please refer to Mitigation Measure AES-1g under Impact AES-1 in the discussion of Alternative 4.

Mitigation Measure AES-4a: Limit Construction to Daylight Hours Within 0.25 Mile of Residents

Please refer to Mitigation Measure AES-4a under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Please refer to Mitigation Measure AES-4b under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Please refer to Mitigation Measure AES-4c under Impact AES-4 in the discussion of Alternative 4.

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Please refer to Mitigation Measure AES-6a under Impact AES-6 in the discussion of Alternative 4.

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-Intensity and Lights Off Policy

Please refer to Mitigation Measure AES-6b under Impact AES-6 in the discussion of Alternative 4.

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

Please refer to Mitigation Measure AES-6c under Impact AES-6 in the discussion of Alternative 4.

Impact AES-7: Compatibility of the Proposed Water Conveyance Facilities and Other Environmental Commitments with Federal, State, or Local Plans, Policies, or Regulations Addressing Aesthetics and Visual Resources

NEPA Effects: Constructing water conveyance facilities and implementing other environmental commitments under Alternative 5A would generally have the same potential for incompatibilities with one or more plans and policies related to preserving the visual quality and character of the Delta as described for Alternative 4 in Appendix A of this RDEIR/SDEIS. As described for Alternative 4, potential incompatibility with plans and policies could exist related to preserving the visual quality and character of the Delta (i.e., The Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, Delta Protection Commission Land Use and Resource Management Plan for the Primary Zone of the Delta, Delta Plan, Brannan Island and Franks Tract State Recreation Areas General Plan). In addition, with the exception of Solano County, the alternative may be incompatible with county general plan policies that protect visual resources in the study area.

CEQA Conclusion: The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts AES-1 through AES-6, above and no additional CEQA conclusion is required related to the compatibility of Alternative 5A with relevant plans and policies.

4.5.14 Cultural Resources

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, however the number of Sacramento River intakes would be reduced to one located near Clarksburg (Intake 2). Constructing the water conveyance facilities under Alternative 5A would result in impacts on identified archaeological sites similar to those disclosed under Alternative 4 in Appendix A of this RDEIR/SDEIS. This encompasses the seven previously recorded archeological sites occurring in the footprint of the conveyance facility. Site descriptions summarizing available information regarding these resources, are provided in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2 *Archaeological Site Descriptions*, of the Draft EIR/EIS.

The significance of the identified archeological sites is the same as described for Alternative 4. Because many of these resources are large (typically in excess of 30 meters across), they are each likely to contain sufficient integrity to yield artifacts in their original associations in a manner that will convey the significance themes outlined in the Alternative 4 discussion in Appendix A of this RDEIR/SDEIS. These resources are likely to qualify as historical resources under CEQA and historic properties under the NRHP.

The mechanisms that could impact the archeological sites under Alternative 5A, would be similar to those described for Alternative 4. These resources occur within the footprint of both temporary work areas and permanent surface impacts and would be subject to the same types of disturbance described under Alternative 4. Construction of the water conveyance facilities has the potential to materially impair these resources under CEQA and to adversely affect the resources as defined by Section 106 of the NHPA.

NEPA Effects: Construction may disturb and damage NRHP and CRHR-eligible archaeological resources. This effect is considered adverse because the damage may impair the integrity of these resources and thus reduce their ability to convey their significance

CEQA Conclusion: Construction of conveyance facilities would affect identified archaeological resources that occur in the footprint of this alternative. DWR identified these resources and found that they are likely to qualify as historical resources under CEQA (see the individual site descriptions in Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, Section B.1.2 *Archaeological Site Descriptions*, of the Draft EIR/EIS). This impact would be significant because construction could materially alter or destroy the potential of these resources to yield information useful in archaeological research through excavation and disruption of the spatial associations that contain meaningful information. Identified but currently inaccessible resources may also be significant under other register criteria; indirect effects such as introduction of inconsistent changes to the setting may also diminish the significance of these resources. Mitigation Measure CUL-1 would reduce this impact, by recovering data at affected significant archeological sites and by monitoring and protecting resources during construction. However, this measure but would not ensure that all of the scientifically important material would be retrieved because feasible archaeological excavation only typically retrieves a sample of the deposit, and portions of the site containing important information may remain after treatment. The impact on identified archaeological sites is considered significant and unavoidable because construction could damage the remaining portions of the deposit.

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Please see Mitigation Measure CUL-1 under Impact CUL-1 in the discussion of Alternative 4.

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

The potential effects of constructing water conveyance facilities on archaeological sites identified through future inventories would be less under Alternative 5A when compared to Alternative 4, as described in Appendix A of this RDEIR/SDEIS, because the footprint of the water conveyance facility is smaller. These future impacts could occur because most of the area crossed by the proposed water conveyance facility is not currently legally accessible and as such has not been surveyed for the presence of archaeological sites. Alternative 5A would also require less geotechnical testing than Alternative 4 because of the smaller footprint. However, testing could damage or destroy archaeological sites. Although the majority of the footprint of the water conveyance facility has not be surveyed, sensitive resources have been located within and near the portions of the alignment that have been surveyed. For this reason, additional prehistoric archaeological resources are likely to be found in the portion of the footprint where surveys have not yet been conducted. For the reason enumerated under Alternative 4, these sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

The potential effects on historic sites under Alternative 5A would be less than those disclosed for Alternative 4. Historic sites are likely to be associated with the historic-era themes of settlement, reclamation, agriculture, and flood management in the Delta region and as such contributed to the economic base for developing urban centers. These historic sites are likely to qualify as historical resources or unique archaeological resources under CEQA and historic properties under Section 106 of the NHPA.

Absent mitigation, ground-disturbing construction is likely to physically damage many of these resources by disrupting the spatial associations that convey data useful in research or changing the setting such that the resource no longer contains its significance. These impacts would materially impair these resources within the meaning of CEQA and adversely affect the resources within the meaning of Section 106 of the NHPA. These effects would be adverse.

NEPA Effects: Alternative 5A has the potential to damage previously unidentified archaeological sites. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA Conclusion: The footprint for Alternative 5A is sensitive for both prehistoric and historic-era resources that cannot be identified at this time because much of the footprint is not legally accessible. Because many of these resources are likely to have data useful in prehistoric and historic archaeological research, as well as the integrity to convey this significance, they are likely to qualify as historical resources or unique archaeological sites under CEQA or historic properties under the Section 106 of the NHPA. Ground-disturbing construction may materially alter the significance of these resources by disrupting the spatial associations that could yield important data, resulting in a significant effect. Mitigation Measure CUL-2 would address the impacts of both prehistoric and historic resources through conducting inventories, evaluating significance, and proposing treatment of archeological and historic resources as well as monitoring during the construction phase. However, this mitigation cannot guarantee that all eligible or significant resources would be preserved in place, or that all important data would be retrieved before construction destroys these resources. The scale of the project, investment into existing designs, and the presence of other important environmental resources such as habitat, natural communities, and wetlands that should be avoided are constraints on the flexibility and feasibility of avoidance. For these reasons this impact is significant and unavoidable.

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Please see Mitigation Measure CUL-2 under Impact CUL-2 in the discussion of Alternative 4.

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

The potential effects of construction of the water conveyance facilities on archaeological sites that may not be identified during inventory efforts under Alternative 5A would be less when compared to Alternative 4 because of the smaller footprint. As described for Alternative 4 in Appendix A of this RDEIR/SDEIS, although surveys will be completed for the water conveyance footprint, such surveys cannot guarantee that all sites will be identified prior to construction.

Ground-disturbing activities occurring under Alternative 5A, including the construction of surface features such as intakes, subterranean tunnel boring operations, and access may disturb and damage these resources before they can be identified and avoided during monitoring efforts required under Mitigation Measure CUL-3. This damage and disturbance may materially impair these resources within the meaning of CEQA or adversely affect the resources within the meaning of Section 106 because this disturbance would impair the ability of these resources to yield data useful in research. While Mitigation Measure CUL-3 would reduce the potential for this impact, it would not guarantee the impact would be avoided entirely. Therefore, this impact is adverse.

NEPA Effects: Constructing Alternative 5A has the potential to damage previously unidentified archaeological sites that also may not necessarily be identified prior to construction. While cultural resource inventories will be completed once legal access is secured, no inventory can ensure that all resources are identified prior to construction. Because these sites may qualify for the NRHP or CRHR, damage to these sites may diminish their integrity. For these reasons this effect would be adverse.

CEQA Conclusion: This impact on archeological resources not identified during inventory efforts would be considered significant for the same reasons described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Construction has the potential to disturb previously unidentified archaeological sites qualifying as historical resources, historic properties, or unique archaeological resources. Mitigation Measures CUL-3 would reduce but not entirely avoid the potential for this impact, by implementing construction worker training, monitoring and discovery protocols. This impact would remain significant and unavoidable because all archaeological resources may not be identified prior to disturbance.

Mitigation Measure CUL-3: Implement an Archaeological Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Please see Mitigation Measure CUL-3 under Impact CUL-3 in the discussion of Alternative 4.

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Effects on buried human remains during construction occurring of Alternative 5A would likely be less than Alternative 4 because the footprint of the water conveyance facilities would be smaller. As describe in greater detail for Alternative 4, the footprint of the water conveyance facilities is sensitive for buried historic and prehistoric human remains. While inventory and monitoring efforts are prescribed by Mitigation Measures CUL-2 and CUL-3, the large land area subject to disturbance under Alternative 5A make exhaustive sampling to identify all buried and isolated human remains technically and economically infeasible. For these reasons the potential remains that such resources may be damaged or exposed before they can be discovered through inventory or monitoring. This effect would be adverse.

NEPA Effects: Buried human remains may be damaged by constructing Alternative 5A because such remains may occur either in isolation or as part of identified and previously unidentified archaeological resources where construction will occur. This effect would be adverse.

CEQA Conclusion: Damage to buried human remains during construction of Alternative 5A would be considered a significant impact for the same reasons described for Alternative 4. The project area is sensitive for buried human remains and construction of Alternative 5A would likely result in disturbance of these features. Disturbance of human remains, including remains interred outside of cemeteries is considered a significant impact. Mitigation measure CUL-4 would reduce the severity of this impact by following state and federal guidelines, including notifying the county coroner and NAHC, if human remains are discovered during construction. This impact is considered significant and unavoidable, because mitigation would not guarantee that these features could be discovered and treated in advance of construction and the scale of construction makes it technically and economically infeasible to perform the level of sampling necessary to identify all such resources prior to construction.

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains if Such Resources Are Discovered during Construction

Please see Mitigation Measure CUL-4 under Impact CUL-4 in the discussion of Alternative 4.

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on built-environment resources under Alternative 5A would be less than those described for Alternative 4 in Appendix A of this RDEIR/SDEIS because of the smaller construction footprint. As described in greater detail under Alternative 4 and Appendix 18B, *Identified Cultural Resources Potentially Affected by BDCP Alternatives*, of the Draft EIR/EIS, a total of 17 built-environment resources have the potential to be directly or indirectly affected by constructing the water conveyance facilities. These effects would materially impair the resources within the meaning of CEQA and result in adverse effects within the meaning of Section 106 because they would diminish the characteristics that convey the significance of the resources.

NEPA Effects: Alternative 5A would result in direct and indirect effects on NRHP and CRHR eligible built environment resources. These alterations may diminish the integrity of these resources. For these reasons this effect would be adverse.

CEQA Conclusion: Alternative 5A could result in fewer impacts on identified historic-era built-environment resources than described for Alternative 4. The impacts on the built-environment resource are considered significant because construction may require demolition or alter the character of the resource to such a degree that each resource may no longer be able to convey its significance. Mitigation measure CUL-5 would reduce the impact by implementing a built environment treatment plan that includes preparing an HSR, assessing preconstruction conditions, implementing protection measures, and preparing HABS records for CRHR and NRHP-eligible historic buildings and structures that will be demolished. The impact on historic-era built-environment resources would remain significant and unavoidable because even with mitigation, the scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely.

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Please see Mitigation Measure CUL-5 under Impact CUL-5 in the discussion of Alternative 4.

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Effects of constructing the water conveyance facilities on unidentified and unevaluated historic architectural and built-environment resources under Alternative 5A would be less than those described for Alternative 4 because the footprint of the water conveyance facility would be smaller. As described in detail for Alternative 4, although DWR does not have legal access to the majority of the footprint for the water conveyance, historical documentation suggests numerous additional resources occur in the footprint of the water conveyance facilities that have not been identified or which cannot currently be accessed and evaluated. Construction may result in direct demolition of these resources, damage through vibration, or indirect effects such as changes to the setting.

The resources may exhibit significance under both CEQA (State CEQA Guidelines Section 15064.5[a][3]) and the NRHP (30 CFR 60.4). In addition, because many of the historic-era structures in the Delta region are intact, and retain their rural agricultural setting, many of these resources are likely to have integrity within the meaning of CEQA and the NRHP (14 CCR Section 4852[c], 30 CFR 60.4). Because many unidentified resources are likely to have significance and integrity, they may qualify as historical resources under CEQA and historic properties under Section 106 of the NHPA.

NEPA Effects: Alternative 5A may result in direct modification or indirect changes to the setting for inaccessible and NRHP- and CRHR-eligible resources. These changes may diminish the integrity of these resources. For these reasons, this effect would be adverse.

CEQA Conclusion: Alternative 5A may result in the fewer impacts on unidentified and unevaluated historic architectural and built-environment resources than described for Alternative 4. Construction may also result in permanent indirect effects such as changes to the setting. Direct demolition or changes to the setting would be material alterations because they would either remove the resource or alter the resource character, resulting in an inability of the resource to convey its significance. Many of these resources are likely to qualify as historic properties or historical resources under the NHPA and CEQA. Mitigation measure CUL-6 would reduce these impacts by requiring surveys be conducted on previously inaccessible properties to determine if constructing the water conveyance facilities would adversely impact the properties and if so, the development and implementation of implement treatment plans. The scale of the project and the constraints imposed by other environmental resources make avoidance of all significant effects unlikely. For these reasons this impact remains significant and unavoidable even with implementation of the following mitigation measures.

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Please see Mitigation Measure CUL-6 under Impact CUL-6 in the discussion of Alternative 4.

Impact CUL-7: Effects of Other Environmental Commitments on Cultural Resources

Implementing conservation and stressor reduction components as part of Alternative 5A would result in impacts on cultural resources similar to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS. The extent of these impacts occurring under Alternative 5A would be less than under Alternative 4 because the total acreage that would be affected by the habitat restoration and enhancement activities would be substantially less. The following Environmental Commitments could result in impacts on cultural because they involve ground-disturbing activities:

- *Environmental Commitment 3: Natural Communities Protection and Restoration*
- *Environmental Commitment 4: Tidal Natural Communities Restoration*
- *Environmental Commitment 6: Channel Margin Enhancement*
- *Environmental Commitment 7: Riparian Natural Community Restoration*
- *Environmental Commitment 8: Grassland Natural Community Restoration*
- *Environmental Commitment 9: Vernal Pool and Alkali Seasonal Wetland Complex Restoration*
- *Environmental Commitment 10: Nontidal Marsh Restoration*

These Environmental Commitments would result in effects on cultural resources when ground-disturbing work is performed to construct improvements and enhance or restore natural communities. Similar to Alternative 4, direct effects would occur through demolition or destruction of NRHP-, CRHR-, and/or local registry-eligible prehistoric and historic archaeological sites, unique archaeological sites, TCPs, human remains, and built-environment resources. In addition, indirect effects may occur where changes to the setting alter the existing setting in a manner that is inconsistent with the feeling and association of the resource. Because the ability of the resources to convey their significance would be lost this effect would materially alter these resources under CEQA and would be adverse under NEPA. For example, reclaimed agricultural landscapes that are converted to habitat may no longer convey the themes of agriculture and settlement, and thus would be inconsistent with remaining features associated with rural historic landscapes created by reclamation, cultivation, and ranching.

Mitigation Measure CUL-7 below addresses the impact on cultural resources as a result of implementing the conservation and stressor reduction components. Because of the large acreages of land included in all these components, it is unlikely that all effects on NRHP-, CRHR-, and /or local registry-eligible resources and unique archaeological sites could be avoided. Therefore, this impact would be adverse.

NEPA Effects: Implementation of environmental commitments will result in ground disturbing work and introduction of new infrastructure to the project area. These physical modifications may result in direct effects on NRHP and CRHR eligible resources and therefore reduce the integrity of these resources. For these reasons these effects would be adverse.

CEQA Conclusion: Implementing environmental commitments would require ground-disturbing activities that could alter the significant characteristics of NRHP-, CRHR-, and/or local registry-eligible cultural resources, including prehistoric and historic archaeological sites, TCPs, and built-environment resources such as historic architectural structures and rural historic landscapes. The same construction may damage unique archaeological sites. This construction would likely result in materially adverse changes for the following reasons.

- Ground-disturbing construction in archaeological sites disrupts the spatial associations that contain data useful in research, thus diminishing or destroying the basis for the significance of the resource.
- Ground-disturbing construction may either directly demolish or indirectly affect the setting of built-environment resources, resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may either directly demolish or change the setting of TCPs resulting in an inability of the resource to convey its significance.
- Ground-disturbing construction may inadvertently disturb human remains.

The alteration of a resource that changes the characteristics that convey its significance is a material alteration under CEQA. The inadvertent disturbance of human remains is a significant impact under Appendix G of the State CEQA Guidelines. Because this construction would materially alter these categories of resources and disturb human remains it would result in a significant impact. Mitigation measure CUL-7 would reduce these impacts by identifying and evaluating resources, avoiding resources where possible, and developing treatment where avoidance is not possible. In addition construction would be monitored. However, because of the acreage that could be disturbed as a result of implementing the components, as well as the multiple constraints associated with other environmental resources that require mitigation or avoidance, it is unlikely that all cultural resources could be avoided. Therefore, this impact remains significant and unavoidable.

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

Please see Mitigation Measure CUL-7 under Impact CUL-7 in the discussion of Alternative 4.

Impact CUL-8: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments with Plans and Policies

Similar to Alternative 4 (as described in Appendix A of this RDEIR/SDEIS), constructing the proposed water conveyance facilities and implementing environmental commitments under Alternative 5A could result in the potential for incompatibilities with plans and policies adopted to protect the cultural resources of the Delta. A number of plans and policies that coincide with the study area provide guidance for protection of cultural resources as overviewed in Section 18.2.3, *Regional and Local Plans, Policies, and Regulations*, of the Draft EIR/EIS. The policies include the Alameda County East Area Plan, Contra Costa County General Plan, San Joaquin County General Plan, Sacramento County General Plan, Solano County General Plan, and the Yolo County General Plan. A detailed summary of the policies is provided in Alternative 4. Similar to Alternative 4, the construction of the water conveyance facilities and conservation and stressor reduction components under Alternative 5A would be compatible with the cultural resource protection policies indicated in the Alameda County East Area Plan, San Joaquin County General Plan, Yolo County General Plan and potentially incompatible with the Contra Costa County General Plan, Sacramento County General Plan and Solano County General Plan. Similar to Alternative 4, restoration actions under Alternative 5A would be compatible with policies that emphasize mitigation and incompatible with policies that emphasize preservation.

It should be noted that, as described in Section 13.2.3, *Land Use*, of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment.

NEPA Effects: Alternative 5A has the potential to be in consistent some of the local land use plans and policies for preservation of cultural resources. Although federal agencies are not subject to local land use policy, the physical effects related to construction of Alternative 5A would be addressed by implementing measures identified under Impacts CUL 1-7. No additional conclusion is required.

CEQA Conclusion: For policies that emphasize preservation or mitigation, Alternative 5A will be compatible with these policies because DWR and appropriate federal agencies will implement cultural resource management practices that will identify significant resources, preserve such resources where feasible, and complete mitigation to reduce significant effects where preservation is not feasible. For policies that emphasize preservation, the project is incompatible in some instances because multiple constraints governing the location of proposed facilities makes preservation of all significant cultural resources unlikely. It should be noted that, as described in Section 13.2.3, *Land Use*, of the Draft EIR/EIS, state and federal agencies are not subject to local land use regulations. Furthermore, policy incompatibility, by itself is not a physical impact on the environment and physical impacts on cultural resources are addressed under Impacts CUL 1-7, above.

4.5.15 Transportation

Impact TRANS-1: Increased Construction Vehicle Trips Resulting in Unacceptable LOS Conditions

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. Increased traffic volumes generated during construction of Alternative 5A would therefore range between those generated under Alternatives 4 (in Appendix A of this RDEIR/SDEIS) and those described for Alternative 5. See the discussion of Impact TRANS-1 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 19-25 in Appendix A of this RDEIR/SDEIS, under baseline plus background growth (BPBG) conditions[1], Alternative 4 would exacerbate an already unacceptable LOS under BPBG conditions on **15** roadway segments. The estimated number of vehicles generated by Alternative 5A would be lower compared to Alternative 4 due to the reduction in the number of intakes. Localized impacts in the vicinity of Intakes 3 and 5 would not occur. However, the effect of increased traffic volumes in excess of LOS thresholds throughout the Project area would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of the necessary improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

***CEQA Conclusion*:** Construction under Alternative 5A would add hourly traffic volumes to study area roadways that would exceed acceptable LOS threshold. This would be a significant impact. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that required roadway capacity improvements outlined under TRANS-1c will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of unacceptable LOS would occur. Accordingly, this impact would be significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

[1] Background traffic growth was included for the traffic operations analysis based on the anticipated year of construction activity. The final result is a set of volumes representing baseline plus background growth (BPBG) and baseline plus background growth plus project (BPBGPP) traffic conditions.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-2: Increased Construction Vehicle Trips Exacerbating Unacceptable Pavement Conditions

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. Increased traffic volumes generated during construction of Alternative 5A would therefore range between those generated under Alternative 4 (in Appendix A of this RDEIR/SDEIS) and those described for Alternative 5 in the Draft EIR/EIS. See the discussion of Impact TRANS-2 under Alternative 4 and Alternative 5.

NEPA Effects: As shown in Table 19-26 in Appendix A of this RDEIR/SDEIS, Alternative 4 would deteriorate existing pavement conditions to less than the acceptable pavement condition index (PCI) or similar applicable threshold on a total of **46** roadway segments. The estimated number of vehicles generated by Alternative 5A would be lower compared to Alternative 4 due to the reduction in the number of intakes. Localized impacts in the vicinity of Intakes 3 and 5 would not occur. Nevertheless, damage to roadway pavement is also expected throughout the study area on various local and state roads, as well as on a few interstates. The effect of roadway damage in excess of PCI thresholds would be adverse.

Mitigation Measures TRANS-2a through TRANS-2c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, an adverse effect in the form of deficient pavement conditions would occur. Accordingly, this effect could remain adverse. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, adverse effects could be avoided.

***CEQA Conclusion*:** Construction under Alternative 5A would add traffic trips to study area roadways that would exacerbate unacceptable pavement conditions. This would be a significant impact. Mitigation Measures TRANS-2a through TRANS-2c would reduce the severity of this impact, but not necessarily to less-than-significant levels, as the project proponents cannot ensure that the agreements or encroachment permits will be obtained from the relevant transportation agencies. If an agreement or encroachment permit is not obtained, a significant impact in the form of deficient pavement conditions would occur. Accordingly, this impact could be significant and unavoidable. If, however, mitigation agreement(s) or encroachment permit(s) providing for the improvement or replacement of pavement are obtained and any other necessary agreements are completed, impacts would be reduced to less than significant.

Mitigation Measure TRANS-2a: Prohibit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2a under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2b: Limit Construction Activity on Physically Deficient Roadway Segments

Please refer to Mitigation Measure TRANS-2b under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-2c: Improve Physical Condition of Affected Roadway Segments as Stipulated in Mitigation Agreements or Encroachment Permits

Please refer to Mitigation Measure TRANS-2c under Impact TRANS-1 in the discussion of Alternative 4 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-3: Increase in Safety Hazards, Including Interference with Emergency Routes during Construction

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to increase safety hazards during construction would be similar to those impacts described under Alternative 4 (in Appendix A of this RDEIR/SDEIS) and Alternative 5. See the discussion of Impact TRANS-3 under Alternatives 4 and 5.

NEPA Effects: Increases in heavy construction traffic on local roadways could increase safety hazards, such as conflicts with recreational and commuter traffic and with farming operations. The increase in heavy construction traffic using emergency routes could also interfere with emergency service response times. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could create localized interferences with emergency service response times in the vicinity of Byron Highway. The effect of increased safety hazards from increased heavy construction traffic on local roadways and emergency routes would be adverse.

Mitigation Measure TRANS-1c is available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of increased safety hazards would occur. Accordingly, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

CEQA Conclusion: Construction of Alternative 5A would increase the amount of trucks using the transportation system in the study area, which could increase the potential for safety hazards, including conflicts with farming operations, emergency services, and recreational and commuter traffic. Minor delays and congestion created by rerouted traffic during the temporary realignment of Byron Highway/South Pacific Railroad could also create localized interferences with emergency service response times in the vicinity of Byron Highway. This would be a significant impact.

Mitigation Measure TRANS-1c will reduce the severity of this impact, but not to less-than-significant levels since the project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact in the form of increased safety hazards would occur. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-4: Disruption of Marine Traffic during Construction

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, marine traffic generated by construction of non-intake features structures would be similar to Alternative 4, whereas marine traffic generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to disrupt marine traffic during construction would be similar to those impacts described under Alternatives 4 and 5. See the discussion of Impact TRANS-4 under Alternatives 4 and 5.

NEPA Effects: Commercial barges would be used to transport tunnel segments from three concrete precast yards to temporary barge unloading facilities on Bouldin Island and at the Clifton Court Forebay. Tugboats would also be used during intake and forebay construction. The number of barge trips required to carry tunnel segments would be similar to Alternative 4 (approximately 5,500 trips). This potential effect is not considered adverse because construction of Alternative 5A would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area, such that existing marine traffic would be disrupted. Barge routes and landing sites will be selected to maximize continuous waterway access and a minimum waterway width greater than 100 feet. Moreover, Mitigation Measure TRANS-1a would also reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

CEQA Conclusion: Construction of Alternative 5A would not require modification to existing deep water channels, interfere with Port of Stockton navigation, or substantially increase the volume of barge movement within the study area such that existing marine traffic would be disrupted (on average, only eight additional barge trips per day are expected through the segment hauling period). Accordingly, this impact would be less than significant. While no mitigation is required, it is important to note that Mitigation Measure TRANS-1a (implemented to reduce effects from Impact TRANS-1) would reduce any potential disruptions as it includes stipulations to notify the commercial and leisure boating community of proposed barge operations in the waterways.

Impact TRANS-5: Disruption of Rail Traffic during Construction

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to disrupt rail traffic during construction would be similar to those impacts described under Alternatives 4 and 5. See the discussion of Impact TRANS-5 under Alternatives 4 and 5.

NEPA Effects: The water conveyance alignment crosses under the existing BNSF/Amtrak San Joaquin line between Bacon Island and Woodward Island and would therefore have no effect on freight service. Similarly, construction of the Clifton Court Forebay would not disrupt UPRR Tracy Subdivision service since the line is currently inactive. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities may adversely affect new service. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) is available to address this effect.

CEQA Conclusion: Construction of Alternative 5A would not physically cross or require modification to an active railroad. However, if the UPRR Tracy Subdivision branch line is reopened, construction activities at the Clifton Court Forbay may affect new service. This would be a significant impact. Mitigation Measure TRANS-1a, which includes stipulations to coordinate with rail providers to develop alternative transportation modes (e.g., trucks or buses) would reduce this impact to less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-6: Disruption of Transit Service during Construction

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to disrupt transit service during construction would therefore be similar to those impacts described under Alternatives 4 and 5. See the discussion of Impact TRANS-6 under Alternatives 4 and 5.

NEPA Effects: Construction activities associated with Alternative 5A would decrease LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions (refer to Impact TRANS-1). Increased congestion resulting from construction traffic would result in an adverse effect on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

***CEQA Conclusion*:** Construction activities associated with Alternative 5A would decrease LOS below applicable thresholds, as well as exacerbate already unacceptable LOS conditions. Increased congestion resulting from construction traffic would result in a significant impact on transit routes and schedules, particularly along the SCT Link/Delta Route and Greyhound bus lines. Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this impact, but not necessarily to a level that would not be less than significant, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the effect is made, a significant and unavoidable impact in the form of disruptions to transit service would occur. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the impact is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-7: Interference with Bicycle Routes during Construction

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, traffic volumes generated by construction of non-intake features structures would be similar to Alternative 4, whereas traffic volumes generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to interfere with bicycle routes during construction would therefore be similar to those impacts described under Alternatives 4 and 5. See the discussion of Impact TRANS-7 under Alternatives 4 and 5.

NEPA Effects: Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12. The effect of disruption to bicycle routes during construction would be adverse. Mitigation Measure TRANS-1a, which requires alternative access routes via detours or bridges be provided to maintain continual circulation for bicyclists, is available to reduce this effect.

***CEQA Conclusion*:** Increased traffic and vehicle delays during construction could temporarily disrupt bicycle routes on SR 160/River Road and potentially on SR 12, resulting in a significant impact. However, Mitigation Measure TRANS-1a would reduce the severity of this impact to less-than-significant levels because project proponents would provide alternate access routes via detours or bridges to maintain continual circulation for local travelers in and around construction zones, including bicycle riders.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-8: Increased Traffic Volumes and Delays during Operations and Maintenance

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Traffic volumes generated during operation of Alternative 5A would therefore be lower higher than Alternative 4, as described below. See the discussion of Impact TRANS-8 under Alternative 4.

NEPA Effects: Based on the number of employees required for routine operations and yearly maintenance under Alternative 4 (40 and 35, respectively) and the estimated number of employees required to maintain two fewer intakes (10), Alternative 5A would require 30 and 35 employees for routine operations and yearly maintenance, respectively. Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during project operations would not be adverse.

***CEQA Conclusion*:** Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections under Alternative 5A would result in substantial increases of traffic volumes or roadway congestion. The impact of increased traffic volumes and delays during operations would therefore be less than significant. No mitigation is required.

Impact TRANS-9: Permanent Alteration of Transportation Patterns during Operations and Maintenance

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Traffic volumes generated during operation of Alternative 5A would therefore be slightly lower than Alternative 4. However, the potential for Alternative 5A to permanently alter transportation patterns during operations and maintenance would be similar to those impacts described under Alternative 4, as described above under Impact TRANS-8. See the discussion of Impact TRANS-9 under Alternative 4.

NEPA Effects: Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. The effect of permanent alteration of transportation patterns during operations would therefore not be adverse.

***CEQA Conclusion*:** Impacts on public roadways would be limited to the intake areas and would not substantially alter traffic patterns. The design and construction of all project components (i.e., conveyances, intakes, and forebays) would provide for on-going continuity of all rail operations following completion of construction. Impediments to boat traffic associated with the intakes would continue for the life of the project, but would not substantially affect boat passage or usage. Accordingly, the impact of permanent alteration of transportation patterns during operations would be less than significant. No mitigation is required.

Impact TRANS-10: Increased Traffic Volumes during Implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

Effects of Alternative 5A related to increased traffic volumes during implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16 would be similar to, but less than those described for Alternative 4. See the discussion of Impact TRANS-10 under Alternative 4 in Appendix A in this RDEIR/SDEIS.

NEPA Effects: Habitat restoration and enhancement activities that require personnel or heavy-duty equipment transport would generate traffic on area roadways. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. This would be an adverse effect. The magnitude of the effect would vary according to the amount of traffic generated by implementation of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the roadway and traffic conditions at the time of implementation.

Alternative 5A would restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,839 acres under Alternative 4. Therefore, the magnitude of traffic volumes and associated traffic impacts under Alternative 5A would be smaller than those associated with Alternative 4. Nevertheless, the effect of increased traffic volumes during construction and maintenance of Environmental Commitments 3, 4, 6, 7, and 9–11 would be adverse.

Mitigation Measures TRANS-1a through TRANS-1c are available to reduce this effect, but not necessarily to a level that would not be adverse, as the project proponents are not solely responsible for the timing, nature, or complete funding of required improvements. If an improvement that is identified in any mitigation agreement(s) contemplated by Mitigation Measure TRANS-1c is not fully funded and constructed before the project's contribution to the effect is made, an adverse effect in the form of unacceptable LOS would occur. Therefore, this effect would be adverse. If, however, all improvements required to avoid adverse effects prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, effects would not be adverse.

***CEQA Conclusion*:** Impacts on roadways could result in circulation delays or the inability to maintain adequate vehicular access in or around restoration or enhancement work zones. Roads and highways in and around Suisun Marsh could experience increases in traffic volumes, resulting in localized congestion and conflicts with local traffic. Maintenance and monitoring of the restoration areas would also generate some vehicle trips. The impact of increased traffic volumes during implementation of Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16 would be significant. Mitigation Measures TRANS-1a through TRANS-1c would reduce the severity of this impact, but not to less-than-significant levels. The project proponents cannot ensure that the improvements will be fully funded or constructed prior to the project's contribution to the impact. If an improvement identified in the mitigation agreement(s) is not fully funded and constructed before the project's contribution to the impact is made, a significant impact would occur. Therefore, the project's impacts on roadway segment LOS would be conservatively significant and unavoidable. If, however, all improvements required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please refer to Mitigation Measure TRANS-1a in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1b: Limit Hours or Amount of Construction Activity on Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1b in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Mitigation Measure TRANS-1c: Make Good Faith Efforts to Enter into Mitigation Agreements to Enhance Capacity of Congested Roadway Segments

Please refer to Mitigation Measure TRANS-1c in Alternative 4, Impact TRANS-1 in Chapter 19, *Transportation*, of the Draft EIR/EIS.

Impact TRANS-11: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments with Plans and Policies

Constructing the proposed water conveyance facilities and implementing environmental commitments could result in the potential for incompatibilities with plans and policies related to transportation and circulation. These inconsistencies may result from increases in traffic volumes in excess of regional forecasts, modification of transportation infrastructure, or disruption in regional circulation patterns. Since traffic volumes generated during construction of Alternative 5A would range between those generated under Alternative 5A and those described for Alternative 4, Alternative 5A would generally have the same potential for incompatibilities with one or more transportation plans and policies as described for Alternatives 5A and 4 (which are similar). See the discussion of Impact TRANS-11 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: As described for Alternative 4, the project would be constructed with regulations related to transportation and circulation enforced by local (including the local metropolitan planning organizations [MPOs]) and federal (including the FHWA [Federal Highway Administration] and FAA [Federal Aviation Administration]) agencies. The project would also be consistent with the Delta Protection Act of 1992 and Delta Plan (see the discussion of Impact TRANS-11 under Alternative 4 for additional information). Accordingly, there would be no adverse effect.

***CEQA Conclusion*:** The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts TRANS-1 and TRANS-10, above and no additional CEQA conclusion is required related to the compatibility of Alternative 5A with relevant plans and policies.

Impact TRANS-12: Potential Effects on Navigation from Changes in Surface Water Elevations Caused by Construction of Water Conveyance Facilities

The potential impacts to navigation caused by changes in surface water elevation during construction of the proposed intakes under Alternative 5A would be similar to those described for Alternative 4A. Although Alternative 5A includes two less intakes (Alternative 5A includes one intake compared to three for Alternative 4A), the effects to surface water elevation caused by construction of the proposed intakes is highly localized, and therefore, the number of intakes would not substantially change the analysis. Nevertheless, because Alternative 5A includes less intakes, the effects to surface elevations caused by intakes would likely be less than those described for alternative 4A.

Alternative 5A includes the construction of one fish-screened intake (Intake 2) on the bank of the Sacramento River near Clarksburg. Construction for Intake 2 would be accomplished using coffer dams at each location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Intakes and screens have been designed and located on-bank to minimize changes to river flow characteristics. Nevertheless, some localized water elevation changes will occur upstream and adjacent to each coffer dam at these intake sites due to facility location within the river. These localized surface elevation changes will not exceed an increase of 0.10 feet at any intake location even at high river flows (when surface elevation changes would be expected to be highest). This represents the highest surface upstream elevation increase after coffer dam removal and during intake operation. Because this maximum increase in elevation is entirely localized, downstream surface elevation changes during intake construction would be insignificant and changes to river depth and width at any location will be insignificant. As a result, boat passage and river use, including Sacramento River tributaries, will not be affected.

As explained in Chapter 6, *Surface Water*, construction of facilities within or adjacent to waterways could change surface water elevations or runoff characteristics. Alternative 5A would result in alterations to drainage patterns, stream courses, and runoff, and potential for slightly increased surface water elevations in the rivers and streams during construction and operations of facilities located within the waterway, similar in type but to a lesser extent than described for Alternative 1A. Construction and operations under Alternative 5A would not result in a substantial decrease in surface water elevations on any navigable waterways and therefore would not have an adverse effect on navigation. Although the increase in surface water elevations in rivers and streams under Alternative 5A creates a potential impact regarding flooding (which is considered less-than-significant with implementation of Mitigation Measure SW-4) the changes in surface water elevation would not have any adverse effects on navigation. See Chapter 6, *Surface Water*, for additional information regarding changes to surface water under Alternative 5A.

NEPA Effects: Water surface changes and potential impacts associated with intake construction are not considered adverse to navigation. Water depth and surface elevations will not be substantially effected during construction and operation of the water conveyance facilities (either localized or downstream of the intake structures). Although some construction activities and in-water features (i.e., cofferdams) may cause minor changes in surface water elevations, these effects are highly localized and surface water elevations would not increase by more than .10 feet at any location, even during flood events. These changes would not result in a substantial decrease in surface water elevations on any navigable waterways. Therefore, surface water changes associated with construction and operation of the water conveyance facilities would not cause an adverse impact to navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during construction of the intake will not have a significant impact on navigation.

Impact TRANS-13: Potential Effects of Navigation from Changes in Surface Elevations Caused by Operation of Intakes

The potential impacts to navigation caused by changes in surface water elevation during operation of the proposed intakes under Alternative 5A would be similar in type to those described for Alternative 4A; however, the effect will likely be much less under Alternative 5A because Alternative 5A includes one intake (two less than Alternative 4A) and because Alternative 5A has a 3,000 cfs total conveyance capacity (compared to 9,000 cfs for Alternative 4A). In any event, the hydraulic modeling scenario and analysis for changes in surface water elevations included five intakes because that is the maximum number of intakes included under any alternative. The modeling also assumed the highest North Delta diversion capacity allowed under any alternative (15,000 cfs). Again, because Alternative 5A includes only one intake, and only 3,000 cfs capacity, the impact would be much less than described for Alternative 4A.

With respect to Alternative 5A, operation of Intake 2 may have localized effects on water surface elevation during certain operational regimes and at various river flows. While intake operations and pumping levels are dictated by many factors, Sacramento River diversions are limited during low flows by operational rules. The nature and extent of impacts caused by diversions at an intake are dependent in large part on the location of the intake on the river. To minimize the intake effects on river surface elevations, intakes were designed as on-bank structures and were placed so that river flood and flow characteristic will be minimally altered. Based on hydrologic modelling, even at the lowest river flows (taking into account both seasonal and tidal variations) and at maximum intake operation (full diversions at each of five alternative intakes), estimates are that boat draft depths of at least 16.5 feet will be maintained within the Sacramento River. (*Planning and Design of Navigation Locks* United States Army Corps of Engineers, EM 1110-2-2602 (September 30, 1995) pages 3-8.)

This river depth has occurred historically and has been adequate to support navigation along the Sacramento River. Additionally, under these same intake divisions/river flows, water surface elevations would be lowered by no more than 0.7 feet, which represents a localized and maximum estimate. Surface elevations downstream of the intakes would be affected less, and during higher river flow and lower intake diversions, river depths would be greater than the minimum estimate.

The minimal changes in surface water elevation anticipated under Alternative 5A, even assuming a maximum lowering of 0.7 feet, would not likely expose any currently unexposed natural or man-made features that would affect or impede navigation and there would be no new snags or obstructions that would impede navigation.

Moreover, even when operating at maximum capacity, the intakes would not alter flows in a way that would affect commercial vessels or recreational watercraft. The intakes are designed to ensure pumping velocities will have minimal impacts to aquatic species. It is unlikely that changes in flow velocity would be perceptible to operators of marine vessels or recreational watercraft and would have no effect on navigation.

Additional information regarding changes to surface water elevations can be found in Chapter 6, *Surface Water*.

NEPA Effects: Water surface changes and potential impacts associated with intake operation are not considered adverse. Water depth and surface elevations will not be significantly effected (either localized or downstream of the intake structures) and will therefore not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in surface water elevation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in surface water elevation during operation of the intakes will not have a significant impact on navigation.

Impact TRANS-14: Potential Effects on Navigation Caused by Sedimentation from Construction of Intakes

The potential impacts to navigation caused by sedimentation under Alternative 5A would be similar in type to those described for Alternative 4A; however, the impacts would be less under Alternative 5A because Alternative 5A includes two less intake (Alternative 5A includes one intake compared to three for Alternative 4A). In any event, the effects to sedimentation caused by construction of the proposed intakes is highly localized, and therefore, the lower number of intakes does not substantially change the analysis.

Construction for Intake 2 would be accomplished using coffer dams at each intake location. Coffer dams will isolate each construction area from the Sacramento River and will be used to de-water the construction area. Construction of coffer dams would require sheet pile driving that would result in incremental suspension of bed sediments. These effects would be temporary and would not have an effect on navigation. Sheet piles at the edge of the levee embankment would likely change eddy currents locally, but rock slope in the transition zone would limit those currents and potential changes to bed load dynamics. As a result, erosion and sedimentation into the Sacramento River during intake construction would be minimal.

Moreover, potential sedimentation effects will be further minimized by limiting the duration of in-water construction activities and through implementing the environmental commitments described in Appendix 3B, *Environmental Commitments,* including the commitment to *Develop and Implement Erosion and Sediment Control Plans* to control short-term and long-term erosion and sedimentation effects and to restore soils and vegetation in areas affected by construction activities following construction. This commitment is related to Avoidance and Minimization Measure (AMM) 4, *Erosion and Sediment Control Plan*, described in BDCP Appendix 3.C. It is anticipated that multiple erosion and sediment control plans will be prepared for construction activities, each taking into account site-specific conditions such as proximity to surface water, erosion potential, drainage, etc. The plans will include all the necessary state requirements regarding erosion control and will implement BMPs for erosion and sediment control that will be in place for the duration of construction activities.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Construction of coffer dams and intake construction would not have an adverse effect on navigation through increased sedimentation and erosion/deposition in the navigable channel.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during construction of the intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-15: Potential Effects on Navigation Caused by Sedimentation from Construction of Barge Facilities

The potential impacts to navigation caused by sedimentation under Alternative 5A would be similar in type to those described for Alternative 4A; however, because Alternative 5A includes a lower number of barge fleeting facilities, the effects to sedimentation caused by construction of the facilities would be much less under Alternative 5A.

Because it includes fewer intakes, Alternative 5A would involve fewer temporary barge fleeting facilities than Alternative 4A. The temporary barge landings would be constructed at locations adjacent to construction work areas for the delivery of construction materials. Each of the barge landings would likely include in-water and over-water structures, such as piling dolphins, docks, ramps, and possibly conveyors for loading and unloading materials; and vehicles and other machinery. Construction of the landings would involve piles at each landing.

To address potential erosion and sedimentation impacts from barge facility construction associated with Alternative 5A, the project proponents will ensure that a Barge Operations Plan is developed and implemented for facility construction. The requirements for the Barge Operations Plan are described in Draft EIR/EIS Appendix 3B, *Environmental Commitments*. This commitment is related to AMM7, *Barge Operations Plan*, described in BDCP Appendix 3.C. This plan will be developed and submitted by the construction contractors per standard DWR contract specifications. Erosion control measures during construction activities at project locations are provided in Appendix 3B, *Environmental Commitments*, as noted above in the discussion of the intakes. Fleeting facilities will be either docking facilities built through pile and wharves or loaded and unloaded using landward positioned cranes. In either case, through AMM7 and the Environmental Commitments, impacts to sedimentation through construction related activities will be localized and minimal.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

***NEPA Effects*:** Construction and operation of the barge facilities under Alternative 5A would not have an adverse effect on navigation.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation from the temporary barge facilities will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-16: Potential Effects on Navigation Caused by Sedimentation from Construction of Clifton Court Forebay

The potential impacts to navigation from sedimentation at Clifton Court Forebay under Alternative 5A would be identical to those described for Alternative 4A. Clifton Court Forebay would be dredged and redesigned to provide an area where water flowing from the new north Delta facilities will be isolated from water diverted from south Delta channels. While Clifton Court Forebay is a "navigable water," use of the forebay is limited to maintenance operations and is not open to commercial or recreational navigation.

NEPA Effects: No effect.

CEQA Conclusion: No impact.

Impact TRANS-17: Potential Effects on Navigation Caused by Sedimentation from Operation of Intakes

The potential impacts to navigation caused by sedimentation under Alternative 5A would be similar in type to those described for Alternative 4A; however, the impacts under Alternative 5A would be less because Alternative 5A includes two less intake (Alternative 5A includes one intake compared to three for Alternative 4A). In any event, the effects to sedimentation during operation of the proposed intakes under Alternative 5A would be similar to those described for alternative 4A for the reasons described below.

Sediment loads are present in the Sacramento River as bed loads or distributed within the water column. The Sacramento River is sediment "starved" for most of the year since upstream reservoirs act as settling basins for suspended sediments. In most cases, sediment load is concentrated on the river bed and this bed load depends on several factors including particle size, particle density and flow velocity. To exclude bed loads from entering intake structures during operation, design criteria for the intakes require that the lowest point of the screen is placed above the river bed in such a way that there is no change in bed sediment erosion/distribution patterns. Additionally, screen locations for this alternative are placed on the outer bends of the river to minimize scour, erosion and sediment loading at those locations. Flow control baffles at intakes would be adjusted to control sedimentation near the screens as needed and air jets at screens are proposed to re-suspend sediments as needed.

Implementation of Mitigation Measure SW-4 (Implement Measures to Reduce Runoff and Sedimentation) will further ensure that impacts from sedimentation are minimal.

NEPA Effects: Operational criteria and design specifications for intake operations will result in no change to water column or bed load sediment dynamics. Erosion and deposition patterns will change little if any during intake operation. As a result, there will be no adverse effect on navigation either near or downstream of the intake locations.

CEQA Conclusion: Because it does not involve a physical change in the environment, effects to navigation caused by changes in sedimentation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, changes in sedimentation during operation of the proposed intakes will not have a significant impact on navigation.

Mitigation Measure SW-4: Implement Measures to Reduce Runoff and Sedimentation

Please refer to Mitigation Measure SW-4 in Alternative 1A, Impact SW-4.

Impact TRANS-18: Potential Effects on Navigation from Construction and Operations of Head of Old River Barrier

Operable barriers would not be constructed under Alternative 5A. An operable barrier at the head of Old River would be constructed to support operations of Alternatives 2A, 2B, 2C, 2D, 4 and 4A only.

NEPA Effects: No affect.

CEQA Conclusion: No Impact.

Impact TRANS-19: Potential Cumulative Effects on Navigation from Construction and Operations of Water Conveyance Facilities

As explained above and with respect to the construction and operation of these facilities, Alternative 5A would not result in an adverse effects to navigation due to water level elevation changes or altered sedimentation patterns. It is highly unlikely that other projects would combine with these impacts of the project to result in cumulative effects on navigation. This is because the minimal effects of these elements of the project on navigation are localized and would combine only with probable future projects if the projects were located immediately adjacent to the project components. There are no other reasonably foreseeable projects proposed to be located near or adjacent to the planned Alternative 5A facilities.

NEPA Effects: Alternative 5A in combination with other reasonably foreseeable projects would not have a cumulatively adverse effect on navigation.

CEQA Conclusion**:** Because it does not involve a physical change in the environment, effects to navigation, by themselves, are not considered environmental impacts under CEQA. Any secondary physical environmental impacts that may result are covered under other impacts. Nonetheless, as explained above, Alternative 5A in combination with other reasonably foreseeable projects would not have a cumulatively significant impact on navigation.

4.5.16 Public Services and Utilities

Impact UT-1: Increased Demand on Law Enforcement, Fire Protection, and Emergency Response Services from New Workers in the Project Area as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the provision of law enforcement, fire protection, and emergency response services as a result of construction of the proposed water conveyance facilities would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS, but slightly less due to the fact that Alternative 5A involves two fewer intakes. Increased service demands would be experienced in the communities in which new construction workers relocate and in the areas in which construction would take place. However, it is anticipated that many construction jobs would be filled from the existing labor force in the five-county project area region. Additionally, effects on services from the presence of new workers in the project area would be anticipated to be somewhat less than under Alternative 4 because one intake facility would be constructed rather than three. The minor increase in construction workers relocating into the project area for specialized jobs (e.g., tunnel construction) during the construction period of approximately 13.5 years would be spread across a large multi-county area. Increases in demand for law enforcement, fire protection and medical services related to this small change in population in any one county are expected to be negligible.

Similarly, the scale and duration of construction required for Alternative 5A could result in increased demand on law enforcement services, especially near major construction sites. Incorporation of an environmental commitment that would provide 24-hour onsite private security at construction sites (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS) would ensure there would be no adverse effect on local law enforcement agencies associated with construction property protection. Incorporation of environmental commitments that would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires would reduce adverse effects related to the potential demand for law enforcement, fire protection, or emergency services (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

Construction of Alternative 5A would not increase the demand on law enforcement, fire protection, and emergency response services from new workers in the project area such that it would result in the need for, new or physically altered governmental facilities. Impacts to emergency response times from construction traffic using emergency routes are discussed in Chapter 19 Impact TRANS-3. Accordingly, there would be no adverse effect.

CEQA Conclusion: The potential for impacts on law enforcement and fire services and facilities is not expected to be significant because the estimated increase in population in the project area associated with construction of the alternative during peak construction would be distributed over multiple cities and counties within the project area. In addition, environmental commitments would be incorporated into the alternative to reduce effects related to demand for law enforcement, fire protection, and emergency response services at or near construction sites from new construction workers in the project area, and effects on local law enforcement agencies associated with construction property protection. Construction of Alternative 5A would not require new or physically altered governmental facilities to support the needs of new workers in the project area. These impacts would be considered less than significant. No mitigation is required.

Impact UT-2: Displacement of Public Service Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Under Alternative 5A, a proposed 28-foot interior diameter single-bore tunnel would be constructed more than 100 feet below the surface of Hood. It would connect north of Hood to pipelines running from Intake 2, south of Hood to the intermediate forebay. There are no public facilities in the proposed tunnel location. Construction of the tunnel is not anticipated to disturb the surface and would not conflict with any public facilities, nor would it require the construction or major alteration of such facilities. This effect would not be adverse.

***CEQA Conclusion*:** Construction of the proposed water conveyance facilities under Alternative 5A would not require the construction or major alteration of such facilities. Therefore, this impact would be less than significant. No mitigation is required.

Impact UT-3: Effects on Public Schools as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects on public schools as a result of construction of the proposed water conveyance facilities would be similar to those described for Alternative 4. However, the construction worker population increase and associated school-age children who would enroll in public schools would be less because Alternative 5A would only require construction of one intake facility instead of three. The minor increase in school-age children of construction personnel moving into the area for specialized jobs (e.g., tunnel construction) would likely be distributed through a number of schools within the project area. This increase would not be substantial enough to exceed the capacity of any identified district, or to warrant construction of a new facility. There would not be an adverse effect.

CEQA Conclusion: The majority of construction jobs are expected to be filled by workers from the five-county labor force. The incremental increase in school-age children of construction personnel moving into the area for specialized construction jobs (e.g., tunnel construction) would likely be distributed through a number of schools within the project area. This increase in school enrollment would not be substantial enough to exceed the capacity of any individual district, or to warrant construction of a new facility within the project area. The impact on public schools is less than significant. No mitigation is required.[2]

Impact UT-4: Effects on Water or Wastewater Treatment Services and Facilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Effects related to the need for expanded water or wastewater treatment facilities would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Under this alternative, however, concrete batch plants would require a smaller quantity of water for concrete production because only one intake facility (and the associated conveyance pipelines and other structures) would be constructed. Considered across the alternative, potable water supply needs are substantial in volume; however, these requirements would need to be met over a construction period of approximately 13.5 years, and would be anticipated to be met with non-municipal water sources without any need for new water supply entitlements. If there are no existing water lines in

[2] Under California law, the rules governing what constitutes adequate mitigation for impacts on school facilities is governed by legislation. Pursuant to the operative statutes, impacts on schools, with some exceptions, are sufficiently mitigated, as a matter of law, by the payment of school impact fees by residential developers. (See Cal. Gov. Code, §§ 65995[h], 65996[a].)

the vicinity, then field offices will require construction of a water tank. Water for construction will be provided by available sources to the extent possible; if needed, water may be brought to the construction sites in water trucks. Also similar to Alternative 4, wastewater created as a result of tunnel boring and concrete batching would be provided by temporary facilities and treated onsite. Construction of Alternative 5A would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. As discussed under Alternative 4, as part of the Environmental Commitments (Appendix 3B) for each alternative, DWR will be required to conduct project construction activities in compliance with the State Water Board's *NPDES Stormwater General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities* (Order No. 2009-0009-DWQ/NPDES Permit No. CAS000002). This General Construction NPDES Permit requires the development and implementation of a SWPPP that outlines the temporary construction-related BMPs to prevent and minimize erosion, sedimentation, and discharge of other construction-related contaminants, as well as permanent post-construction BMPs to minimize adverse long-term stormwater related–runoff water quality effects. This effect would not be adverse.

CEQA Conclusion: While construction of this alternative would require a substantial supply of water, this supply could be met by non-municipal sources such as non-municipal water wells or water trucks. Additional needs for wastewater treatment and potable water could also be served by non-municipal entities. Construction of Alternative 5A would not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities. This impact would be less than significant. Mitigation is not required.

Impact UT-5: Effects on Landfills as a Result of Solid Waste Disposal Needs during Construction of the Proposed Water Conveyance Facilities

NEPA Effects: Potential effects associated with an increased demand for solid waste management providers in the project area and surrounding communities as a result of waste generated from construction of the proposed water conveyance facilities would be similar to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, there would be less solid waste generated as a result of construction because Alternative 5A would only require construction of one intake facility. Overall, the construction waste that could be generated by implementing Alternative 5A would not result in an adverse effect on the capacity of available landfills because 50% or more of construction waste generated by this alternative would be diverted (in accordance with diversion requirements set forth by the State Agency Model Integrated Waste Management Act (IWMA) and BMP 13 [Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS]), and the construction debris and excavated material that would require disposal at a landfill could be accommodated by, and would have a negligible effect, on the remaining permitted capacity of Project area landfills. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. This effect would not be adverse.

CEQA Conclusion: Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it would be expected that construction of the proposed water conveyance facilities would not cause any exceedance of landfill capacity. RTM resulting from construction of tunnel segments would be treated in designated RTM work areas. Debris from structure demolition, power poles, utility lines, piping, and other materials would be diverted from landfills to the maximum extent feasible at the time of demolition. This alternative is not expected to affect the lifespan of area landfills, because over 70% of the remaining permitted capacity is associated with landfills with expected lifespans of between 18 and 70 years—well beyond the expected timeframe for construction of project facilities, when solid waste disposal services would be needed. Further, implementation of BMP 13 (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS) would require development of a project-specific construction debris recycling and diversion program to achieve a documented 50% diversion of construction waste. Construction of Alternative 5A would not create solid waste in excess of the permitted capacity of area landfills, nor would it adversely affect the expected lifespan of these solid waste management facilities. Therefore, there would be a less-than-significant impact on solid waste management facilities.

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

NEPA Effects: Disruption of utility services or relocation of existing facilities would be similar to that described under Alternative 4 in Appendix A of this RDEIR/SDEIS. While construction of two fewer intakes associated with Alternative 5A may interfere with less additional utilities, the rest of the alignment past the intakes would have the same amount of interferences as Alternative 4: 12 overhead power/electrical transmission lines (Figure 24-6 in the Draft EIR/EIS), 6 natural gas pipelines (Table 20-5 and Figure 24-3 in the Draft EIR/EIS), 11 inactive oil or gas wells (Figure 24-5 in the Draft EIR/EIS), the Mokelumne Aqueduct, and 43 miles of agricultural delivery canals and drainage ditches, including approximately 13 miles on Byron Tract, and 7 miles on Bouldin Island. Additionally, active gas wells may need to be plugged and abandoned. Relocation of additional facilities near proposed forebays, RTM, and borrow or spoils areas could also be necessary. The potential damage and disruption to buried and overhead electric transmission lines would be similar for telecommunication infrastructure. Because relocation and disruption of existing utility infrastructure would be required under this alternative and would have the potential to create environmental effects, this effect would be adverse.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce the severity of this effect. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the effect would not be adverse.

CEQA Conclusion: Under this alternative, most features would avoid disrupting existing facilities by crossing over or under infrastructure. However, construction of facilities would conflict with existing utility facilities in some locations. Regional power transmission lines and one natural gas pipeline would require relocation. Because the relocation and potential disruption of utility infrastructure would be required, this impact would be significant.

Mitigation Measures UT-6a, UT-6b, and UT-6c are available to reduce these impacts through measures that could avoid disruption of utility infrastructure. If coordination with all appropriate utility providers and local agencies to integrate with other construction projects and minimize disturbance to communities were successful under Mitigation Measure UT-6b, the impact would be less-than-significant. However, because coordination with a third party is required in order to carry out this mitigation, a conservative assessment of significant and unavoidable is being made.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS.

Impact UT-7: Effects on Public Services and Utilities as a Result of Operation and Maintenance of the Proposed Water Conveyance Facilities

NEPA Effects: The proposed water conveyance facilities under this alternative would be operated to provide diversions up to a total of 3,000 cfs from one new north Delta intake, rather than 9,000 cfs from three intakes under Alternative 4. However, potential effects associated with operation and maintenance of water conveyance facilities would be similar to those described under Alternative 4.

Operation and maintenance activities would require minimal labor. Impacts under Alternative 5A would be similar to those discussed under Alternative 4 in Appendix A of this RDEIR/SDEIS. Fewer additional workers would be needed given the need to operate the two fewer intakes. Given the limited number of workers involved and the large number of work sites, it is not anticipated that routine operations and maintenance activities or major inspections would result in substantial demand for law enforcement, fire protection, or emergency response services. In addition, operation and maintenance would not place service demand on public schools or libraries. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new or physically altered government facilities as a result of increased need for public services.

Potential effects associated with operation and maintenance of water conveyance facilities would be similar to those described under Alternative 4. Therefore, Alternative 5A would not result in physical effects associated with the provision of new or physically altered government facilities.

Operation and maintenance of Alternative 5A facilities would involve use of water for pressure washing intake screen panels and basic cleaning of building facilities and other equipment. Impacts would be similar to those under Alternative 4, but slightly less due to two fewer intakes. The operation and maintenance of the proposed water conveyance facilities would not result in the need for new water supply entitlements, or require construction of new water or wastewater treatment facilities or expansion of existing facilities.

Similar to Alternative 4, the operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to generate solid waste such that there would be an increase in demand for solid waste management providers in the project area and surrounding communities. Therefore, there would be no or minimal effect on solid waste management facilities.

As with Alternative 4, operation and maintenance of proposed water conveyance facilities under this alternative would require new transmission lines for intakes, pumping plants, operable barriers, boat locks, and gate control structures throughout the various proposed conveyance alignments and construction of project facilities. Points of interconnection would be located similarly to Alternative 4.

Construction of permanent transmission lines would not require improvements to the existing physical power transmission system. As such, operation and maintenance activities associated with the proposed water conveyance facilities would not be expected to result in the disruption or relocation of utilities. Effects associated with energy demands of operation and maintenance of the proposed water conveyance facilities are addressed in Chapter 21, *Energy*, of the Draft EIR/EIS.

Overall, operation and maintenance of the conveyance facilities under Alternative 5A would not result in adverse effects on service demands, water supply and treatment capacity, wastewater and solid waste facilities nor conflict with local and regional utility lines. There would not be an adverse effect.

CEQA Conclusion: Operation and maintenance activities associated with the Alternative 5A proposed water conveyance facilities would not result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities. The impact on public services and utilities would be less than significant. No mitigation is required.

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 6–12, 15, and 16

NEPA Effects: Effects of Alternative 5A related to the potential for effects on public services and utilities from implementing applicable conservation and other stressor reductions would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described in Section 4.1, *Introduction*, Alternative 5A would protect and restore up to 14,908 acres of habitat under Environmental Commitment 3, 4, and 7-10, as compared with 83,800 acres under Alternative 4. Up to 3.1 miles of channel margin habitat would be enhanced under Alternative 5A with Environmental Commitment 6 (compared with 20 miles under Alternative 4). Similarly, Environmental Commitments 11, 12, 15, and 16 would be implemented only at limited locations. Conservation Measures 2, 5, 8, 13, 14, and 17–21 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 5A would likely be substantially smaller than those associated with Alternative 4.

Public Services

Potential effects of implementing conservation and other stressor reductions under Alternative 5A on law enforcement, fire protection, and emergency response services would primarily involve demand for services related to construction site security and construction-related accidents. The effect would be similar to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS, but because the habitat restoration and enhancement activities under Alternative 5A would be of a smaller magnitude than the Conservation Measures under Alternative 4, it is likely that the effects on public services would be less than those presented for Alternative 4. This effect would not be considered adverse with the implementation of environmental commitments to provide onsite private security services at construction areas and environmental commitments that would minimize the potential for construction-related accidents associated with hazardous materials spills, contamination, or fires, as described in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS. These environmental commitments would be incorporated into this alternative and would provide for onsite security at construction sites and minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities.

Utilities

Water and Wastewater

Implementation of some of the Environmental Commitments, in particular those involved with restoration and enhancement of some habitat types, could require a water supply, but would not require city or county treated water sources. Effects would be similar to, but less in magnitude than those discussed under Alternative 4 in Appendix A of this RDEIR/SDEIS, because Alternative 5A involves smaller acreage amounts of restoration and conservation. Additionally, some components that would require water supply under Alternative 4 are not a part of Alternative 5A (CM5, CM8 of the Draft BDCP). Environmental Commitments that could increase need for water supply are restoration of natural tidal communities (Environmental Commitment 4), channel margin (Environmental Commitment 6), riparian (Environmental Commitment 7), vernal pool and alkali seasonal wetland complex (Environmental Commitment 9), and nontidal marsh habitats (Environmental Commitment 10); and maintenance of these habitats. Measures related to the reduction of stressors on covered species that are a part of Alternative 5A would not generally require a treated water supply or generate wastewater. Because the location and construction or operational details (i.e., water consumption and water sources associated with habitat restoration and enhancement activities of these facilities and programs have not yet been developed, the need for new or expanded water or wastewater treatment facilities is uncertain. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely.

Solid Waste

Implementation of some of the habitat restoration and enhancement activities would result in construction debris and green waste. Implementation of habitat restoration and enhancement proposed under Environmental Commitments 4, 6, 7, and 9–11 would involve restoration, enhancement, and management of various types of habitat. Construction activities could require clearing and grubbing, demolition of existing structures (e.g., roads and utilities), surface water quality protection, dust control, establishment of storage and stockpile areas, temporary utilities and fuel storage, and erosion control. Effects would be similar to, but less in magnitude than those described under Alternative 4 in Appendix A of this RDEIR/SDEIS, because Alternative 5A involves smaller acreage amounts of restoration and conservation. The estimated tonnage of construction debris and solid waste that would be generated from construction associated with the proposed habitat restoration and enhancement activities is unknown. However, there is a remaining landfill capacity of over 300 million tons in nearby landfills (Table 20A-6 in Appendix 20A of the Draft EIR/EIS). The disposal of construction debris and excavated material would occur at several different locations depending on the type of material and its origin. Based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California, it is expected that construction and operation of the proposed habitat restoration and enhancement activities would not cause any exceedance of landfill capacity.

Electricity and Natural Gas

Habitat restoration and enhancement activities including habitat restoration and enhancement would, in some cases, involve substantial earthwork and ground disturbance. As discussed above under Impact UT-6, construction could potentially disrupt utility services, and ground disturbance has potential to damage underground utilities. The long-term conversion of existing utility corridors to habitat purposes could require the relocation of utility infrastructure, which could carry environmental effects. Mitigation Measures UT-6a, UT-6b, and UT-6c would be available to reduce the severity of these effects.

Effects would be similar to, but less in magnitude than that under Alternative 4, because Alternative 5A involves smaller acreage amounts of restoration and conservation. The locations, construction, and operational details for these and other habitat restoration and enhancement activities have not been identified. Adverse effects due to the construction, operation and maintenance activities associated with the habitat restoration and enhancement activities are not expected to result in the need for new government facilities to provide public services or the need for new or expanded water or wastewater treatment facilities based on increased demand. Environmental commitments would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities. However, there is a potential for the disruption or relocation of utility infrastructure, which has the potential to result in an adverse effect. Further, no substantive adverse effects on solid waste management facilities are anticipated. Because the location and construction and operational details (i.e., water consumption and water sources associated with habitat restoration and enhancement activities) related to these facilities and programs have not yet been developed, the need for new or expanded water or wastewater treatment facilities is uncertain. This effect would be adverse. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely.

CEQA Conclusion: Significant impacts could occur if implementation of the proposed habitat restoration and enhancement activities would result in the need for the provision of, or the need for, new or physically altered government facilities from the increased need for public services; construction of new water and wastewater treatment facilities or generate a need for new water supply entitlements; generate solid waste in excess of permitted landfill capacity; or result in the disruption or relocation of utilities.

Implementation of the proposed Environmental Commitments under Alternative 5A is not likely to require alteration or construction of new government facilities due to increased need for public services and utilities. Several measures to reduce stressors on covered species could result in water supply requirements, but are not expected to require substantial increases in demand on municipal water and wastewater treatment services.

Construction and operation activities associated with the proposed Environmental Commitments would result in a less-than-significant impact on solid waste management facilities based on the capacity of the landfills in the region, and the waste diversion requirements set forth by the State of California.

Potential impacts of implementing habitat restoration and enhancement activities on law enforcement, fire protection, and emergency response services within the ROAs would be less-than-significant with the incorporation of environmental commitments into this alternative and would minimize construction-related accidents associated with hazardous materials spills, contamination, and fires that may result from construction of the habitat restoration and enhancement activities (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

The need for new or expanded water or wastewater treatment facilities and the potential to disrupt utilities in the study area as a result of construction of operation of conservation and other stressor reductions is unknown at this time because locations have not been determined, nor have construction and operational details been settled upon. However, because the habitat restoration and enhancement activities consist of restoration consistent with open space, the need for new or expanded wastewater treatment facilities is unlikely. Mitigation Measures UT-6a, UT-6b, and UT-6c would reduce the significance of impacts on utilities, but potentially not to a less-than-significant level. Therefore, this impact would significant and unavoidable.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6b: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Operational Reliability

Please see Mitigation Measure UT-6b under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, in Appendix A of this RDEIR/SDEIS.

4.5.17 Energy

Impact ENG-1: Wasteful or Inefficient Energy Use for Temporary Construction Activities

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5 as described in the Draft EIR/EIS. Construction energy use required for Alternative 5A would therefore be slightly less than Alternative 4, described in Appendix A of this RDEIR/SDEIS, but the potential to result in a wasteful or inefficient energy use would be the same as Alternative 4. Accordingly, the effects from construction energy use under Alternative 5A would be similar to Alternative 4. See the discussion of Impact ENG-1 under Alternative 4.

NEPA Effects: Based on the total construction energy use for Alternative 4 (2,132 GWh) and the estimated demand required to construct two intakes (16 GWh), Alternative 5A would require about 2,116 GWh of electricity over the 14-year construction period. Diesel and gasoline consumption by Alternative 5A would be less than Alternative 4 due to the reduced number of intakes, and would likely range between that of Alternatives 4 and 5. Accordingly, the alternative may consume between 87 and 104 million gallons over the construction period.

The potential for Alternative 5A to result in a wasteful, inefficient or unnecessary consumption of construction energy would be similar to Alternative 4. Construction best management practices (BMPs) would ensure that only high-efficiency equipment is utilized during construction and that construction activity would not result in an adverse effect on energy resources.

***CEQA Conclusion*:** Energy requirements for construction of the water conveyance facilities associated with Alternative 5A would equate to approximately 2,116 GWh during the construction period. Alternative 5A would also consume between 87 and 104 million gallons of diesel and gasoline. Construction BMPs would ensure that only high-efficiency equipment is utilized during construction and that construction activity would result in a less-than-significant impact on energy resources. No mitigation is required.

Impact ENG-2: Wasteful or Inefficient Energy Use for Pumping and Conveyance

Alternative 5A would have the same operations as Alternative 5. Accordingly, the effects from operational energy use under Alternative 5A would be similar to Alternative 5. See the discussion of Impact ENG-2 under Alternative 5 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: As shown in Table 21-12 in Appendix A of this RDEIR/SDEIS, energy use for north Delta intake pumping and tunnel conveyance would range be 84 GWh per year under ELT conditions and 78 GWh per year under LLT conditions. Accordingly, increased energy use at the north Delta would be slightly less under Alternative 5A than estimated for Alternative 4. While Alternative 5A would still increase energy demand at the north Delta, relative to the No Action Alternative, operation of the water conveyance facility would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 5A would not result in a wasteful or inefficient energy use and there would be no adverse effect.

***CEQA Conclusion*:** Operation of Alternative 5A would require an additional 84 GWh per year under ELT conditions and 78 GWh per year under LLT conditions for north Delta pumping, relative to

Existing Conditions. Operation of the water conveyance facility under both scenarios would be managed to maximize efficient energy use, including off-peak pumping and use of gravity. Accordingly, implementation of Alternative 5A would not result in a wasteful or inefficient energy use and this impact would be less than significant. No mitigation is required.

Impact ENG-3: Compatibility of the Proposed Water Conveyance Facilities and Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16 with Plans and Policies

Constructing the water conveyance facilities and implementing the environmental commitments under Alternative 5A would generally have the same potential for incompatibilities with one or more plans and policies related to energy resources as described for Alternative 4. See the discussion of Impact ENG-3 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: As described for Alternative 4, the project would be constructed and operated in compliance with regulations related to energy resources enforced by Federal Energy Regulatory Commission (FERC) and other federal agencies. The project would not conflict with the Warren-Alquist Act or State CEQA Guidelines, Appendix F, *Energy Conservation.* Accordingly, there would be no adverse effect.

***CEQA Conclusion*:** The potential incompatibilities with plans and policies listed above indicate the potential for a physical consequence to the environment. The physical effects they suggest are discussed in impacts ENG-1 and ENG-2, above and no additional CEQA conclusion is required related to the compatibility of Alternative 5A with relevant plans and policies.

4.5.18 Air Quality and Greenhouse Gases

Impact AQ-1: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, intake construction emissions generated by Alternative 5 in the Sacramento Metropolitan Air Quality Management District (SMAQMD) would be less than Alternative 4 due to the reduced number of intakes, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-1 under Alternatives 4 and 5.

NEPA Effects: As shown in Tables 22-99 and 22-117 in Appendix A of this RDEIR/SDEIS, nitrogen oxide (NO_X) emissions generated by Alternatives 4 and 5 would exceed SMAQMD's daily threshold for all years between 2018 and 2029, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS). Since NO_X is a precursor to ozone and particulate matter (PM), violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the national ambient air quality standards (NAAQS) and California ambient air quality standards (CAAQS). Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** NO_X emissions generated during construction of Alternative 5A would exceed SMAQMD regional threshold of significance. Since NO_X is a precursor to ozone and PM, violations of SMAQMD's daily NO_X threshold could affect both regional ozone and PM formation. The impact of generating NO_X emissions in excess of local air district thresholds would violate applicable air quality standards in the study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-1a and AQ-1b would be available to reduce NO_X emissions to a less-than-significant level by offsetting emissions to quantities below SMAQMD CEQA thresholds.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants[3]

Please refer to Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[3] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-2: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. There would be no construction of physical features in the Yolo-Solano Air Quality Management District (YSAQMD). Accordingly, emissions generated in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions generated in YSAQMD would therefore be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-2 under Alternatives 4 and 5.

NEPA Effects: As shown in Tables 22-99 and 22-117 in Appendix A of this RDEIR/SDEIS, criteria pollutant emissions generated neither Alternative 4 or Alternative 5 would exceed YSAQMD regional thresholds. Accordingly, construction of Alternative 5A would not contribute to or worsen existing air quality conditions. There would be no adverse effect.

***CEQA Conclusion*:** Construction emission would not exceed YSAQMD's regional thresholds of significance. Accordingly, Alternative 5A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-3: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions from construction of physical features in the Bay Area Air Quality Management District (BAAQMD) would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD. Accordingly, total emissions generated in the BAAQMD would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-3 under Alternatives 4 and 5.

NEPA Effects: As shown in Tables 22-99 and 22-117 in Appendix A of this RDEIR/SDEIS, construction emissions generated by Alternatives 4 and 5 would exceed BAAQMD's daily thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

- Reactive organic gases (ROG): 2020–2028 (Alternative 4); 2023–2026 (Alternative 5)
- NO_X: 2018–2029 (Alternatives 4 and 5)

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could impact both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Mitigation Measures AQ-3a and AQ-3b are available to reduce ROG and NO_X emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** Emissions of ROG and NO_X generated during construction would exceed BAAQMD regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of BAAQMD's ROG and NO_X thresholds could affect both regional ozone and PM formation. The impact of generating ROG and NO_X emissions in excess of BAAQMD's regional thresholds would therefore violate applicable air quality standards in the Study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-3a and AQ-3b would be available to reduce ROG and NO_X emissions to a less-than-significant level by offsetting emissions to quantities below BAAQMD CEQA thresholds.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[4]

Please refer to Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-4: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds during Construction of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions from construction of physical features and equipment and material transport in the San Joaquin Valley Air Pollution Control District (SJVAPCD) would be similar to those generated by Alternative 4. See the discussion of Impact AQ-4 under Alternative 4.

NEPA Effects: As shown in Table 22-99 in Appendix A of this RDEIR/SDEIS, construction emissions would exceed SJVAPCD's regional thresholds for the following pollutants and years, even with implementation of environmental commitments (see Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS).

- ROG: 2020–2025
- NO_X: 2018–2028
- PM less than 10 microns in diameter (PM10): 2019–2025

[4] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could impact both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. Mitigation Measures AQ-4a and AQ-4b are available to reduce ROG, NO_X, and PM10 emissions, and would thus address regional effects related to secondary ozone and PM formation.

***CEQA Conclusion*:** Emissions of ROG, NO_X, and PM10 generated during construction would exceed SJVAPCD's regional thresholds of significance. Since ROG and NO_X are precursors to ozone and NO_X is a precursor to PM, violations of SJVAPCD's ROG and NO_X thresholds could affect both regional ozone and PM formation, which could worsen regional air quality and air basin attainment of the NAAQS and CAAQS. Similarly, exceedances of SJVAPCD's PM10 threshold could impede attainment of the NAAQS and CAAQS for PM10. The impact of generating ROG, NO_X, and PM10 emissions in excess of SJVAPCD's regional thresholds would therefore violate applicable air quality standards in the Study area and could contribute to or worsen an existing air quality conditions. This would be a significant impact. Mitigation Measures AQ-4a and AQ-4b would be available to reduce ROG, NO_X, and PM10 emissions to a less-than-significant level by offsetting emissions to quantities below SJVAPCD CEQA thresholds.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants[5]

Please refer to Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-5: Generation of Criteria Pollutants in Excess of the SMAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, operational emissions generated by Alternative 5A in the SMAQMD would be less than Alternative 4 due to the reduced number of intakes, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-5 under Alternatives 4 and 5.

NEPA Effects: As shown in Tables 22-100 and 22-118 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternatives 4 and 5 would not exceed SMAQMD's regional

[5] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

thresholds of significance. Accordingly, operation of Alternative 5A would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed SMAQMD regional thresholds of significance. Accordingly, Alternative 5A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-6: Generation of Criteria Pollutants in Excess of the YSAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

Operations and maintenance emissions generated by Alternative 5A in the YSAQMD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-6 under Alternative 4.

NEPA Effects: As discussed for Alternative 4, no permanent features would be constructed in the YSAQMD that would require routine operations and maintenance. Accordingly, no operational emissions would be generated in the YSAQMD and operation of Alternative 5A would neither exceed the YSAQMD regional thresholds of significance nor result in an adverse effect to air quality.

***CEQA Conclusion*:** No operational emissions would be generated in the YSAQMD. Consequently, operation of Alternative 5A would not exceed the YSAQMD regional thresholds of significance. This impact would be less than significant. No mitigation is required.

Impact AQ-7: Generation of Criteria Pollutants in Excess of the BAAQMD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the Clifton court forebay). Since the water conveyance footprint under Alternative 5A in BAAQMD would be similar to Alternative 4, operational activities required for Alternative 5A in the BAAQMD would be the same as those required for Alternative 4. See the discussion of Impact AQ-7 under Alternative 4.

NEPA Effects: As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternative 4 during ELT conditions would not exceed BAAQMD's regional thresholds of significance. Accordingly, operation of Alternative 5A would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed BAAQMD regional thresholds of significance. Accordingly, Alternative 5A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-8: Generation of Criteria Pollutants in Excess of the SJVAPCD Regional Thresholds from Operation and Maintenance of the Proposed Water Conveyance Facility

The number of equipment and personnel required for routine and annual inspections is influenced by the physical water conveyance footprint (i.e., size and location of the tunnel segments). Since the water conveyance footprint under Alternative 5A in SJVPACD would be similar to Alternative 4, operational activities required for Alternative 5A in the SJVPACD would be the same as those required for Alternative 4. See the discussion of Impact AQ-8 under Alternative 4.

NEPA Effects: As shown in Table 22-100 in Appendix A of this RDEIR/SDEIS, operational emissions generated by Alternative 4 during ELT conditions would not exceed SJVAPCD's regional thresholds of significance. Accordingly, operation of Alternative 5A would not contribute to or worsen existing air quality violations. There would be no adverse effect.

***CEQA Conclusion*:** Emissions generated during operation and maintenance activities would not exceed SJVAPCD regional thresholds of significance. Accordingly, Alternative 5A would not contribute to or worsen existing air quality conditions. This impact would be less than significant. No mitigation is required.

Impact AQ-9: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SMAQMD's Health-Based Concentration Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5A. Accordingly, construction emissions and associated health risks generated by Alternative 5A in SMAQMD would be less than Alternative 4 due to the reduced number of intakes, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-9 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-102 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would exceed the SMAQMD's 24-hour PM10 threshold at several receptor locations. Concentrations under Alternative 5 were not explicitly quantified, but may result in 24-hour PM10 exceedances in the vicinity of Intake 1 (based on modeling conducted for Alternative 1A). All exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce this effect.

***CEQA Conclusion*:** As shown in Table 22-102 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would exceed the SMAQMD's 24-hour PM10 threshold at several receptor locations. Concentrations under Alternative 5 were not explicitly quantified, but may result in 24-hour PM10 exceedances in the vicinity of Intake 1 (based on modeling conducted for Alternative 1A). All exceedances would be temporary and occur intermittently due to soil disturbance (primarily entrained road dust). Mitigation Measure AQ-9 is available to reduce impacts to less than significant.

Mitigation Measure AQ-9: Implement Measures to Reduce Re-Entrained Road Dust and Receptor Exposure to PM2.5 and PM10

Please see Mitigation Measure AQ-9 under Impact AQ-9 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-10: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of YSAQMD's Health-Based Concentration Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. There would be no construction of physical features in the YSAQMD. Accordingly, increased health risks in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions and associated health risks generated in YSAQMD would therefore be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-10 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than YSAQMD's adopted thresholds. Concentrations under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 5A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

CEQA Conclusion**:** As shown in Table 22-103 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than YSAQMD's adopted thresholds. Concentrations under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 5A would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-11: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of BAAQMD's Health-Based Concentration Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions and increased health risks from construction of physical features in the BAAQMD would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD. Accordingly, total emissions and associated health risks generated in the BAAQMD would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-11 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than BAAQMD's adopted thresholds. Concentrations under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 5A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

CEQA Conclusion**:** As shown in Table 22-104 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than BAAQMD's adopted thresholds. Concentrations under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 5A would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-12: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter in Excess of SJVAPCD's Health-Based Concentration Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions and associated health risks from construction of physical features and equipment and material transport in the SJVAPCD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-12 under Alternative 4.

NEPA Effects: As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 5A would not expose of sensitive receptors to adverse localized particulate matter concentrations.

***CEQA Conclusion*:** As shown in Table 22-105 in Appendix A of this RDEIR/SDEIS, predicted PM2.5 and PM10 concentrations under Alternative 4 are less than SJVAPCD's adopted thresholds. The project would also implement all air district recommended onsite fugitive dust controls, such as regular watering. Accordingly, Alternative 2D would not expose of sensitive receptors to significant localized particulate matter concentrations. This impact would be less than significant. No mitigation is required.

Impact AQ-13: Exposure of Sensitive Receptors to Health Threats from Localized Carbon Monoxide

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. The potential for exposure of sensitive receptors to increased health threats from localized carbon monoxide (CO) would therefore likely range between impacts described under Alternatives 4 and 5. See the discussion of Impact AQ-13 under Alternatives 4 and 5.

NEPA Effects: Given that 1) construction activities typically do not result in CO hot-spots, 2) onsite concentrations must comply with OSHA standards, and 3) CO levels dissipate as a function of distance, equipment-generated CO emissions are not anticipated to result in adverse health threats to sensitive receptors.

With respect to CO hot-spot formation along construction haul routes, as shown in Table 19-25 in Appendix A of this RDEIR/SDEIS, the highest peak hour traffic volumes under BPBGPP—8,088 vehicles per hour under Alternative 4—would occur on westbound Interstate 80 between Suisun Valley Road and State Route 12. This is about half of the congested traffic volume modeled by BAAQMD (24,000 vehicles per hour) that would be needed to contribute to a localized CO hot-spot, and less than half of the traffic volume modeled by SMAQMD (31,600 vehicles per hour). Accordingly, construction traffic is not anticipated to result in adverse health threats to sensitive receptors.

***CEQA Conclusion*:** Continuous engine exhaust may elevate localized CO concentrations. Receptors exposed to these CO "hot-spots" may have a greater likelihood of developing adverse health effects. Construction sites are less likely to result in localized CO hot-spots due to the nature of construction activities (Sacramento Metropolitan Air Quality Management District 2014), which normally utilize diesel-powered equipment for intermittent or short durations. Moreover, construction sites must comply with the OSHA CO exposure standards for onsite workers. Accordingly, given that construction activities typically do not result in CO hot-spots, onsite concentrations must comply with OSHA standards, and CO levels dissipate as a function of distance, equipment-generated CO emissions are not anticipated to result in significant health threats to sensitive receptors. Similarly, peak-hour construction traffic on local roadways would not exceed BAAQMD's or SMAQMD's conservative screening criteria for the formation potential CO hot-spots. This impact would be less than significant. No mitigation is required.

Impact AQ-14: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SMAQMD's Chronic Non-Cancer and Cancer Risk Assessment Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, construction emissions and associated health risks generated by Alternative 5A in SMAQMD would be less than Alternative 4 due to the reduced number of intakes, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-14 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-106 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SMAQMD's chronic non-cancer or cancer thresholds. Health threats under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4 and are not expected to exceed SMAQMD's chronic non-cancer or cancer thresholds. Therefore, construction of Alternative 5A is not expected to expose sensitive receptors to DPM and health hazards that would be adverse.

***CEQA Conclusion*:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Table 22-106 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SMAQMD's chronic non-cancer or cancer thresholds. Health threats under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4 and are not expected to exceed SMAQMD's chronic non-cancer or cancer thresholds. Therefore, construction of Alternative 5A is not expected to expose sensitive receptors to significant DPM or health hazards. This impact would be less than significant. No mitigation is required.

Impact AQ-15: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of YSAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. There would be no construction of physical features in the YSAQMD. Accordingly, increased health risks in the air district would result from equipment and material transport to construction sites in the SMAQMD. Criteria pollutant emissions and associated health risks generated in YSAQMD would therefore be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-15 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-107 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would not exceed the YSAQMD's chronic non-cancer or cancer thresholds. Health threats under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. Therefore, construction of Alternative 5A is not expected to expose sensitive receptors to DPM and health hazards that would be adverse.

***CEQA Conclusion*:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Table 22-107 in Appendix A of this RDEIR/SDEIS, construction of Alternative 4 would not exceed the YSAQMD's chronic non-cancer or cancer thresholds. Health threats under Alternative 5 were not explicitly quantified, but would be lower than those estimated for Alternative 4. Therefore, construction of Alternative 5A is not expected to expose sensitive receptors to significant DPM or health hazards. This impact would be less than significant. No mitigation is required.

Impact AQ-16: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of BAAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions and increased health risks from construction of physical features in the BAAQMD would be similar to those generated by Alternative 4. However, emissions generated by equipment and material transport from the Port of San Francisco would be less than Alternative 4 due to the reduced number of intakes constructed in SMAQMD. Accordingly, total emissions and associated health risks generated in the BAAQMD would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-16 under Alternatives 4 and 5.

NEPA Effects: As shown in Table 22-108 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 5 may expose receptors adjacent to haul routes to heath treats in excess of BAAQMD thresholds (based on modeling conducted for Alternative 1A).

Mitigation Measure AQ-16 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, an adverse effect in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, effects would not be adverse.

CEQA Conclusion**:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. As shown in Table 22-108 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 5 may expose receptors adjacent to haul routes to heath treats in excess of BAAQMD thresholds (based on modeling conducted for Alternative 1A).

Mitigation Measure AQ-16 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, an adverse effect in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, effects would not be adverse.

Mitigation Measure AQ-16: Relocate Sensitive Receptors to Avoid Excess Cancer Risk

Please refer to Mitigation Measure AQ-16 under Impact AQ-16 in the discussion of Alternative 1A in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-17: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of SJVAPCD's Chronic Non-Cancer and Cancer Risk Thresholds

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions and associated health risks from construction of physical features and equipment and material transport in the SJVAPCD would be similar to those generated by Alternative 4. See the discussion of Impact AQ-17 under Alternative 4.

NEPA Effects: As shown in Table 22-109 in Appendix A of this RDEIR/SDEIS, Alternative 4 would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds and, thus, would not expose sensitive receptors to substantial DPM concentrations. Therefore, the effect of exposure of sensitive receptors to DPM health threats during construction would not be adverse.

***CEQA Conclusion*:** DPM generated during construction poses inhalation-related chronic non-cancer hazard and cancer risk if adjacent receptors are exposed to significant concentrations for prolonged durations. The DPM generated during Alternative 5A construction would not exceed the SJVAPCD's chronic non-cancer or cancer thresholds, and thus would not expose sensitive receptors to substantial pollutant concentrations. Therefore, this impact for DPM emissions would be less than significant. No mitigation is required.

Impact AQ-18: Exposure of Sensitive Receptors to *Coccidioides immitis* (Valley Fever)

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. While construction activities may be slightly less under Alternative 5A than Alternative 4, the potential for Alternative 5A to expose receptors adjacent to the construction site to spores known to cause Valley Fever would be similar to Alternative 4. See the discussion of Impact AQ-18 under Alternative 4.

***NEPA Effects*:** Earthmoving activities during construction could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of advanced air-district recommended fugitive dust controls outlined in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, the effect of exposure of sensitive receptors to increased Valley Fever risk during construction would not be adverse.

***CEQA Conclusion*:** Construction of the water conveyance facility would involve earthmoving activities that could release *C. immitis* spores if filaments are present and other soil chemistry and climatic conditions are conducive to spore development. Receptors adjacent to the construction area may therefore be exposed to increase risk of inhaling *C. immitis* spores and subsequent development of Valley Fever. Implementation of air-district recommended fugitive dust controls outlined in Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS, would avoid dusty conditions and reduce the risk of contracting Valley Fever through routine watering and other controls. Therefore, this impact would be less than significant. No mitigation is required.

Impact AQ-19: Creation of Potential Odors Affecting a Substantial Number of People during Construction or Operation of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. While construction activities may be slightly less under Alternative 5A than Alternative 4, the potential for Alternative 5A to expose receptors to nuisance odors during construction and operation of the water conveyance facilities would be similar to Alternative 4. See the discussion of Impact AQ-19 under Alternative 4.

NEPA Effects: Odors from construction activities would be localized and generally confined to the immediate area surrounding the construction site. Moreover, odors would be temporary and localized, and they would cease once construction activities have been completed. Thus, it is not anticipated that construction of water conveyance facilities would create objectionable odors from construction equipment or asphalt paving. Similarly, drying and stockpiling of removed muck and sediment will occur under aerobic conditions, which will limit any potential decomposition and associated malodorous products. Accordingly, tunnel and sediment excavation would not create objectionable odors. Finally, since Alternative 5A would not result in the addition of odors facilities (e.g., wastewater treatment plants), long-term operation of the water conveyance facility would not result in objectionable odors. There would be no adverse effect.

CEQA Conclusion**:** Alternative 5A would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Likewise, potential odors generated during asphalt paving would be addressed through mandatory compliance with air district rules and regulations. While tunnel excavation would unearth approximately 27 million cubic yards of muck, geotechnical tests indicate that soils in the project area have relatively low organic constituents. Moreover, drying and stockpiling of the removed muck will occur under aerobic conditions, which will further limit any potential decomposition and associated malodorous products. Accordingly, the impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-20: Generation of Criteria Pollutants in the Excess of Federal *De Minimis* Thresholds from Construction and Operation and Maintenance of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Emissions generated by Alternative 5A would therefore likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-20 under Alternatives 4 and 5.

NEPA Effects: As shown in Tables 22-110 and 22-119 in Appendix A of this RDEIR/SDEIS, implementation of Alternatives 4 and 5 would exceed the following federal *de minimis* thresholds:

Sacramento Federal Nonattainment Area (SFNA)

- NO_X: 2019–2027 (Alternative 4); 2020–2027 (Alternative 5)

San Joaquin Valley Air Basin (SJVAB)[6]

- ROG: 2020-2025 (Alternative 4)
- NO_X: 2018-2028 (Alternative 4)

San Francisco Bay Area Air Basin (SFBAAB)

- NO_X: 2024-2025 (Alternative 4 only)

ROG and NO_X are precursors to ozone, for which the SFNA, SJVAB, and SFBAAB are in nonattainment for the NAAQS. Since project emissions exceed the federal *de minimis* thresholds for ROG (SJVAB only) and NO_X, a general conformity determination must be made to demonstrate that total direct and indirect emissions of ROG (SJVAB only) and NO_X would conform to the appropriate SFNA, SJVAB, and SFBAAB SIPs for each year of construction in which the *de minimis* thresholds are exceeded.

[6] Emissions from construction of physical features and equipment and material transport in the SJVAPCD would be identical to those generated by Alternative 4. Accordingly, violations of the federal *de minimis* thresholds under Alternative 5 are not listed.

NO_X is also a precursor to PM and can contribute to PM formation. Sacramento County and the SJVAB are currently designated maintenance for the PM10 NAAQS, whereas the SJVAB, SFBAAB, and portions of the SFBA are designated nonattainment for the PM2.5 NAAQS. NO_X emissions in excess of 100 tons per year in Sacramento County and SJVAB trigger a secondary PM10 precursor threshold, whereas NO_X emissions in excess of 100 tons per year in the SFNA, SJVAB, or SFBAAB trigger a secondary PM2.5 precursor threshold. Since NOx emissions can contribute to PM formation, NO_X emissions in excess of these secondary precursor thresholds could conflict with the applicable PM10 and PM2.5 SIPs.

As shown in Table 22-117 in Appendix A of this RDEIR/SDEIS, NO_X emissions generated by construction activities in SMAQMD (Sacramento County) under Alternative 5 would exceed 100 tons per year between 2023 and 2026. It is therefore likely that Alternative 5A would trigger the secondary PM10 precursor threshold, requiring all NO_X offsets for 2023 through 2026 to occur within Sacramento County.

With respect to NO_X emissions in SJVAB and SFBAAB, the PM2.5 precursor threshold would be exceeded in the SFBAAB in 2024 and 2025. The PM10 and PM2.5 precursor thresholds would be exceeded in the SJVAB in 2021 and 2022. Accordingly, NO_X offsets for these years must occur within the federally-designated PM10 maintenance (SJVAB only) and PM2.5 nonattainment areas of the SJVAB and SFBAAB, which are consistent with the nonattainment boundary for ozone.

Mitigation Measures AQ-3a, AQ-3b, AQ-4a, and AQ-4b are available to fully offset emissions generated by Alternatives 4 and 5 in excess of the federal *de minimis* thresholds in SFBAAB and SJVAB to net zero. However, within SFNA, given the limited geographic scope available for offsets in 2023 through 2026 (Sacramento County), neither Mitigation Measures AQ-1a nor 1b could feasibly reduce NO_X emissions to net zero for the purposes of general conformity.[7] This impact would be adverse. In the event that Alternative 5A is selected as the APA, Reclamation, USFWS, and NMFS would need to demonstrate that conformity is met for NO_X and secondary PM10 formation in SFNA through a local air quality modeling analysis (i.e., dispersion modeling) or other acceptable methods to ensure project emissions do not cause or contribute to any new violations of the NAAQS or increase the frequency or severity of any existing violations.

Mitigation Measure AQ-1a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1a under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

[7] The secondary PM precursor thresholds are triggered through the General Conformity Regulation (40 CFR 93.153 (a)(1)). Accordingly, confinement of the geographic scope for available offsets only applies to the General Conformity determination and does not influence mitigation feasibility for Impact AQ-1.

Mitigation Measure AQ-1b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SFNA to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-1b under Impact AQ-1 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants[8]

Please see Mitigation Measure AQ-3a under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-3b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the BAAQMD/SFBAAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable BAAQMD CEQA Thresholds for Other Pollutants

Please refer to Mitigation Measure AQ-3b under Impact AQ-3 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4a: Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4a under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-4b: Develop an Alternative or Complementary Offsite Mitigation Program to Mitigate and Offset Construction-Generated Criteria Pollutant Emissions within the SJVAPCD/SJVAB to Net Zero (0) for Emissions in Excess of General Conformity *De Minimis* Thresholds (Where Applicable) and to Quantities below Applicable SJVAPCD CEQA Thresholds for Other Pollutants

Please see Mitigation Measure AQ-4b under Impact AQ-4 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

CEQA Conclusion: SFNA, SJVAB, and SFBAAB are classified as nonattainment areas with regard to the ozone NAAQS and the impact of increases in criteria pollutant emissions above the air basin *de minimis* thresholds could conflict with or obstruct implementation of the applicable air quality plans. Since construction emissions in the SFNA, SJVAB, and SFBAAB would exceed the *de minimis* thresholds for ROG (SJVAB only) and NO_X, this impact would be significant.

[8] In the title of this mitigation measure, the phrase "for other pollutants" is intended to apply to other alternatives, where associated impacts on other pollutants may exceed thresholds other than NO_X.

Mitigation Measures AQ-3a, AQ-3b, AQ-4a, and AQ-4b would ensure project emissions would not result in an increase in regional ROG (SJVAB only) or NO_X in the SFBAAB and SJVAB. These measures would therefore ensure total direct and indirect ROG (SJVAB only) and NO_X emissions generated by the project would conform to the appropriate SFBAAB and SJVAB SIPs by offsetting the action's emissions in the same or nearby area to net zero. Accordingly, impacts would be less than significant with mitigation in the SFBAAB and SJVAB.

Although Mitigation Measures AQ-1a and AQ-1b would reduce NO_X in the SFNA, given the magnitude of NO_X emissions and the limited geographic scope available for offsets (Sacramento County), neither measure could feasibly reduce NO_X emissions to net zero for the purposes of general conformity. This impact would be significant and unavoidable in the SFNA.

Impact AQ-21: Generation of Cumulative Greenhouse Gas Emissions during Construction of the Proposed Water Conveyance Facility

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Total GHG emissions generated by construction of Alternative 5A would therefore be slightly less than Alternative 4, but the potential effect of those emissions would be the same as Alternative 4. See the discussion of Impact AQ-21 under Alternative 4.

NEPA Effects: Based on the total GHG emissions generated by Alternative 4 (3,019,413 metric tons carbon dioxide equivalent [CO_2e]) and emissions that would be generated by construction of two fewer intakes (60,000 metric tons CO_2e), Alternative 5A would emit about 2.9 million metric tons CO_2e over the 14-year construction period. This is equivalent to adding 620,000 typical passenger vehicles to the road during construction (U.S. Environmental Protection Agency 2014e). As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2, any increase in emissions above net zero associated with construction of the project water conveyance features would be adverse. Mitigation Measure AQ-21, which would develop a GHG Mitigation Program to reduce construction-related GHG emissions to net zero, is available address this effect.

***CEQA Conclusion*:** Construction of Alternative 5A would generate about 2.9 million metric tons of GHG emissions. As discussed in Chapter 22, *Air Quality and Greenhouse Gases*, Section 22.3.2, *Determination of Effects*, in the Draft EIR/EIS, any increase in emissions above net zero associated with construction of the project water conveyance features would be significant. Mitigation Measure AQ-21 would develop a GHG Mitigation Program to reduce construction-related GHG emissions to net zero. Accordingly, this impact would be less-than-significant with implementation of Mitigation Measure AQ-21.

Mitigation Measure AQ-21: Develop and Implement a GHG Mitigation Program to Reduce Construction Related GHG Emissions to Net Zero (0)

Please see Mitigation Measure AQ-21 under Impact AQ-21 in the discussion of Alternative 4 in Chapter 22, *Air Quality and* Greenhouse *Gases*, of the Draft EIR/EIS.

Impact AQ-22: Generation of Cumulative Greenhouse Gas Emissions from Operation and Maintenance of the Proposed Water Conveyance Facility and Increased Pumping

Alternative 5A would have the same operations as Alternative 5. Accordingly, the potential to result in a cumulative GHG effect during operation and maintenance would be the same as Alternative 5. See the discussion of Impact AQ-22 under Alternative 5.

NEPA Effects: Table 4.5.18-1 summarizes long-term operational GHG emissions associated with operations, maintenance, and increased SWP pumping under Alternative 5A at the ELT and LLT timeframes. Emissions are compared to both the No Action Alternative (NEPA point of comparison) and Existing Conditions (CEQA baseline). The equipment emissions presented in Table 4.5.18-1 are representative of project impacts for both the NEPA and CEQA analysis.

Table 4.5.18-1. GHG Emissions from Operation, Maintenance, and Increased SWP Pumping, Alternative 5A

Condition	Equipment CO_2	NEPA Point of Comparison Electricity)	CEQA Baseline (Electricity)	NEPA Point of Comparison (Total)	CEQA Baseline (Total)
ELT	199	15,913	20,203	16,112	20,403
LLT	199	12,377	-9,198	12,576	-8,999

Note: The *NEPA point of comparison* compares total CO_2e emissions after implementation of Alternative 4 to the No Action Alternative (ELT), whereas the *CEQA baseline* compares total CO_2e emissions to Existing Conditions.

As shown in Table 4.5.18-1, operations, maintenance, and increased SWP pumping under Alternative 5A would generate 12,500 to 16,100 metric tons CO_2e per year, relative to the No Action Alternative. Emissions relative to existing conditions would range from a net reduction of 9,000 metric tons CO_2e per year to a net increase of 20,400 metric tons CO_2e per year. This increase relative to existing conditions is lower than emissions and potential effects analyzed under the Scenario H1 for Alternative 4 (113,555 metric tons CO_2e).

As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their Climate Action Plan (CAP) goals with implementation of BMPs and modification to DWR's Renewable Energy Procurement Program (REEP). The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines Section 15183.5. As shown in Table 22-115, the assessment considers the amount of additional renewable energy that would need to be added to the REPP annually following construction in order for DWR to meet their long-term GHG reduction goals. Since emissions under Alternative 5A ELT conditions would be lower than those analyzed for Alternative 4 ELT conditions, and because DWR demonstrated that implementation of Alternative 4 (Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 5A would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. There would be no adverse effect

CEQA Conclusion: As discussed in Impact AQ-22 in Chapter 22, *Air Quality and Greenhouse Gases*, of this RDEIR/SDEIS, analysis was undertaken to confirm additional energy demand and associated GHG emissions under Alternative 4 would not impede DWR's ability to achieve their CAP goals with implementation of BMPs and modification to DWR's REEP. The analysis presented in the chapter meets the consistency requirements detailed in the DWR CAP, therefore enabling the project to tier from the environmental document prepared for the CAP pursuant to CEQA Guidelines section 15183.5. Since emissions under Alternative 5A would be lower than those analyzed for Alternative 4, and because DWR demonstrated that implementation of Alternative 4 (Operational Scenario H1) would not adversely affect DWR's ability to achieve the GHG emissions reduction goals set forth in the CAP, Alternative 5A would be consistent with the analysis performed in the CAP and would not conflict with any of DWR's specific action GHG emissions reduction measures. Prior adoption of the CAP by DWR already provides a commitment on the part of DWR to make all necessary modifications to DWR's REEP or any other GHG emission reduction measure in the CAP necessary to achieve DWR's GHG emissions reduction goals. Therefore no amendment to the approved CAP is necessary to ensure the occurrence of the additional GHG emissions reduction activities needed to account for project-related operational emissions. The effect of Alternative 5A with respect to GHG emissions is less than cumulatively considerable and therefore less than significant. No mitigation is required.

Impact AQ-23: Generation of Cumulative Greenhouse Gas Emissions from Increased CVP Pumping as a Result of Implementation of Water Conveyance Facility

Alternative 5A would have the same operations from those under Alternative 5. Accordingly, the potential to result in a cumulative GHG effect from increased CVP pumping under LLT conditions would be the same as Alternative 5. Potential effects under ELT conditions, which were not analyzed for CVP operation under Alternative 5, would be slightly higher than those estimated under LLT conditions. See the discussion of Impact AQ-23 under Alternative 5.

NEPA Effects: Under Alternative 5A, operation of the CVP yields the generation of clean, GHG emissions-free, hydroelectric energy. This electricity is sold into the California electricity market or directly to energy users. Implementation of Alternative 5A could result in an increase of up to 75 GWh in the demand for CVP generated electricity at the ELT timeframe, which would result in a reduction of up to 75 GWh or electricity available for sale from the CVP to electricity users (57 GWh under LLT). This reduction in the supply of GHG emissions-free electricity to the California electricity users could result in a potential indirect effect of the project, as these electricity users would have to acquire substitute electricity supplies that may result in GHG emissions (although additional conservation is also a possible outcome).

It is unknown what type of power source (e.g., renewable, natural gas) would be substituted for CVP electricity or if some of the lost power would be made up with higher efficiency. Given State mandates for renewable energy and incentives for energy efficiency, it is possible that a considerable amount of this power would be replaced by renewable resources or would cease to be needed as a result of higher efficiency. However, to ensure a conservative analysis, indirect emissions were quantified for the entire quantity of electricity (up to 75 GWh) using the current and future statewide energy mix (adjusted to reflect RPS).

Substitution of up to 75 GWh of electricity with a mix of sources similar to the current statewide mix would result in emissions of up to 20,963 metric tons of CO_2e; however, under expected future conditions (after full implementation of the RPS), emissions would be up to 16,290 metric tons of CO_2e. These emissions could contribute to a cumulatively considerable effect and are therefore adverse. The emissions would be caused by dozens of independent electricity users, who had previously bought CVP power, making decisions about different ways to substitute for the lost power. These decisions are beyond the control of Reclamation or any of the other project Lead Agencies. Further, monitoring to determine the actual indirect change in emissions as a result of project actions would not be feasible. In light of the impossibility of predicting where any additional emissions would occur, as well as Reclamation's lack of regulatory authority over the purchasers of power in the open market, no workable mitigation is available or feasible.

CEQA Conclusion**:** Operation of the CVP is a federal activity beyond the control of any State agency such as DWR, and the power purchases by private entities or public utilities in the private marketplace necessitated by a reduction in available CVP-generated hydroelectric power are beyond the control of the State, just as they are beyond the control of Reclamation. For these reasons, there are no feasible mitigation measures that could reduce this potentially significant indirect impact, which is solely attributable to operations of the CVP and not the SWP, to a less than significant level. This impact is therefore determined to be significant and unavoidable.

Impact AQ-24: Generation of Regional Criteria Pollutants from Implementation of Environmental Commitments 3, 4, 6–11

Effects of Alternative 5A related to the generation of regional criteria pollutants during implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-24 under Alternative 4A in Section 4.3.18 in this RDEIR/SDEIS.

NEPA Effects: Habitat restoration and enhancement activities that require physical changes or heavy-duty equipment would generate construction emissions through earthmoving activities and heavy-duty diesel-powered equipment. Criteria pollutants from restoration and enhancement actions could exceed applicable general conformity *de minimis* levels and applicable local thresholds. The effect would vary according to the equipment used in construction of a specific environmental commitment, the location, the timing of the actions called for in the environmental commitment, and the air quality conditions at the time of implementation. Nevertheless, increases in emissions during implementation of Environmental Commitments 3, 4, 6–11 in excess of applicable general conformity *de minimis* levels and air district regional thresholds could violate air basin SIPs and worsen existing air quality conditions. Mitigation Measure AQ-24 would be available to reduce this effect, but emissions would still be adverse.

CEQA Conclusion**:** Construction and operational emissions associated with the restoration and enhancement actions would result in a significant impact if the incremental difference, or increase, relative to Existing Conditions exceeds the applicable local air district thresholds. Mitigation Measure AQ-24 would be available to reduce this effect, but may not be sufficient to reduce emissions below applicable air quality management district thresholds. Consequently, this impact would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-25: Exposure of Sensitive Receptors to Health Threats from Localized Particulate Matter, Carbon Monoxide, and Diesel Particulate Matter from Implementation of Environmental Commitments 3, 4, 6–11

The potential for Alternative 5A to expose sensitive land uses to increased health risks from implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-25 under Alternative 4A in Section 4.3.18 in this RDEIR/SDEIS.

NEPA Effects: Potential health effects from localized pollutant increases would vary according to the equipment used, the location and timing of the actions called for in the environmental commitment, the meteorological and air quality conditions at the time of implementation, and the location of receptors relative to the emission source. Increases in PM, CO, or DPM (cancer and non-cancer-risk) in excess of applicable air district thresholds at receptor locations would be adverse. Mitigation Measures AQ-24 and AQ-25 would be available to reduce this effect.

***CEQA Conclusion*:** Construction and operational emissions associated with the restoration and enhancement actions under Alternative 5A would result in a significant impact if PM, CO, or DPM (cancer and non-cancer-risk) concentrations at receptor locations exceed the applicable local air district thresholds. Mitigation Measures AQ-24 and AQ-25 would ensure localized concentrations at receptor locations would be below applicable air quality management district thresholds. Consequently, this impact would be less than significant.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-25: Prepare a Project-Level Health Risk Assessment to Reduce Potential Health Risks from Exposure to Localized DPM and PM Concentrations

Please see Mitigation Measure AQ-25 under Impact AQ-25 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Impact AQ-26: Creation of Potential Odors Affecting a Substantial Number of People from Implementation of Environmental Commitments 3, 4, 6–11

The potential for Alternative 5A to expose sensitive land uses to nuisance odors from implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-26 under Alternative 4A in Section 4.3.18 in this RDEIR/SDEIS.

NEPA Effects: Diesel emissions from earthmoving equipment could generate temporary odors, but these would quickly dissipate and cease once construction is completed. While restored land uses have the potential to generate odors from natural processes, the odors would be similar in origin and magnitude to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, odor-related effects associated with Environmental Commitments 3, 4, 6–11 would not be adverse.

***CEQA Conclusion*:** Alternative 5A would not result in the addition of major odor producing facilities. Diesel emissions during construction could generate temporary odors, but these would quickly dissipate and cease once construction is completed. Increases in wetland, tidal, and upland habitats may increase the potential for odors from natural processes. However, the origin and magnitude of odors would be similar to the existing land use types in the restored area (e.g., managed wetlands). Accordingly, the impact of exposure of sensitive receptors to potential odors would be less than significant. No mitigation is required.

Impact AQ-27: Generation of Cumulative Greenhouse Gas Emissions from Implementation of Environmental Commitments 3, 4, 6–11

Effects of Alternative 5A related to the generation of GHG emissions during implementation of Environmental Commitments 3, 4, 6–11 would be similar to those described for Alternative 4A. See the discussion of Impact AQ-27 under Alternative 4A in Section 4.3.18 in this RDEIR/SDEIS.

NEPA Effects: Construction equipment required for earthmoving could generate short-term GHG emissions. Implementing Environmental Commitments 3, 4, 6–11 would also affect long-term sequestration rates through land use changes, such as conversion of agricultural land to wetlands, inundation of peat soils, drainage of peat soils, and removal or planting of carbon-sequestering plants. Without additional information on site-specific characteristics associated with each of the restoration components, a complete assessment of GHG flux from Environmental Commitments 3, 4, 6–11 is currently not possible. The effect of carbon sequestration and methane generation would vary by land use type, season, and chemical and biological characteristics. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this effect. However, due to the potential for increases in GHG emissions from construction and land use change, this effect would be adverse.

CEQA Conclusion**:** The restoration and enhancement actions under Alternative 5A could result in a significant impact if activities are inconsistent with applicable GHG reduction plans, do not contribute to a lower carbon future, or generate excessive emissions, relative to other projects throughout the state. Mitigation Measures AQ-24 and AQ-27 would be available to reduce this impact, but may not be sufficient to reduce to a less-than-significant level. Consequently, this impact is would be significant and unavoidable.

Mitigation Measure AQ-24: Develop an Air Quality Mitigation Plan (AQMP) to Ensure Air District Regulations and Recommended Mitigation are Incorporated into Future Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-24 under Impact AQ-24 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

Mitigation Measure AQ-27: Prepare a Land Use Sequestration Analysis to Quantify and Mitigate (as Needed) GHG Flux Associated with Conservation Measures and Associated Project Activities

Please see Mitigation Measure AQ-27 under Impact AQ-27 in the discussion of Alternative 4 in Chapter 22, *Air Quality and Greenhouse Gases*, of the Draft EIR/EIS.

4.5.19 Noise

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, noise levels generated by construction of non-intake features structures would be similar to Alternative 4, whereas noise levels generated by construction of the intakes would be similar to Alternative 5. The potential for Alternative 5A to expose noise-sensitive land uses to noise from construction of the water conveyance facilities would therefore range between impacts described under Alternative 4, as described in Appendix A of this RDEIR/SDEIS and those described for Alternative 5. See the discussion of Impact NOI-1 under Alternatives 4 and 5.

NEPA Effects: Noise would be generated by heavy-duty equipment operating at the various construction sites, as well as by haul trucks and worker vehicles traveling on local roadways. Construction noise would also affect onsite workers. However, occupational exposure to noise levels in excess of 85 A-weighted decibels (dBA) requires monitoring and mitigation to protect workers. Given that onsite workers would be protected under OSHA requirements, no adverse impacts would occur to workers. Accordingly, this analysis focuses exclusively on potential noise effects to noise-sensitive land uses adjacent to construction activities.

Potential reasonable worst-case noise levels generated at construction work areas were evaluated against the 60 dBA L_{eq} (1hr) daytime (7 a.m. to 10 p.m.) and 50 dBA L_{max} nighttime (10 p.m. to 7 a.m.) construction thresholds. Construction noise along roadways was evaluated against the 12 decibel (dB) traffic noise threshold. As described in Impact NOI-1 in Appendix A of this RDEIR/SDEIS, Alternative 4 could generate noise levels in excess of daytime and nighttime standards at up to 765 and 1,293 parcels, respectively, depending on the local and land use type. The effect of exposing noise-sensitive land uses to noise increases above established thresholds at intake work areas, conveyance and associated facility work areas, utility construction work areas, borrow/spoil work areas and truck trips and worker commutes would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to reduce this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion*:* Construction activities would expose noise-sensitive land uses adjacent to intake, conveyance, forebay, barge facility, utility, and borrow/spoil work areas to noise levels above the 60 dBA L_{eq} (1hr) daytime and 50 dBA L_{max} nighttime threshold. Receptors near haul roads would also be exposed to noise levels in excess of the 12 dB traffic noise threshold. This would be a significant impact. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1a in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1b in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Construction at the intake sites would involve use of impact pile driving, and tunnel construction would involve the use of TBMs and tunnel locomotives, both of which would cause groundborne vibration in localized areas. The potential for Alternative 5 to expose noise-sensitive land uses to vibration at the intake sites would be less than that of Alternative 4, as described in Appendix A of this RDEIR/SDEIS, and similar to that of Alternative 5. The potential for Alternative 5A to expose noise-sensitive land uses to vibration from tunneling activities would be similar to that of Alternative 4. See the discussion of Impact NOI-2 under Alternatives 1A and 4.

NEPA Effects: Vibration effects from pile driving under Alternative 5 were evaluated against a threshold of 0.2 inches per second peak particle velocity (in/sec PPV) at residential buildings within 70 feet of pile driving sites. Groundborne vibration from impact pile driving is predicted to exceed vibration thresholds at 42 residential receptors. Although intake construction under Alternative 5A would be located slightly south of intake construction under Alternative 5, vibration levels from pile driving would be similar and could expose adjacent land uses to adverse noise effects. Mitigation Measure NOI-2 is available to reduce this effect, but not to a level that would avoid adverse conditions.

Vibration effects from tunneling locomotives and TBMs were evaluated against a threshold of 0.04 in/sec PPV. As described under Alternative 4, groundborne vibrations from the TBMs would not exceed 0.008 in/sec PPV and would therefore not result in adverse vibration effects to nearby sensitive receptors. Similarly, tunnel locomotives would be operated at slow speeds inside of tunnels and would not result in excessive vibrations. Groundborne noise from tunnel locomotive operation during construction is therefore not predicted to exceed groundborne noise thresholds or result in an adverse noise impact on sensitive receptors along the tunnel conveyance.

As outlined in Mitigation Measure NOI-2, the potential for tunneling induced ground vibration effects will be thoroughly analyzed in the preliminary and final design phases of the project, using site-specific geotechnical data and the expected TBM configuration. Potential effects on surface structures and human perception will be evaluated in detail during preliminary design. As additional precautions, and where necessary, a ground vibration monitoring program using seismographs and other high-precision equipment will be implemented during construction to ensure ground vibration is within the required contract limits.

***CEQA Conclusion**:* Groundborne vibrations during tunneling would not exceed 0.008 in/sec PPV and would therefore be less than significant. Likewise, locomotives are not expected to generate significant noise levels because they will travel at low speeds between 5 and 10 miles per hour. However, the impact of exposing residential structures to groundborne vibration during intake construction would be significant as reasonable worst-case modeling indicates that up to 42 residential parcels could be exposed to vibration levels in excess of 0.2 in/sec PPV during intake pile driving. Although Mitigation Measure NOI-2 will reduce the impact, it is not anticipated that feasible measures will be available in all situations to reduce vibration to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

Please see Mitigation Measure NOI-2 under Impact NOI-2 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-3: Exposure of Noise-Sensitive Land Uses to Noise from Operation of Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes, similar to Alternative 5. Accordingly, the potential for Alternative 5A to expose sensitive land uses to noise from intake pump operations would be similar to Alternative 5. Since the number of pumps and noise generating equipment at the combined pumping plant would be the same under Alternative 5A as Alternative 4, noise effects from operation of the combined pumping plant would be similar to impacts described under Alternative 4 in Appendix A of this RDIER/SDEIS. See the discussion of Impact NOI-3 under Alternatives 4 and 5.

NEPA Effects: Operation of pumping equipment at the intakes and combined pumping plant could result in increases in noise levels affecting nearby communities and residences. Noise would also affect onsite workers, although OSHA monitoring requirements would avoid adverse effects to personnel. Accordingly, this analysis focuses exclusively on potential noise effects to noise-sensitive land uses adjacent to the conveyance facilities.

Potential reasonable worst-case pump noise levels generated during operation of the intake and pump structures were evaluated against the 50 dBA L_{max} daytime (7 a.m. to 10 p.m.) and 45 dBA L_{max} nighttime (10 p.m. to 7 a.m.) operational thresholds. As described under Alternative 5 in the Draft EIR/EIS, operational activities would exceed the daytime and nighttime thresholds at noise-sensitive land uses within 1,600 feet and 2,600 feet, respectively, from intake locations. Various residential, recreational, and agricultural receptors would therefore be exposed to adverse noise levels during operation. Operational activities at the combined pumping plant would exceed the nighttime threshold at noise-sensitive land uses within a distance of up to 2,800. Mitigation Measure NOI-3 is available to address this effect.

CEQA Conclusion: The impact of exposing noise-sensitive land uses during operations to noise levels above the daytime (50 dBA L_{max}) or nighttime (45 dBA L_{max}) noise thresholds would be considered significant. Based on reasonable worst-case modeling, various agricultural parcels would be affected by daytime and nighttime noise levels in excess of the operational threshold. Mitigation Measure NOI-3 would reduce operational noise levels below applicable thresholds, thus resulting in a less-than-significant level.

Mitigation Measure NOI-3: Design and Construct Intake Facilities and Other Pump Facilities Such That Operational Noise Does Not Exceed 50 dBA (One-Hour L_{eq}) during Daytime Hours (7:00 A.M. to 10:00 P.M.) or 45 dBA (One-Hour L_{eq}) during Nighttime Hours (10:00 P.M. to 7:00 A.M.) or the Applicable Local Noise Standard (Whichever Is Less) at Nearby Noise Sensitive Land Uses

Please see Mitigation Measure NOI-3 under Impact NOI-3 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed Environmental Commitments 3, 4, 6, 7, 9, and 10

The potential for Alternative 5A to expose noise-sensitive land uses to noise from implementation of Environmental Commitments 3, 4, 6, 7, 9, and 10 would be similar to, but less than, those described for Alternative 4. See the discussion of Impact NOI-4 under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Restoration and enhancement activities that require heavy-duty equipment and construction vehicles would generate increases in ambient noise levels. The effect would vary according to the type of construction equipment and techniques used in construction of the specific environmental commitment, the location and timing of the actions called for in the environmental commitment, and the noise environment at the time of implementation.

Alternative 5A would restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,839 acres under Alternative 4. Therefore, the number of noise generation equipment and magnitude of potential noise impacts under Alternative 5A would be smaller than those associated with Alternative 4. Nevertheless, receptors within 1,200 feet of an active restoration work area could be exposed to construction noise in excess of the daytime (7 a.m. to 10 p.m.) noise threshold of 60 dBA L_{eq} (1hr). The nighttime threshold of 50 dBA L_{max} would be exceeded within a distance of 2,800 feet. The effect of exposing sensitive land uses to increases in construction noise levels above thresholds would be adverse. Mitigation Measures NOI-1a and NOI-1b would be available to address this effect, but not to a level that would avoid adverse conditions.

CEQA Conclusion*:* Noise levels during implementation of Environmental Commitments 3, 4, 6, 7, 9, and 10 are expected to vary according to the type of construction equipment and techniques used, but may exceed the daytime noise threshold within 1,200 feet of an active restoration work area and the nighttime threshold within 2,800 feet. The impact of exposing receptors to noise increases above established thresholds would be significant. Mitigation Measures NOI-1a and NOI-1b, which require noise-reducing construction practices and development of a complaint/response tracking program, would reduce noise impacts on sensitive land uses. However, it is not anticipated that feasible measures will be available in all situations to reduce construction noise to levels below the applicable thresholds. This impact would therefore be considered significant and unavoidable.

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Please see Mitigation Measure NOI-1a under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Please see Mitigation Measure NOI-1b under Impact NOI-1 in the discussion of Alternative 4 in Chapter 23, *Noise*, of the Draft EIR/EIS.

4.5.20 Hazards and Hazardous Materials

Impact HAZ-1: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Construction of the Water Conveyance Facilities

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4 but would include one intake (Intake 2) rather than three. The nature of the impacts related to hazards and hazardous materials under Alternative 5A would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 5A to create substantial hazards through release of hazardous materials during construction of conveyance facilities would be less than under Alternative 4 due to two fewer intakes because the geographic extent, magnitude and duration of construction under Alternative 5A would be smaller. Regardless, due to the overall magnitude, duration and geographical extent of construction under Alternative 5A it is anticipated that there would be the potential to create a substantial hazard to the public or environment through the release of hazardous material or by other means during the construction of the water conveyance facilities, and this would constitute an adverse effect on the physical environment. Potential effects include routine use of hazardous materials, possible natural gas accumulation in tunnels, contact with existing contaminants, constituents in RTM, effects of electrical transmission lines, conflicts with utilities containing hazardous materials and routine transport of hazardous materials. Mitigation Measures HAZ-1a, HAZ-1b, UT-6a UT-6c and Trans-1a would be available to reduce the severity of these effects.

CEQA Conclusion: During construction of the water conveyance facilities, the potential for direct impacts on construction personnel, the public and/or the environment associated with a variety of hazardous physical or chemical conditions under Alternative 5A would be less than under Alternative 4 because there would be two fewer intakes. The nature of the impacts, however, would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. Impacts related to hazards and/or hazardous materials may arise as a result of the intensity and duration of construction activities at the north Delta intakes, forebays and conveyance pipelines and tunnels, and the hazardous materials that would be needed in these areas during construction. Potential hazards include the routine use of hazardous materials (as defined by Title 22 of the California Code of Regulations, Division 4.5); natural gas accumulation in water conveyance tunnels; the inadvertent release of existing contaminants in soil, sediment, and groundwater, or release of hazardous materials from existing infrastructure; disturbance of electrical transmission lines; and hazardous constituents present in RTM. Additionally, the potential would exist for the construction of the water conveyance facilities to indirectly result in the release of hazardous materials through the disruption of existing road, rail, or river hazardous materials transport routes because construction would occur in the vicinity of three hazardous material transport routes, three railroad corridors, and waterways with barge traffic. These impacts are considered significant because the potential exists for substantial hazard to the public or environment to occur related to conveyance facility construction. However, implementation of Mitigation Measures HAZ-1a and HAZ-1b, UT-6a, and UT-6c (described in Chapter 20, *Public Services and Utilities*, of the Draft EIR/EIS), and TRANS-1a (described in Chapter 19, *Transportation*, of the Draft EIR/EIS), along with environmental commitments to prepare and implement SWPPPs, HMMPs, SPCCPs, SAPs, and a Barge Operations Plan (described in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS) would reduce these impacts to a less-than-significant level by identifying and describing potential sources of hazardous materials so that releases can be avoided and materials can be properly handled; detailing practices to monitor pollutants and control erosion so that appropriate measures are taken; implementing onsite features to minimize the potential for hazardous materials to be released to the environment; minimizing risk associated with the relocation of utility infrastructure; and coordinating the transport of hazardous materials to reduce the risk of spills.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please see Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please see Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact HAZ-2: Expose Sensitive Receptors Located within 0.25 Mile of a Construction Site to Hazardous Materials, Substances, or Waste during Construction of the Water Conveyance Facilities

NEPA Effects: An adverse effect may occur if a construction work site is located within 0.25 mile of an existing or proposed school, or other sensitive receptor, and releases hazardous materials that pose a health hazard. However, no schools, parks or hospitals are located within 0.25 mile of Alternative 5A. Therefore, no sensitive receptors would be exposed to hazardous materials, substances, or waste during construction of the water conveyance facilities under Alternative 5A. As such, there would be no effect. Potential air quality effects on sensitive receptors are discussed in Chapter 22, *Air Quality and Greenhouse Gases.*

CEQA Conclusion: Conclusion**:** There are no schools, parks or hospitals located within 0.25 mile of the Alternative 5A water conveyance facilities alignment, therefore, there would be no impact due to exposure of sensitive receptors to hazardous materials, substances or waste during construction of the water conveyance facilities. Accordingly, there would be no impact. No mitigation is required. Potential air quality effects on sensitive receptors are discussed in Chapter 22, *Air Quality and Greenhouse Gases.*

Impact HAZ-3: Potential to Conflict with a Known Hazardous Materials Site and, as a Result, Create a Significant Hazard to the Public or the Environment

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4 but would include two fewer intakes. The nature of the impacts related to hazards and hazardous materials under Alternative 5A would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 5A to create conflicts with, or result in exposure to known hazardous material sites during conveyance facility construction would be smaller than under Alternative 4 because the geographic extent, magnitude and duration of construction under Alternative 5A would be smaller. However, because there are no known SOCs within the construction footprint of the water conveyance facility of Alternative 5A, there would be no conflict with known hazardous materials sites during construction of the water conveyance facilities, and therefore, no related hazard to the public or the environment. Therefore, there would be no effect. The potential for encountering unknown hazardous materials sites during the course of construction is discussed under Impact HAZ-1.

CEQA Conclusion: The potential under Alternative 5A to create the potential for conflicts with, or result in exposure to known hazardous material sites during conveyance facility construction under Alternative 5A would be smaller than under Alternative 4 because the geographic extent, magnitude and duration of construction due to two fewer intakes. However, because there are no known SOCs within the construction footprint of the water conveyance facility under this alternative, there would be no conflict with known hazardous materials sites during construction of the water conveyance facilities, and therefore, no related hazard to the public or the environment. Accordingly, there would be no impact. No mitigation is required. The potential for encountering unknown hazardous materials sites during the course of construction is discussed under Impact HAZ-1.

Impact HAZ-4: Result in a Safety Hazard Associated with an Airport or Private Airstrip within 2 Miles of the Water Conveyance Facilities Footprint for People Residing or Working in the Study Area during Construction of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 5A to result in a safety hazard associated with activities within 2.0 miles of an airport or private airstrip is similar to effects described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two fewer intakes under this alternative relative to Alternative 4, the geographical extent of Alternative 5A would be smaller. Two private airports (Walnut Grove Airport, and Spezia Airport) and one public airport (Byron Airport) are located within 2 miles of the water conveyance facilities for Alternative 5A. Walnut Grove and Spezia Airports, on Andrus Island and Tyler Island, respectively, are within 2 miles of the following proposed features or areas: a temporary 69 kV transmission line; a permanent 230 kV transmission line; a RTM area; the tunnel; a tunnel work area; and the main construction shaft for the tunnel. Byron Airport, less than 1.5 miles west of Clifton Court Forebay, is within 2 miles of a proposed 12 kV temporary transmission line; a proposed 230 kV permanent transmission line; and a borrow and/or spoils area. With the exception of the proposed transmission lines, construction of these features or work in these areas would not require the use of high-profile construction equipment. Because construction of the proposed transmission lines would potentially require high-profile equipment (e.g., cranes), and because construction of the 230 kV transmission line would require the use of helicopters during the stringing phase, the safety of air traffic arriving or departing from either of these airports could be compromised during construction of the proposed transmission lines.

This potential for implementation of Alternative 5A to result in a safety hazard associated with an airport or private airstrip within 2 miles of the water conveyance facility is not considered adverse because, As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as part of an environmental commitment pursuant to the State Aeronautics Act (described in Section 24.2.2.17 in Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics to eliminate any potential conflicts prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron Airport).

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 5A to result in a safety hazard associated with activities within 2.0 miles of an airport or private airstrip is similar in nature to impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS, although there would be two fewer intakes relative to Alternative 4 so the geographical extent of Alternative 5A would be smaller. The use of helicopters for stringing the proposed 230 kV transmission lines and relocating the existing 230 kV and 500 kV transmission lines, and of high-profile construction equipment (200 feet or taller), such as cranes, for installation of pipelines, and potentially pile drivers, such as would be used during the construction of the intakes, have the potential to result in safety hazards to aircraft during takeoff and landing if the equipment is operated too close to runways. Two private airports (Walnut Grove Airport and Spezia Airport) and one public airport (Byron Airport) are located within 2 miles of the water conveyance facilities for Alternative 5A.

As described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, as part of an environmental commitment pursuant to the State Aeronautics Act (described in Section 24.2.2.17 in Chapter 24, *Hazards and Hazardous Materials* in Appendix A of this RDEIR/SDEIS), DWR would coordinate with Caltrans' Division of Aeronautics prior to initiating construction and comply with its recommendations based on its investigations and compliance with the recommendations of the OE/AAA (for Byron Airport). These recommendations, which could include limitations necessary to minimize potential problems such as the use of temporary construction equipment, supplemental notice requirements, and marking and lighting high-profile structures, would reduce potential impacts on air safety. This impact would be less than significant because recommendations to avoid conflicts with existing airports located near construction areas would be implemented by DWR prior to construction as required by Caltrans. No mitigation is required.

Impact HAZ-5: Expose People or Structures to a Substantial Risk of Property Loss, Personal Injury or Death Involving Wildland Fires, Including Where Wildlands Are adjacent to Urbanized Areas or Where Residences Are Intermixed with Wildlands, as a Result of Construction, and Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The potential for construction of conveyance facilities under Alternative 5A to result in exposure of people or structures to risks associated with wildfire would be similar to the impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two fewer intakes under Alternative 5A relative to Alternative 4, the geographical extent of Alternative 5A would be smaller. Regardless, this potential effect is not adverse because no portion of Alternative 5A is located in or near an area designated as a High or Very High Fire Hazard Severity

Zone and measures to prevent and control wildland fires would be implemented by DWR during construction, operation, and maintenance of the water conveyance facilities in full compliance with Cal-OSHA standards for fire safety and prevention.

CEQA Conclusion: The potential for construction of conveyance facilities under Alternative 5A to result in exposure of people or structures to risks associated with wildfire would be similar to the impacts described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, because there would be two fewer intakes under Alternative 5A relative to Alternative 4, the geographical extent of Alternative 5A would be smaller. People or structures would not be subject to a significant risk of loss, injury or death involving wildland fires during construction or operation and maintenance of the water conveyance facilities because the alternative would comply with Cal-OSHA fire prevention and safety standards; DWR would implement standard fire safety and prevention measures as part of an FPCP (described in Appendix 3B, *Environmental Commitments*, in Appendix A of the RDEIR/SDEIS); and because the water conveyance facilities would not be located in a High or Very High Fire Hazard Severity Zone. This impact would be less than significant because conditions do not exist near construction areas that would result in exposure of people or structures to significant risk of exposure to wildfire and DWR would implement standard fire safety and prevention measures. No mitigation is required.

Impact HAZ-6: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means during Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4 but would include two fewer intakes. The nature of the impacts related to hazards and hazardous materials under Alternative 5A would be similar to those impacts described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 5A to create substantial hazards through release of hazardous materials during maintenance and operation of the water conveyance facilities would be smaller than under Alternative 4 because the geographic extent and magnitude of O&M activities would be smaller due to two fewer intakes under this alternative.

The Walnut Grove, and Spezia Airports (private air facilities), and the Byron Airport (a public airport), are within 2 miles of the Alternative 5A construction footprint, as discussed under Impact HAZ-1 for this alternative. With the exception of power transmission lines supplying power to pumps, and other equipment used for water conveyance facilities operation and maintenance, water conveyance facilities operations and maintenance are not anticipated to require high-profile equipment (i.e., equipment with a vertical reach of 200 feet or more), the use of which near an airport runway could result in an adverse effect on aircraft. DWR would adhere to all applicable FAA regulations (14 CFR Part 77 [as described in Chapter 24, *Hazards and Hazardous Materials,* Section 24.2, in Appendix A of this RDEIR/SDEIS]) and coordinate with Caltrans' Division of Aeronautics (as described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) prior to initiating maintenance activities requiring high-profile equipment to assess whether a site investigation is necessary. If a site investigation is performed, DWR would adhere to Caltrans' recommendations in order to avoid any adverse effects on air safety. Further, compliance with the results of the OE/AAA for Byron Airport would reduce the risk for adverse effects on air traffic safety by implementing recommendations which could include limitations necessary to minimize potential problems, supplemental notice requirements, and marking and lighting high-profile structures.

During routine operation and maintenance of the water conveyance facilities the potential would exist for the accidental release of hazardous materials and other potentially hazardous releases (e.g., contaminated solids and sediment). Accidental hazardous materials releases, such as chemicals directly associated with routine maintenance (e.g., fuels, solvents, paints, oils), are likely to be small, localized, temporary and periodic; therefore, they are unlikely to result in adverse effects on workers, the public, or the environment. Further, BMPs and measures implemented as part of SWPPPs, SPCCPs, SAPs and HMMPs would be developed and implemented as part of the project, as described under Impact HAZ-1, and in detail in described in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, which would reduce the potential for accidental spills to occur and would result in containment and remediation of spills should they occur. Solids collected at solids lagoons and sediment dredged during periodic maintenance dredging at the intakes may contain potentially hazardous constituents (e.g., persistent pesticides, mercury, PCBs). Contaminated solids could pose a hazard to the environment if improperly disposed of, which would be an adverse effect. Implementation of Mitigation Measure HAZ-6 (described below) would help ensure that there are no adverse effects on soil, groundwater or surface water due to improperly disposed of lagoon solids. Dewatered solids may require special management to meet discharge/disposal requirements. To ensure that potentially contaminated sediment from maintenance dredging activities at the intakes would not adversely affect soil, groundwater or surface water, a SAP would be implemented prior to any dredging activities, as described under Impact HAZ-1 for this alternative. All sediment would be characterized chemically prior to reuse and/or disposal to ensure that reuse of this material would not result in a hazard to the public or the environment.

CEQA Conclusion: The potential for operation and maintenance of conveyance facilities under Alternative 5A to result in a substantial hazard to the public or environment would be similar to the effects described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential under Alternative 5A to create substantial hazards through release of hazardous materials during maintenance and operation off conveyance facilities would be less than under Alternative 4 because the geographic extent and magnitude of O&M activities under this alternative would be smaller due to two fewer intakes. The accidental release of hazardous materials (including contaminated solids and sediment) to the environment during operation and maintenance of the water conveyance facilities could result in significant impacts on the public and environment. However, implementation of the BMPs and other activities required by SWPPPs, HMMPs, SAPs, SPCCPs, as well as adherence to all applicable FAA regulations (14 CFR Part 77 [as described in Chapter 24, Hazards and Hazardous Materials, Section 24.2, in Appendix A of this RDEIR/SDEIS) and, pursuant to the State Aeronautics Act (described in the Regulatory Setting section of Chapter 24, Hazards and Hazardous Materials in Appendix A of this RDEIR/SDEIS), coordination/ compliance with Caltrans' Division of Aeronautics when performing work with high-profile equipment within 2 miles of an airport would ensure that impacts are reduced to a less-than-significant level. Contaminated solids could pose a hazard to the environment if improperly disposed of, and would be considered a significant impact because of the large volume of sediment/solids that would be handled and the potential for improper disposal. However, implementation of Mitigation Measure HAZ-6, would reduce this impact to a less-than-significant level by requiring sampling and characterizing solids from the solids lagoons to evaluate options to dispose of material at an appropriate, licensed facility.

Mitigation Measure HAZ-6: Test Dewatered Solids from Solids Lagoons Prior to Reuse and/or Disposal

Please see Mitigation Measure HAZ-6 under Impact HAZ-6 in the discussion of Alternative 4 of the Draft EIR/EIS.

Impact HAZ-7: Create a Substantial Hazard to the Public or the Environment through the Release of Hazardous Materials or by Other Means as a Result of Implementing Environmental Commitments 3, 4, 6-12, 15 and 16

Effects of Alternative 5A related to the potential for release of hazardous materials from implementing these environmental commitments would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, under Alternative 5A the project would restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,800 acres under Alternative 4. Similarly, Environmental Commitment 16 would be implemented only at limited locations. Conservation Measures 13, 14 and 18 would not be implemented as part of this alternative. Therefore, the magnitude of effects under Alternative 5A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, 6–12, 15 and 16 at limited locations under Alternative 5A could result in multiple potentially hazardous effects related to the release of or exposure to hazardous materials or other hazards including increased production, mobilization and bioavailability of methylmercury; release of existing contaminants (e.g., pesticides in agricultural land); air safety hazards; and wildfires. These effects are considered adverse because of the potential for substantial hazards to occur while constructing restoration actions. However, implementation of Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a, as well as activities required by SWPPPs, HMMPs, SAPs, SPCCPs, and fire prevention and fire control BMPs as part of a FPCP (described under Alternative 4 in Chapter 24, *Hazards and Hazardous Materials,* of the Draft EIR/EIS) are available to reduce/minimize these potential effects.

CEQA Conclusion: The potential for impacts related to the release and exposure of workers and the public to hazardous substances or conditions during construction, operation, and maintenance of Environmental Commitments 3, 4, 6, 7, 9–11, and 16 under Alternative 5A is considered significant because implementation of these environmental commitments would involve extensive use of heavy equipment during construction and transporting hazardous chemicals during operations and maintenance (e.g., herbicides for nonnative vegetation control). These chemicals could be inadvertently released, exposing construction workers or the public to hazards. Construction of restoration projects on or near existing agricultural and industrial land and/or SOCs may also result in a conflict with or exposure to known hazardous materials, and the use of high-profile equipment (i.e., 200 feet or higher) in close proximity to airport runways could result in safety hazards to air traffic. However in addition to implementation of SWPPPs, HMMPs, SPCCPs, SAPs, and fire prevention and fire control BMPs as part of a FPCP(described in Appendix 3B, *Environmental Commitments*, Appendix A of this RDEIR/SDEIS), Mitigation Measures HAZ-1a, HAZ-1b, UT-6a, UT-6c, and TRANS-1a would be implemented to ensure no substantial hazards to the public or the environment would occur from implementation of Environmental Commitments 3, 4, 6, 7, 9–11, and 16, and that impacts would be reduced to a less-than-significant level.

Mitigation Measure HAZ-1a: Perform Preconstruction Surveys, Including Soil and Groundwater Testing, at Known or Suspected Contaminated Areas within the Construction Footprint, and Remediate and/or Contain Contamination

Please refer to Mitigation Measure HAZ-1a under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS. Implementation of this mitigation measure will result in the avoidance, successful remediation or containment of all known or suspected contaminated areas, as applicable, within the construction footprint, which would prevent the release of hazardous materials from these areas into the environment.

Mitigation Measure HAZ-1b: Perform Pre-Demolition Surveys for Structures to Be Demolished within the Construction Footprint, Characterize Hazardous Materials and Dispose of Them in Accordance with Applicable Regulations

Please refer to Mitigation Measure HAZ-1b under Impact HAZ-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS. Implementation of this measure will ensure that hazardous materials present in or associated with structures being demolished will not be released into the environment.

Mitigation Measure UT-6a: Verify Locations of Utility Infrastructure

Please see Mitigation Measure UT-6a under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure UT-6c: Relocate Utility Infrastructure in a Way That Avoids or Minimizes Any Effect on Worker and Public Health and Safety

Please see Mitigation Measure UT-6c under Impact UT-6 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Mitigation Measure TRANS-1a: Implement Site-Specific Construction Traffic Management Plan

Please see Mitigation Measure TRANS-1a under Impact TRANS-1 in the discussion of Alternative 4 in Appendix A of this RDEIR/SDEIS.

Impact HAZ-8: Increased Risk of Bird–Aircraft Strikes during Implementation of Environmental Commitments that Create or Improve Wildlife Habitat

Effects of Alternative 5A related to the potential for increased risk of aircraft bird strikes from implementing restoration actions that improve wildlife habitat would be similar to those described for Alternative 4 in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1, Alternative 5A would restore up to 14,908 acres of habitat under Environmental Commitments 3, 4, 6-10 as compared with 83,800 acres with Conservation Measures 3–11 under Alternative 4 in Appendix A of this RDEIR/SDEIS. Therefore, the magnitude of effects under Alternative 5A would likely be smaller than those associated with Alternative 4.

NEPA Effects: Implementation of Environmental Commitments 3, 4, 6, 7, and 9–11 under Alternative 5A could result in an increase of bird-aircraft strikes in the vicinity of restoration areas that attract waterfowl and other birds in proximity to local airports. This effect is considered adverse because of the potential to affect aircraft safety in the vicinity of restoration projects. Mitigation Measure HAZ-8 is available to reduce this effect.

CEQA Conclusion: Under Alternative 5A, implementation of Environmental Commitments 3, 4, 6, 7, and 9–11, because they would create or improve wildlife habitat, could potentially attract waterfowl and other birds to areas in proximity to existing airport flight zones, and thereby potentially result in an increase in bird-aircraft strikes. The potential for this impact is considered significant because of the increased wildlife restoration projects that could occur in the vicinity of Travis Air Force Base; Rio Vista Municipal Airport; Funny Farm Airport; Sacramento International Airport; and Byron Airport. Mitigation Measure HAZ-8 could reduce the severity of this impact by minimizing bird strike hazards, but this impact would not be reduced to a less-than-significant level because of the inherent uncertainty related to bird strike risks for these future projects. Therefore this impact is significant and unavoidable.

Mitigation Measure HAZ-8: Consult with Individual Airports and USFWS, and Relevant Regulatory Agencies

Please see Mitigation Measure HAZ-8 under Impact HAZ-8 in the discussion of Alternative 4 of in Appendix A of this RDEIR/SDEIS.

4.5.21 Public Health

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 5A construction and operation to increase vector-borne diseases would be similar to that for Alternative 4. Like Alternative 4, Alternative 5A will increase surface water within the study area at an intermediate forebay on Glannvale Tract, and at an expanded Clifton Court Forebay; however, unlike Alternative 4, Alternative 5A has only one intake (Intake 2) rather than three intakes (Intakes 2, 3, and 5). Therefore, there would be fewer sedimentation basins and solids lagoons under Alternative 5A relative to Alternative 4. As described for Alternative 4, the depth, design, and operation of the sedimentation basin and solids lagoons would prevent the development of suitable mosquito habitat. Specifically, the basins would be too deep and the constant movement/circulation of water would prevent mosquitoes from breeding and multiplying. It is unlikely that forebays would provide suitable breeding habitat for mosquitoes given that the water in the forebays would not be stagnant and would generally be too deep to support substantial mosquito habitat. Shallow edges of the forebays could provide some suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of these forebay areas, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity. To further minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs, as necessary, to control mosquitoes and reduce the likelihood that construction and operation of the water conveyance facilities would require an increase in mosquito abatement activities by the local MVCDs (Appendix 3B, Environmental Commitments, in Appendix A of the RDEIR/SDEIS). BMP activities would be consistent with the CDPH's *Best Management Practices for Mosquito Control* plan (described in Section 25.2.3.4 in the Draft EIR/EIS). Accordingly, Alternative 5A would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. No adverse effects on public health would result because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented.

CEQA Conclusion: The potential for construction and operation of conveyance facilities under Alternative 5A to result in an increase in exposure of people to vector-borne diseases would be similar in nature to the impacts described for Alternative 4. However, because Alternative 5A has 2 fewer intakes and fewer associated sedimentation basins and solids lagoons than Alternative 4, there would be less surface water created under this alternative relative to Alternative 4. Alternative 5A conveyance facilities could create new and increased surface water areas (relative to baseline) at the intakes, intermediate forebay, and the expanded Clifton Court Forebay, and these areas have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held there. However, during operations, the depth, design, and operation of conveyance facilities would prevent the development of suitable mosquito habitat. Specifically, the water bodies would be too deep to provide suitable mosquito habitat, and the constant movement of water would prevent mosquitoes from breeding and multiplying. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the sedimentation basins, solids lagoons, the expanded Clifton Court Forebay, the intermediate forebay, and the intermediate forebay inundation area. Therefore, construction and operation of Alternative 5A would not result in a substantial increase in vector-borne diseases in the study area. This impact is considered to be less than significant because conditions for mosquito breeding at conveyance facilities would be minimized and standard practices to control mosquitos would be implemented. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

As described in detail in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, the analysis of bromide and DOC (among other constituents) for Alternative 5A in the ELT is based on modeling done for Alternative 4 in the ELT timeframe, which assumes implementation of Yolo Bypass Improvements and 25,000 acres of tidal natural communities restoration. As described in Section 4.1.4, *Description of Alternative 5A*, CM2 would not be implemented as a part of Alternative 5A and Environmental Commitment 4 would restore approximately 59 acres of tidal wetlands, as opposed to the 65,000 acres contemplated under CM4. As such, the assessment of bromide for Alternative 5A relative to Existing Conditions and the No Action Alternative (ELT) likely overestimates potential increases in bromide, particularly in the west Delta. Regardless, there is notable uncertainty in the results of all quantitative assessments that refer to modeling results, due to the differing assumptions used in the modeling and the description of Alternative 5A and the No Action Alternative (ELT). Effects of Alternative 5A on these constituents may be greater than or less than indicated in the assessment of the modeling results.

NEPA Effects:

Disinfection Byproducts

As described in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, the effects on DOC concentrations in the Delta under Alternative 5A would be similar to Alternative 4. To the extent that habitat restoration actions alter hydrodynamics within the Delta region these effects are included in this assessment. However, there would be less potential for increased DOC concentrations at western Delta locations associated with habitat restoration and enhancement under this alternative because very little would occur relative to Alternative 4.

The geographic extent of effects related to long-term average DOC concentrations within Delta waters with water supply operations under Alternative 5A would be less extensive than Alternative 4 and the magnitude of predicted long-term change and relative frequency of DOC concentration exceedances would be lower than Alternative 4. Relative to the No Action Alternative (ELT), Alternative 5A would result in small increases in long-term average DOC concentrations for the modeled 16-year period and drought period at the S. Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, and Contra Costa Pumping Plant #1. The increases in average DOC concentrations would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at Contra Costa Pumping Plant #1.

While Alternative 5A would lead to slightly higher long-term average DOC concentrations at some municipal water intakes and Delta interior locations, the predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use. The change in frequency of threshold concentration exceedances at other assessment locations would be similar or lower. In general, substantial change in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under Alternative 5A are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed. In the LLT, the primary difference will be changes in the Delta source water fractions due to hydrologic effects from climate change and higher water demands. These effects would occur regardless of the implementation of the alternative and, thus, at the LLT the effects of the alternative on DOC are expected to be similar to those described above. Therefore, changes in DOC concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 5A are not anticipated to contribute to increases in disinfection byproducts (DBPs).

As described in Section 4.5.4, *Water Quality* of this RDEIR/SDEIS, operations and maintenance of the water conveyance facilities under Alternative 5A, relative to the No Action Alternative (ELT), would result in increases in long-term average bromide concentrations in the South Fork Mokelumne River at Staten Island and decrease at all other assessment locations. However, at South Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island there would be an increased frequency of exceedance of the 50 µg/L bromide threshold (the CALFED Drinking Water Program goal) for protecting against the formation of DBPs in treated drinking water. The greatest increase in frequency of exceedance of the 50 µg/L threshold would occur in the South Fork Mokelumne River and Sacramento River at Emmaton. Other locations would increase in the frequency of exceedance of the 50 µg/L and 100 µg/L threshold. The 100 µg/L threshold is the concentration believed to be sufficient to meet currently established drinking water criteria for DBPs. The greatest increase in frequency of exceedance this threshold would occur at Franks Tract. Unlike Alternative 4, there would be no increased bromide concentration or frequency of exceedance of bromide thresholds in Barker Slough at the North Bay Aqueduct under Alternative 5A. As described for Alternative 4, the effects of Alternative 5A in the LLT in the Delta relative to the No Action Alternative (LLT) would be expected to be similar to that described above. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not Alternative 5A, because the primary source of bromide to the Delta is sea water intrusion. The use of seasonal intakes at these locations is largely driven by acceptable water quality, and thus has historically been opportunistic. The opportunity to use these intakes would remain, and the predicted increases in bromide concentrations at Antioch and Mallard Slough would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations. Therefore, changes in bromide concentrations in the Delta resulting from operation of the water conveyance facilities under Alternative 5A are not anticipated to contribute to increases in DBPs.

Trace Metals

The changes in modeled trace metal concentrations of primarily human health and drinking water concern (arsenic, iron, manganese) in the Delta under Alternative 5A would be similar to those described for Alternative 4A (see Draft BDCP EIR/EIS, Chapter 8, *Water Quality,* Section 8.3.3.9) because the factors that would affect trace metal concentrations in Delta waters would be the same in the ELT and LLT.

The arsenic criterion was established to protect human health from the effects of long-term chronic exposure, while secondary MCLs for iron and manganese were established as reasonable federal regulatory goals for drinking water quality, and enforceable standards in California. Average concentrations for arsenic, iron, and manganese in the primary source water (Sacramento River, San Joaquin River, and the bay at Martinez) are below these criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and, given that the modeled average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be an expected result under this alternative. Accordingly, no adverse effect on public health related to the trace metals arsenic, iron, or manganese from drinking water sources is anticipated.

Pesticides

The changes in modeled pesticide concentrations in the Delta under Alternative 5A would be similar to those described for Alternative 4. The average winter and summer flow rates, relative to the No Action Alternative (ELT) are expected to be similar to or less than changes in flow rates under Alternative 4 in the Sacramento River at Freeport, American River at Nimbus, Feather River at Thermalito and the San Joaquin River at Vernalis. The main factor influencing pesticide concentrations in Delta waters (i.e., changes in San Joaquin River, Sacramento River and Delta Agriculture source water fractions at various Delta locations, including Banks and Jones pumping plants) is expected to change by a similar degree. As described in Section 5.5.4, *Water Quality,* of the RDEIR/SDEIS, the percent change in monthly average source water fractions would be similar to changes expected under Alternative 4. Modeled changes in the source water fractions of Sacramento River, San Joaquin River, and Delta agriculture water under Alternative 5A would not be of sufficient magnitude to substantially alter beneficial uses of the Delta. Therefore, it is not anticipated that there would be adverse effects on public health related to pesticides from drinking water sources.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in trace metals and pesticide concentrations would not increase substantially in magnitude or frequency in the Delta under Alternative 5A relative to the No Action Alternative (ELT and LLT), there would be no adverse effect on public health as a result of operation of the water conveyance facilities.

CEQA Conclusion: Under Alternative 5A, modeled long-term average pesticide levels in the Delta would be similar to or slightly less that described under Alternative 4 and would not be expected to increase substantially, relative to Existing Conditions, such that beneficial use impairments are made measurably worse. Long-term average bromide concentrations would increase in the South Fork Mokelumne River at Staten Island and decrease at all other assessment locations relative to Existing Conditions. However, there would be an increased frequency of exceedance of the 50 μg/L and 100 μg/L bromide thresholds for protecting against the formation of DBPs in treated drinking water at the South Fork Mokelumne River at Staten Island, Franks Tract, Old River at Rock Slough, Sacramento River at Emmaton, San Joaquin River at Antioch, and Sacramento River at Mallard Island. The effects of Alternative 5A in the LLT in the Delta relative to Existing Conditions would be expected to be similar. There may be higher bromide concentrations in the LLT in the western Delta, but this would be associated with sea level rise, not the project alternative, because the primary source of bromide to the Delta is sea water intrusion. The use of seasonal intakes at Antioch and Mallard Island is largely driven by acceptable water quality, and therefore has historically been opportunistic, and the opportunity to use these intakes would remain. Thus, the increased bromide concentrations would not be expected to adversely affect municipal beneficial uses, or any other beneficial use, at these locations, and therefore would not be expected to contribute substantially to

DBP formation. Operations and maintenance activities under Alternative 5A would not cause a substantial long-term change in DOC concentrations in the Delta, although there would be relatively small increases in long-term average DOC concentrations at some interior Delta locations. However, the increases are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC above levels currently employed, and therefore these increases would not be expected to contribute substantially to DBP formation. Further, there would be predicted improvements in long-term average DOC concentrations at Barker Slough relative to Existing Conditions. Average concentrations of trace metals are not expected to increase substantially under Alternative 5A in the primary source water. Therefore, this alternative is not expected to cause additional exceedances of applicable water quality objectives by frequency, magnitude, and geographic extent that would cause significant impacts on any beneficial uses of waters in the affected environment.

Because there would be no increases in DBPs due to increases in bromide or DOC in Delta surface waters, and because the modeled changes in trace metals and pesticide concentrations would not increase substantially in magnitude or frequency in the Delta with implementation of water supply operations under Alternative 5A relative to Existing Conditions, there would be no significant impact on public health as a result of operation of the water conveyance facilities. No mitigation is required.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

NEPA Effects: As described in Section 4.5.4, *Water Quality*, of this RDEIR/SDEIS, modeling scenarios included assumptions regarding how certain habitat restoration activities would affect Delta hydrodynamics. The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. To the extent that restoration actions would alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of water quality changes due to water conveyance facilities operations and maintenance.

One intake would be constructed and operated under Alternative 5A. Sediment-disturbing activities during construction and maintenance of this intake and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. In-channel construction activities, such as pile driving during the construction of cofferdams at the intakes and pier construction at the barge unloading facilities, which would occur over a period of 5 months, would result in the localized disturbance of river sediment. In addition, maintenance of the single proposed north Delta intakes and the intermediate forebay would entail periodic dredging for sediment removal at these locations. Sediment accumulation in both the northern and southern portion of the expanded Clifton Court Forebay is expected to be minimal in the ELT period as the need for dredging is anticipated to be every 50 years given the design. However, it is anticipated that there may be some sediment accumulation at the inlet structure of the northern portion of Clifton Court Forebay. Therefore, while overall sediment accumulation in this forebay is not expected to be substantial, some dredging may be required at the inlet structure to maintain an even flow path.

Pesticides

Legacy pesticides, such as organochlorines, have low water solubility; they do not readily volatilize and have a tendency to bond to particulates (e.g., soil and sediment), settle out into the sediment, and not be transported far from the source. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree. Therefore, no significant adverse effect on public health would result from construction.

Numerous pesticides are currently used throughout the affected environment. While some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence of their presence in waters affected by SWP and CVP operations (i.e., organophosphate pesticides, such as diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative. Thus, changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. The effects of Alternative 5A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT) would be similar to or slightly less than those described for the Alternative 4. Alternative 5A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides.

Methylmercury

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter 8, Section 8.1.3.9, *Mercury,* in Appendix A of the RDEIR/SDEIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 5A are expected to be small. As described in Section 4.5.4, *Water Quality,* the greatest annual average methylmercury concentration for drought conditions under Alternative 5A would be 0.169 ng/L for the San Joaquin River at Buckley Cove, which would be slightly higher than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases for mercury concentrations relative to the No Action Alternative (ELT) based on long-term annual average concentrations in the Delta. Mercury concentrations in fish tissue expected for Alternative 5A (with Equation 1), show increases of 5 percent or less, relative to the No Action Alternative (ELT), in all modeled years. Mercury concentrations in fish tissue expected for Alternative 5A (with Equation 2), are estimated to be <1 percent relative to the No Action Alternative (ELT), in all modeled years. Because these increases are relatively small, and because it is not apparent that substantive increases are expected throughout the Delta, these estimated changes in mercury concentrations in fish tissue under Alternative 5A are expected to be within the uncertainty inherent in the modeling approach and would not likely be measureable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a discussion of the uncertainty associated with fish tissue estimates of mercury. Therefore, modeled changes in mercury in the Delta and in fish tissues due to operation of Alternative 5A would not be expected to adversely affect public health.

In summary, operation of the water conveyance facilities under Alternative 5A would not alter bioaccumulative pesticide concentrations or mercury concentrations in the Delta such that there would be an effect on public health. As such, there would be no adverse effect.

CEQA Conclusion: Operation of the water conveyance facilities under Alternative 5A is not expected to cause additional exceedance of applicable water quality objectives/criteria by frequency, magnitude, and geographic extent that would cause adverse effects on any beneficial uses of waters in the affected environment. Because mercury concentrations are not expected to increase substantially relative to the Existing Conditions, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury.

The effects of Alternative 5A on bioaccumulative pesticide levels in the Delta would be similar to or slightly less than those described for the Alternative 4. Alternative 5A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree.

For these reasons, there would be no significant impact on public health due to mercury or bioaccumulative pesticides as a result of construction of or operation of the water conveyance facilities under Alternative 5A. No mitigation is required.

Impact PH-4: Expose Substantially More People to Transmission Lines Generating New Sources of EMFs as a Result of the Construction and Operation of the Water Conveyance Facilities

NEPA Effects: The potential for Alternative 5A transmission line construction and operation to expose people to new sources of EMFs would be somewhat smaller relative to Alternative 4 because there would be fewer facilities requiring power (i.e., intakes) under Alternative 5A. As described for Alternative 4, this effect would not be adverse because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or new permanent transmission lines constructed and operated under Alternative 5A.

CEQA Conclusion: The potential for Alternative 5A transmission line construction and operation to expose people to new sources of EMFs would be smaller relative to Alternative 4 because there would be fewer facilities requiring power (i.e., intakes) under Alternative 5A. Under Alternative 5A, the majority of proposed temporary (69 kV and 230 kV) and permanent (230 kV) transmission lines would be located within the rights-of-way of existing transmission lines; any new temporary or permanent transmission lines not within the right-of-way of existing transmission lines would, for the most part, be located in sparsely populated areas generally away from existing sensitive receptors. None of the proposed temporary or permanent transmission lines would be within 300 feet of sensitive receptors. Further, the temporary transmission lines would be removed when construction of the water conveyance facility features is completed, so there would be no potential permanent effects. Therefore, these transmission lines would not substantially increase people's exposure to EMFs. This impact is considered to be less than significant because transmission lines would generally not be located in populated areas or within 300 feet of sensitive receptors and CPUC's EMF design guidelines would be implemented for any new temporary or permanent transmission lines constructed and operated under Alternative 5A. No mitigation is required.

Impact PH-5: Increase in Vector-Borne Diseases as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 10, and 11

Effects of Alternative 5A related to the potential for increase in vector-borne diseases from implementing Environmental Commitments 3, 4, 6, 7, 10, and 11 would be similar to those described for Alternative 4A. However, as described under Section 4.1.4, *Description of Alternative 5A*, Alternative 5A would restore fewer acres of habitat under these Environmental Commitments and, therefore, the potential for vector-borne disease effects under Alternative 5A would likely be less than the potential associated with Alternative 4A.

NEPA Effects: Implementation of portions of Environmental Commitments 3, 4, 6, 7, 10, and 11 under Alternative 5A would involve protecting and restoring wetland and other surface water habitat that could potentially increase suitable mosquito habitat within the study area. This potential effect would not be adverse because the total restoration acreage of these types of habitat implemented under Alternative 5A would generally not be located near densely populated areas, and management plans under Environmental Commitment 11, *Natural Communities Enhancement and Management*, would be implemented in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, of the Draft EIR/EIS, would be incorporated into Alternative 5A and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. This consultation would occur when specific restoration and enhancement projects and locations are identified.

CEQA Conclusion: The potential for impacts related to increases of vector-borne disease from mosquitos during construction, operation, and maintenance of portions of Environmental Commitment 3, 4, 6, 7, 10, and 11 under Alternative 5A is considered less than significant because the total wetland restoration acreage implemented under this alternative would generally not be located near densely populated areas, and management plans under Environmental Commitment 11 *Natural Communities Enhancement and Management*, would be implemented in consultation with the appropriate MVCDs to ensure MMPs are implemented to reduce mosquito breeding. Additionally, BMPs from the guidelines outlined in Appendix 3B, *Environmental Commitments*, of the Draft BDCP EIR/EIS, would be incorporated and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. No mitigation is required.

Impact PH-6: Substantial Increase in Recreationists' Exposure to Pathogens as a Result of Implementing the Restoration Environmental Commitments

Effects of Alternative 5A related to the potential for increase in recreationists' exposure to pathogens from implementing portions of the restoration environmental commitments would be similar to those described for Alternative 4A. However, as described under Section 4.1, *Introduction*, of this RDEIR/SDEIS, Alternative 5A would restore slightly fewer acres of habitat under Environmental Commitments 3, 4, 6, 7, and 9–11 relative to Alternative 4A.

NEPA Effects: The study area currently supports habitat types, such as tidal habitat, upland wetlands, and agricultural lands that produce pathogens as a result of the biological productivity in these areas (e.g., migrating birds, application of fertilizers, waste products of animals). The study area does not currently have pathogen concentrations that rise to the level of adversely affecting beneficial uses of recreation. However, any potential increase in pathogens associated with the proposed habitat restoration and enhancement environmental commitments under Alternative 5A would be localized and within the vicinity of the actual restoration. This localized increase is not expected to be of sufficient magnitude and duration to result in adverse effects on recreationists because these areas would generally not support livestock and most areas would not have public access.

CEQA Conclusion: The potential for an increase in recreationists' exposure to pathogens under Alternative 5A is considered less than significant because of the localized nature of pathogens and because the rapid die-off of pathogens in water would not create sufficient magnitudes of pathogen generation that could affect recreational beneficial uses. No mitigation is required.

Impact PH-7: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Implementing Environmental Commitments 4 and 10

Effects of Alternative 5A related to the potential to mobilize contaminants known to bioaccumulate (pesticides and methylmercury) from implementing portions of the restoration environmental commitments would be similar to those described for Alternative 4A. However, as described in Section 4.1.4, *Description of Alternative 5A*, of this RDEIR/SDEIS, Alternative 5A would restore fewer acres of habitat under Environmental Commitments 4 and 10 relative to Alternative 4A. Therefore, the potential for mobilization of contaminants under Alternative 5A would likely be less than the potential associated with Alternative 4A.

NEPA Effects: The primary concern with habitat restoration regarding constituents known to bioaccumulate is the potential for mobilizing contaminants sequestered in sediments of the newly inundated floodplains and marshes. The mobilization depends on the presence of the constituent and the biogeochemical behavior of the constituent to determine whether it could re-enter the water column or be reintroduced into the food chain. This potential effect would not be adverse because the total tidal and nontidal habitat restoration acreage implemented under Alternative 5A would be relatively small, bioaccumulation of pesticides and/or methylmercury in these restoration areas is not expected to substantially affect public health because of the limited extent of this type of restored habitat under Alternative 5A, the localized nature of pesticide bioaccumulation, and because current OEHHA standards would be enforced. Implementation of Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats.

CEQA Conclusion: The potential for public health impacts related to mobilization of pesticides and methylmercury in habitat restoration areas related to Environmental Commitment s 4 and 10 is considered less than significant because the total tidal and nontidal restoration acreage implemented under Alternative 5A would be relatively small, bioaccumulation of pesticides and/or methylmercury in the these restoration areas is not expected to substantially affect public health because of the limited extent of restored habitat under Alternative 5A, the localized nature of pesticide bioaccumulation, and because current OEHHA standards would be enforced.

Environmental Commitment 12, *Methylmercury Management*, would be implemented to reduce methylmercury production in restored habitats. No mitigation is required.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Any modified reservoir operations under Alternative 5A are not expected to promote *Microcystis* production upstream of the Delta relative to the No Action Alternative (ELT and LLT) since large reservoirs upstream of the Delta are typically low in nutrient concentrations. Further, in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, bloom development would be limited by high water velocity and low hydraulic residence times. These conditions would not be expected to change under Alternative 5A relative to the No Action Alternative (ELT and LLT)

With implementation of water supply operations under Alternative 5A, conditions in the Export Service Areas are not expected to become more conducive to *Microcystis* bloom formation relative to the No Action Alternative (ELT and LLT) because the fraction of water flowing through the Delta that would reach the existing south Delta intakes is not expected to be adversely affected by *Microcystis* blooms.

As indicated in Section 4.5.4, *Water Quality,* of this RDEIR/SDEIS, there was not modeling available that adequately accounted for the effects of operation of the water conveyance facilities and the hydrodynamic impacts of the environmental commitments on long-term average residence times in the Delta for Alternative 5A. Accordingly, the hydrodynamic effects of Alternative 5A on *Microcystis* were determined qualitatively and the effects discussed for the Delta are related entirely to operations and maintenance and not the hydrodynamic effects of the restoration actions. Although there is uncertainty, water supply operations under Alternative 5A are not expected to increase water residence times or ambient water temperatures throughout the Delta, including Banks and Jones pumping plants, relative to the No Action Alternative (ELT and LLT), and therefore Delta waters are not expected to be adversely affected by *Microcystis* blooms.

CEQA Conclusion: Relative to Existing Conditions, operation of the water conveyance facilities under Alternative 5A is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta because large reservoirs upstream are typically low in nutrient concentrations, and high water velocity and low hydraulic residence times in the upstream area limit the development of *Microcystis* blooms.

The potential for *Microcystis* blooms in the Export Service Areas under Alternative 5A would be less than under Alternative 4, but source waters to the south Delta intakes could be affected by *Microcystis* due to an increase in Delta water temperatures associated with climate change and from an increase in water residence times. The impacts from increased water residence times in the Delta would be mostly related to tidal habitat restoration and improvements to the Yolo Bypass, which are assumed to occur separate from Alternative 5A, as well as to climate change and sea level rise. The combined effect of these factors on increasing *Microcystis* in source waters to the south Delta intakes would likely be a greater influence than that of Alternative 5A operations.

Water supply operations under Alternative 5A could result in localized increases in Delta residence times in some locations and decreased residence times in other Delta locations. As indicated in Section 4.5.4, *Water Quality,* of this RDEIR/SDEIS, there is substantial uncertainty regarding the extent that Alternative 5A operations and maintenance would result in a net increase in water residence times relative to Existing Conditions. Regardless of this uncertainty, it is likely that these potential effects under Alternative 5A would be relatively small compared to the combined effects of tidal habitat restoration and Yolo Bypass improvements unrelated to Alternative 5A, and sea level rise and climate change. Climate change in the ELT is expected to result in a 1.3-2.5°F increase in ambient Delta water temperatures relative to Existing Conditions. The combined effects of restoration activities unrelated to Alternative 5A, climate change, and sea level rise on increased water residence time, as well as the effects of climate change on Delta water temperatures, it is possible that *Microcystis* blooms in the Delta would increase in frequency, magnitude, and geographic extent, relative to Existing Conditions. However, although there is considerable uncertainty regarding this impact, the effects on *Microcystis* due to operations under Alternative 5A would be less than significant. No mitigation is required.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing Environmental Commitment 4.

Effects related to *Microcystis* from implementation of Environmental Commitment 4 under Alternative 5A would be the nearly the same as those described for Alternative 4A because the acreages of tidal natural communities restored under this alternative (55 acres) is nearly the same as under Alternative 4A (59 acres).

NEPA Effects**:** Under Alternative 5A, Yolo Bypass Fisheries Enhancement would not occur, unlike under Alternative 4. However, improvements in the Yolo Bypass, as well as restoration of 8,000 acres of tidal habitat, would be implemented under a plan separate and distinct from Alternative 5A (see Section 4.1.4, *Description of Alternative 5A*, of this RDEIR/SDEIS). These activities are assumed to occur under both Alternative 5A and the No Action Alternative. Similar to Alternative 4 (under CM 4), there would be tidal habitat restoration in the Delta under Alternative 5A with implementation of Environmental Commitment 4. However, the 55 acres of tidal habitat restored under this alternative would be substantially fewer than under Alternative 4. As discussed in Section 4.5.4, *Water Quality,* of this RDEIR/SDEIS, implementation of Environmental Commitment 4 under Alternative 5A would have negligible effects in terms of the potential for creating conditions conducive to *Microcystis* bloom in the Delta relative to what could result from the development of 8,000 acres of tidal habitat and improvements in the Yolo Bypass in the ELT, which could increase water temperatures and hydraulic residence times relative to the No Action Alternative (LLT). Therefore, implementation of Environmental Commitment 4 under Alternative 5A would not be adverse because it would not increase *Microcystis* bloom formation.

CEQA Conclusion: Implementation of Environmental Commitment 4 (*Tidal Natural Communities Restoration*) under Alternative 5A would result in 55 acres of tidal restoration within the Delta. This would have a negligible effect on creating conditions conducive to *Microcystis* bloom formation, particularly relative to the development of 8,000 acres of tidal habitat and improvements to the Yolo Bypass in the ELT—activities separate and distinct from Alternative 5A. These activities would create shallow backwater areas that could result in a measureable increase in water temperatures and water residence times in the Delta, and therefore *Microcystis*, relative to Existing Conditions. Thus, implementation of Environmental Commitment 4 under Alternative 5A would be less than significant. No mitigation is required.

4.5.22 Minerals

Impact MIN-1: Loss of Availability of Locally Important Natural Gas Wells as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: Alternative 5A would include the same physical/structural components as Alternative 4, described in Appendix A of this RDEIR/SDEIS. However the number of Sacramento River intakes would be reduced to one located near Clarksburg (Intake 2). There are no producing natural gas wells within the construction footprint, the temporary construction work areas, or the east-west transmission line alignment option.

Because no producing natural gas wells within the construction footprint would be affected, construction of Alternative 5A would not reduce natural gas production in the study area. Alternative 5A would not affect any locally important natural gas wells or result in the loss of any portion of the study area's natural gas production.

CEQA Conclusion: Because no natural gas wells occur in the Alternative 5A water conveyance facility footprint, there would be no change in the number of active natural gas wells or natural gas production. The construction of Alternative 5A would not impact natural gas wells or gas production. No mitigation is required.

Impact MIN-2: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The extent of the construction and permanent footprints of the water conveyance facilities and resulting loss of extraction potential from natural gas fields under Alternative 5A would be the same as described under Alternative 4 in Appendix A of this RDEIR/SDEIS. Constructing the water conveyance facilities would permanently reduce the land surface available for vertical extraction of natural gas from directly underlying gas fields; however most of the affected gas fields could be accessed from other overlying areas. Similarly, effects on potential gas extraction resulting from construction work areas would be small and temporary and would not prevent recovery of natural gas. Therefore, there would be no short- or long-term adverse effect on the potential to extract natural gas as a result of constructing the water conveyance facilities.

CEQA Conclusion: Although the Alternative 5A conveyance facilities would reduce the land surface available for vertical extraction of natural gas from underlying gas fields, the proportion of these gas fields affected would be small (less than approximately 3% of the areal extent of natural gas field areas intersected). Additionally, there would be no substantial loss of existing production or permanent loss of access to the resource because the gas fields would continue to be accessible using conventional or directional drilling techniques. The impact is less than significant because the potential to extract natural gas would not be substantially reduced. No mitigation is required.

Impact MIN-3: Loss of Availability of Locally Important Natural Gas Wells as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation and maintenance of the water conveyance facilities under Alternative 5A would be similar to those under Alternative 4, described in Appendix A of this RDEIR/SDEIS, and would include moving water through the new water conveyance infrastructure and in natural channels. These operations would not cause additional effects on natural gas wells beyond those occurring as a result of constructing the water conveyance facilities. Maintenance of these facilities under Alternative 5A would be similar but slightly greater as discussed for Alternative 4. Operation and maintenance activities would occur on or immediately adjacent to the water conveyance facilities. Accordingly, the operation and maintenance associated with the water conveyance facilities would not restrict access to or use of existing active wells. There would be no adverse effect on natural gas wells from operating or maintaining Alternative 5A.

CEQA Conclusion: The operation and maintenance of water conveyance facilities under Alternative 5A would have no impact on access to natural gas wells because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would occur on or immediately adjacent to the facilities and would not require the abandonment of wells, eliminate access to wells, or reduce natural gas production. Therefore, the impact on natural gas wells would be less-than-significant. No mitigation is required.

Impact MIN-4: Loss of Availability of Natural Gas Fields as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 5A would include moving water through the new water conveyance infrastructure and in natural channels. These operations would not cause additional effects on access to natural gas fields beyond those occurring as a result of constructing the water conveyance facilities. Maintenance of the water conveyance facilities under Alternative 5A would be similar but slightly greater than as discussed for Alternative 4 in Appendix A of this RDEIR/SDEIS. Operation and maintenance activities would occur on or immediately adjacent to the water conveyance facilities and as such would not restrict access to or use of existing natural gas fields. There would be no adverse effect on natural gas fields from operating or maintaining Alternative 5A.

CEQA Conclusion: The operation and maintenance of Alternative 5A water conveyance facilities would have no impact on the access to natural gas fields because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would occur on or immediately adjacent to the facilities. The impact on the availability of natural gas fields is considered less than significant because access to these fields would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-5: Loss of Availability of Locally Important Natural Gas Wells as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–11, 15, and 16

The type of effects on locally important natural gas wells associated with Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16 would be similar to those described for Alternative 4, described in Appendix A of this RDEIR/SDEIS. However, as described under Section 4.1.4.3 of this RDEIR/SDEIS, Environmental Commitments occurring under Alternative 5A would affect much less land within the study area when compared to Alternative 4. Therefore, the magnitude of effects of Alternative 5A on mineral resources within the study area would be much smaller than those disclosed under Alternative 4 in Appendix A of this RDEIR/SDEIS.

NEPA Effects: Because locations for these activities have not been determined, the extent of the effect of implementing restoration actions on locally important natural gas wells can only be estimated. It is anticipated that implementing the environmental commitments under Alternative 5A would result in adverse effects on locally important natural gas wells however to a lesser degree than under Alternative 4 because much less land would be restored. Similar to Alternative 4, natural gas wells located in areas that would be permanently inundated could remain productive with the use of protective cages or platforms. However, for those instances, modification and maintenance of wells may not be cost effective. It is likely that any producing wells in proposed permanent inundation areas would need to be abandoned because modifications to these wells would not be feasible.

The number of active wells directly affected would vary, depending on the specific lands inundated by the environmental commitments. The active wells that would be affected could be maintained in place if they were only seasonally inundated. In permanently flooded areas, the active wells could be replaced using conventional or directional drilling techniques at a location outside the inundation zone to maintain production. The likelihood of this replacement would depend on the availability of land for lease and the cost of the new construction. If a large number of wells had to be abandoned and could not be re-drilled, there could be a locally adverse effect related to permanent elimination of a substantial portion of a county's active natural gas wells. Mitigation Measure MIN-5 is available to address this effect.

Natural gas wells in upland areas could remain operational and unaffected if they are avoided when restoration activities are implemented and access to the gas well can be maintained. Maintaining access to an oil or gas well is defined by DOC as (1) maintaining rig access to the well, and (2) not building over, or in close proximity to, the well (California Department of Conservation, Division of Oil, Gas, and Geothermal Resources 2007).

CEQA Conclusion: Although the number of natural gas wells likely to be affected under Alternative 5A may be a small percentage of the total wells in the study area, and some wells may be relocated using conventional or directional drilling, there is potential to affect a significant number of locally important gas wells. Consequently, this impact is considered significant. Because implementation of Mitigation Measure MIN-5 cannot assure that all or a substantial portion of a county's existing natural gas wells will remain accessible after implementation of this alternative, this impact is significant and unavoidable.

Mitigation Measure MIN-5: Design Environmental Commitments 4 and 10 to Avoid Displacement of Active Natural Gas Wells to the Extent Feasible

During final design of Environmental Commitments 4 and 10, the project proponents will avoid permanent inundation of or construction over active natural gas well sites where feasible to minimize the need for well abandonment or relocation.

Impact MIN-6: Loss of Availability of Extraction Potential from Natural Gas Fields as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: Because locations of restoration actions occurring under Alternative 5A have not been determined, the extent of the effect of implementing these actions on natural gas fields within the project area can only be estimated. It is anticipated that restoration actions occurring under Alternative 5A would result in adverse effects on the potential to extract natural gas from these fields although to a lesser degree than under Alternative 4 because less land would be restored. Similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, some natural gas fields could be permanently inundated resulting in potential losses in production. However, most natural gas fields would still be accessible from outside the inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of inundation and the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low, there remains the potential for a locally adverse effect on access to natural gas fields because the resource may be permanently inundated or otherwise become inaccessible to recovery. Mitigation Measure MIN-6 is available to lessen this effect.

CEQA Conclusion: The areal extent of lands overlying study area natural gas fields that would be inundated as a result of restoration actions cannot be precisely determined because the final locations for these measures have not been established. Most of these natural gas fields would still be accessible from outside inundated areas using either conventional or directional drilling, although feasibility of access would depend on the exact configuration of the restoration sites the availability of adjacent drilling sites. Although the overall extent of affected natural gas fields in the region is low to moderate, there is potential for a locally significant impact on access to natural gas fields if they are permanently covered (inundated) such that the resource cannot be recovered. Implementation of Mitigation Measure MIN-6 would reduce this impact, but not to a less-than-significant level. Because implementation of Mitigation Measure MIN-6 cannot assure that all or a substantial portion of existing natural gas fields will remain accessible after implementation of Alternative 5A, this impact is significant and unavoidable.

Mitigation Measure MIN-6: Design Environmental Commitments 4 and 10 to Maintain Drilling Access to Natural Gas Fields to the Extent Feasible

During final design of actions to offset the impacts of constructing and operating the water conveyance facilities, the project proponents will identify means to maintain access to natural gas fields that could be adversely affect by implementing Environmental Commitments 4 and 10 where feasible. These could include preserving non-inundated lands either over or adjacent to natural gas fields adequate in size to allow drilling to occur. These measures will ensure that drilling access to natural gas fields is maintained to the greatest extent practicable.

Impact MIN-7: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: Because there is no permitted resource extraction mines (including aggregate mines) and no identified MRZs in the Alternative 5A footprint, including within the footprint for the east-west transmission line alignment option, there would be no effect on the availability of aggregate resources.

CEQA Conclusion: Because there are no permitted mines or MRZs in the construction footprint for Alternative 5A, including within the footprint for the east-west transmission line alignment option, there would be no impact. No mitigation is required.

Impact MIN-8: Loss of Availability of Known Aggregate Resources as a Result of Constructing the Water Conveyance Facilities

NEPA Effects: The demand for construction materials, including aggregates and borrow materials for Alternative 5A would be slightly less than Alternative 4 because of the two fewer intakes. The principal demands for construction material would come from the one intake, Clifton Court Forebay pumping plant and associated facilities, the nearly 40 miles of concrete pipeline tunnels, and forebays. Similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, this demand would not result in a substantial depletion of construction-grade aggregate within the six regional aggregate production study areas, would not cause remaining supplies to be inadequate for future development, and would not substantially contribute to the need for the development of new aggregate resources. Accordingly, it would not have an adverse effect on the availability of known aggregate resources or borrow materials over the water conveyance facilities construction period.

CEQA Conclusion: The use of large amounts of construction aggregate over the 9-year construction period would not result in a substantial depletion of construction-grade aggregate from the study area, would not cause remaining supplies to be inadequate for future development, and would not contribute to the need for development of new aggregate sources. Consequently, although a substantial amount of available aggregate material may be used to construct Alternative 5A, the impact on aggregate resources would be less than significant. No mitigation is required.

Borrow is not a defined mineral resource and is usually developed on an as-needed basis. Consequently, the amount of borrow required for this alternative would not be a significant impact. No mitigation is required.

Impact MIN-9: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 5A would include moving water through both the new water conveyance infrastructure and natural channels. Adverse effects would only occur if operations prevented access to a locally important aggregate resource site; this is not expected to occur because there are no aggregate mines or MRZs in the area where Alternative 5A would operate. Accordingly, operation of Alternative 5A would not block access to existing mines or identified MRZs and similar to Alternative 4, described in Appendix A of this RDEIR/SDEIS, there would be no effect. Similarly, routine facilities maintenance activities such as painting, cleaning, and structure repair, landscape maintenance, road work, and periodic replacement of erosion protection on the levees and embankments would occur at or immediately adjacent to water conveyance facilities and would not cover or block access to existing mines or identified MRZs. Accordingly, the operation and maintenance of the water conveyance facilities under Alternative 5A would not have effects on the availability of aggregate resource sites.

CEQA Conclusion: The operation and maintenance of Alternative 5A water conveyance facilities would have no impact on locally important aggregate resources because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would be limited to the water conveyance facilities. The impact on locally important aggregate resources is considered less than significant because access to areas containing these resources would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-10: Loss of Availability of Known Aggregate Resources as a Result of Operation and Maintenance of the Water Conveyance Facilities

NEPA Effects: The operation of the water conveyance facilities under Alternative 5A would include moving water through both the new water conveyance infrastructure and natural channels. Adverse effects would only occur if operations prevented access known aggregate resources; this is not expected to occur because there are no known aggregate resources located in the area where Alternative 5A would operate. Similarly, routine facilities maintenance activities such as painting, cleaning, and structure repair, landscape maintenance, road work, and periodic replacement of erosion protection on the levees and embankments would occur at or immediately adjacent to water conveyance facilities and would not cover or block access known aggregate resources, Accordingly, the operation and maintenance of the water conveyance facilities under Alternative 5A would not have effects on known aggregate resources.

CEQA Conclusion: The operation and maintenance of Alternative 5A water conveyance facilities would have no impact on known aggregate resources because operation and routine maintenance such as painting, cleaning, repairs, levee and landscape maintenance and similar activities would be limited to the water conveyance facilities. The impact on known aggregate resources is considered less than significant because access to areas containing these resources would not be restricted when operation and maintenance of the water conveyance facilities is occurring. No mitigation is required.

Impact MIN-11: Loss of Availability of Locally Important Aggregate Resource Sites (Mines and MRZs) as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: Implementation of environmental commitments beyond water conveyance facilities would have the potential to affect locally important aggregate resource sites are those that would inundate large areas of land. The loss of important aggregate resource sites under Alternative 5A would be similar to that described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the potential for loss of important aggregate resource sites would be less than Alternative 4 because much less land would be restored within the project area and over a much shorter period. Nevertheless, the potential for inundation and loss of this aggregate resource sites would remain under Alternative 5A and is considered an adverse effect. Mitigation Measure MIN-11 is available to reduce this effect.

CEQA Conclusion: As described under Alternative 4, an active mine on Decker Island may fall within the inundation footprints associated with implementing restoration actions associated with tidal natural communities and nontidal marsh. Although less acreage would be restored under Alternative 5A, restoration actions could result in inundation of aggregate resources. Although the impact is expected to be less than under Alternative 4, the potential loss would remain significant impact because it would eliminate the potential to recover aggregate resources. Mitigation Measure MIN-11 is designed to reduce the impact to less than significant.

Mitigation Measure MIN-11: Purchase Affected Aggregate Materials for Use in Project Construction

Please see Mitigation Measure MIN-11 under Impact MIN-11 in the discussion of Alternative 4, described in in Appendix A of this RDEIR/SDEIS.

Impact MIN-12: Loss of Availability of Known Aggregate Resources as a Result of Implementing Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16

NEPA Effects: Restoration actions occurring under Alternative 5A have the potential to reduce the availability of important aggregate resources. When compared to Alternative 4, loss of aggregate resources under Alternative 5A would be less because the total acreage of restoration occurring with the project area would be substantially less. Similar to Alternative 4, described in in Appendix A of this RDEIR/SDEIS, aggregate and riprap would be used for levee, berm, access road, and rock revetment construction, and rock would be placed for erosion control and stability at levee breaches and toe drain earthworks. The amounts of aggregate and riprap necessary for these activities cannot be calculated at this time because of the programmatic nature and general design of the restoration actions. However, the amount needed would be used over a period of years and would be expected to be within the available resources of the study area and adjacent aggregate resource study areas discussed in Section 26.1.2.1, *Aggregate Resources* of the Draft EIR/EIS and identified in Table 26-1. There would be no depletion (loss of availability) of regional aggregate supplies substantial enough to cause remaining supplies to be inadequate for future development or to require development of new aggregate sources to meet future demand. Therefore, the use of aggregate material for the restoration actions under Alternative 5A would not cause an adverse effect on the availability of aggregate resources.

CEQA Conclusion: Restoration actions occurring under Alternative 5A would use small amounts of aggregate for levee, berm, and access road construction, and placement of rock revetments or riprap for erosion control and stability at level breaches and toe drain earthworks. The amounts of aggregate are unknown but would be within the available resources of the study area or adjacent aggregate resource study areas. The impact on known aggregate resources would be less than significant because implementing environmental commitments would not use an amount of aggregate that would cause remaining supplies to be inadequate to meet future demands or require developing new sources. No mitigation is required.

4.5.23 Paleontological Resources

Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result of Construction of Water Conveyance Facilities

Alternative 5A would include the same physical/structural components as Alternative 4, but would include two fewer intakes than Alternative 4 in Appendix A of this RDEIR/SDEIS. The potential for Alternative 5A to affect unique or significant paleontological resources would be similar to the impacts described for Alternative 4 but could include fewer impacts associated with constructing only Intake 2. Construction activities that could result in adverse effects on paleontological resources include excavation for a new intake, new pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an operable barrier at the head of Old River, other water facility components, roads, and borrow sites. The depth, extent, and location of excavation and other ground-disturbing activities vary greatly across the project area would be similar to the description of the extent of impacts on paleontological resources in Alternative 4 and summarized in Table 27-14 in Appendix A of the RDEIR/SDEIS, with the exception of two fewer intakes.

NEPA Effects: The ground-disturbing activities that occur in geologic units sensitive for paleontological resources have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would represent an adverse effect because conveyance facility construction could directly or indirectly destroy unknown paleontological resources in geologic units known to be sensitive for these resources.

The shallow excavation and grading in surficial Holocene deposits that would take place for the construction of roads could be addressed through implementation of Mitigation Measures PALEO-1b and 1d.

Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the surface-related ground disturbance activities associated with Alternative 5A. However, while these measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring activities because they would be conducted deep underground and could not be monitored. Moreover, although boring material could be examined by monitors, such work would be subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

Excavation for a new intake, new pumping plants, new/expanded forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for Alternative 5A would most likely destroy unique or significant paleontological resources and would constitute an adverse effect under NEPA.

***CEQA Conclusion*:** Construction of water conveyance facilities proposed under Alternative 5A could cause the destruction of unique paleontological resources. The ground-disturbing activities associated with Alternative 5A would occur in geologic units sensitive for paleontological resources and could therefore have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact because construction of conveyance facilities could substantially affect geologic formations that have potential to contain unique paleontological resources.

Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels necessary for Alternative 5A would most likely destroy unique or significant paleontological resources in the project area and would potentially cause a significant and unavoidable impact.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1b under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1c under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1d under Impact Paleo-1 in the discussion of Alternative 4 of the DEIR/DEIS.

Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated with the Implementation of Environmental Commitments 3, 4, 6, 7, 8–12, 15, and 16

Ground-disturbing activities associated with restoration actions under Alternative 5A would result in impacts that would be similar in nature to those described under Alternative 4 in Appendix A of this RDEIR/SDEIS. However, the extent of these impacts would be much less than under Alternative 4 because less ground disturbing activity would occur. The conservation and stressor reduction environmental commitments are described in detail in Section 4.1.4.3, *Environmental Commitments*, and include natural communities protection and restoration, tidal natural communities restoration, channel margin enhancement, riparian natural community restoration, vernal pool and alkali seasonal wetland complex restoration, and nontidal marsh restoration. Land disturbing activities would be required to implement each of the conservation and stressor reduction measures.

NEPA Effects: If fossils are present in the project area, they could be damaged during excavation required to implement the conservation and stressor reduction environmental commitments. The greater the extent of excavation, the greater the potential effect, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be an adverse effect.

Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-disturbing environmental commitments. Mitigation Measures PALEO-1a through PALEO-1d would address all deeper ground-disturbing environmental commitments.

CEQA Conclusion: Ground-disturbing activities associated with implementing the conservation and stressor reduction environmental commitments under Alternative 5A could affect paleontological resources. If fossils are present in the project area, they could be damaged during excavation associated with these environmental commitments. The greater the extent of excavation, the greater the potential impact, although even localized excavation could damage or destroy paleontological resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact because construction activities could substantially affect geologic formations that have potential to contain unique paleontological resources.

Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing environmental commitments and Mitigation Measures PALEO-1a through PALEO-1d for all deeper ground-disturbing environmental commitments ensure that unique or significant paleontological resources in the alternative footprint are systematically identified, documented, avoided or protected from damage where feasible, or recovered and curated so they remain available for scientific study and would reduce these impacts to a less-than-significant level.

Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil Material

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or Significant Fossil Remains When Encountered

Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of Alternative 4.

4.5.24 Environmental Justice

As described in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS some of the resource topics were not considered in the assessment of disproportionate impacts on minority or low-income populations. For the reasons described in Section 28.5.3.1, *Issues Not Analyzed in Detail*, these resources were also not evaluated as part of the Alternative 5A environmental justice impact assessment. The resource topics not evaluated for a disproportionate impact on minority or low income populations are geology and seismicity, hazards and hazardous materials, mineral resources, water supply, surface water, groundwater, water quality, soils, fish and aquatic resources, terrestrial biological resources, agricultural resources, recreation, transportation, energy, and paleontological resources.

4.3.24.1 Land Use

The potential impact on minority and low-income populations resulting from changes in land use for Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in Chapter 13, *Land Use*, Section 13.3.3.9 of the Draft EIR/EIS identifies effects caused by incompatibility with local land uses, potential for physical division of established communities, and incompatibility with land use policies, By itself, incompatibility with land use policies is not a physical effect on the environment, and, therefore, does not have the potential to result in a disproportionate effect on a minority or low-income populations. Chapter 13, *Land Use*, Section 13.3.3.9 of the Draft EIR/EIS also addresses the potential for an alternative to result in the relocation of residents, or a physical effect on existing structures, with the consequence that adverse effects on the physical environment would result. The following adverse effects are relevant to this analysis:

Impact LU-2: Conflicts with Existing Land Uses as a Result of Constructing the Proposed Water Conveyance Facility

Impact LU-3: Create Physical Structures Adjacent to and through a Portion of an Existing Community as a Result of Constructing the Proposed Water Conveyance Facility

The extent of land use changes attributable to construction of Alternative 5A that could affect minority and low-income populations would be the same as disclosed for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As discussed in detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS, a disproportionate effect on minority populations would occur because construction of Intake 2 would result in the displacement of residential structures and permanent structures within census blocks where the minority population is greater than 50%.

4.3.24.2 Socioeconomics

The potential impact on minority and low-income communities associated with changes in socioeconomic conditions for Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in in Chapter 13, *Land Use*, Section 13.3.3.9 of the Draft EIR/EIS identified effects on agricultural economics and local employment conditions associated with constructing and operating the water conveyance facility and implementing environmental commitments. These impacts have the potential to disproportionately affect environmental justice populations. The following adverse effects are relevant to this analysis:

Impact ECON-1: Temporary Effects on Regional Economics in the Delta Region during Construction of the Proposed Water Conveyance Facilities

Impact ECON-7: Permanent Regional Economic Effects in the Delta Region during Operation and Maintenance of the Proposed Water Conveyance Facilities

Land use changes that could affect minority and low-income populations for Alternative 5A would be the same as indicated for Alternative 4 because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As discussed in greater detail under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the majority of farm-related employment is represented by minority populations, including those of Hispanic origin, and potentially low-income, loss of agriculture land and loses of associated employment is expected to result in a disproportionate effect on minority populations. While a net increase in employment would occur during construction of the water conveyance facility, it is expected that most new construction jobs would not likely be filled by displaced agricultural workers because the skills required are not comparable. This effect would, therefore, remain adverse because job losses would disproportionately accrue to a minority population.

4.3.24.3 Aesthetics and Visual Resources

The potential impact on minority and low-income communities associated with changes in visual resources for Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in Chapter 17, *Aesthetics and Visual Resources*, Section 17.3.3.9 in the Draft EIR/EIS addresses impacts on aesthetics and visual resources in the study area. The impacts on aesthetics and visual resources have the potential to disproportionately affect environmental justice populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact AES-1: Substantial Alteration in Existing Visual Quality or Character during Construction of Conveyance Facilities

Impact AES-2: Permanent Effects on a Scenic Vista from Presence of Conveyance Facilities

Impact AES-3: Permanent Damage to Scenic Resources along a State Scenic Highway from Construction of Conveyance Facilities

Impact AES-4: Creation of a New Source of Light or Glare That Would Adversely Affect Views in the Area as a Result of Construction and Operation of Conveyance Facilities

Impact AES-6: Substantial Alteration in Existing Visual Quality or Character during Implementation of Environmental Commitments 3, 4, 6, 7, 8–12, 15, and 16

Mitigation Measure AES-1a: Locate New Transmission Lines and Access Routes to Minimize the Removal of Trees and Shrubs and Pruning Needed to Accommodate New Transmission Lines and Underground Transmission Lines Where Feasible

Mitigation Measure AES-1b: Install Visual Barriers between Construction Work Areas and Sensitive Receptors

Mitigation Measure AES-1c: Develop and Implement a Spoil/Borrow and Reusable Tunnel Material Area Management Plan

Mitigation Measure AES-1d: Restore Barge Unloading Facility Sites Once Decommissioned

Mitigation Measure AES-1e: Apply Aesthetic Design Treatments to All Structures to the Extent Feasible

Mitigation Measure AES-1f: Locate Concrete Batch Plants and Fuel Stations Away from Sensitive Visual Resources and Receptors and Restore Sites upon Removal of Facilities

Mitigation Measure AES-1g: Implement Best Management Practices to Implement Project Landscaping Plan

Mitigation Measure AES-5A: Limit Construction to Daylight Hours within 0.25 Mile of Residents

Mitigation Measure AES-4b: Minimize Fugitive Light from Portable Sources Used for Construction

Mitigation Measure AES-4c: Install Visual Barriers along Access Routes, Where Necessary, to Prevent Light Spill from Truck Headlights toward Residences

Mitigation Measure AES-6a: Underground New or Relocated Utility Lines Where Feasible

Mitigation Measure AES-6b: Develop and Implement an Afterhours Low-intensity and Lights off Policy

Mitigation Measure AES-6c: Implement a Comprehensive Visual Resources Management Plan for the Delta and Study Area

The changes in the visual character of the study area that could affect minority and low-income communities under Alternative 5A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As described in detail under Alternative 4, changes in the visual character of the study area would occur as a result of the construction and location of Intake 2, the intermediate forebay, and expanded Clifton Court Forebay, resulting landscape effects left behind from spoil/borrow and RTM areas, the operable barrier and transmission lines.

The change in visual character as a result of the construction of the water conveyance facilities would be evident from the communities of Walnut Grove and Clarksburg, as well as rural residences located along the entire alignment. Because of the concentration of minority and low income populations in these communities as well as along the entire alignment, a change in visual character of the study area would disproportionately affect these populations. For these reasons, although mitigation is available to reduce the severity of these effects, this effect would be adverse.

Similar to Alternative 4, implementing conservation and stressor reduction measures as part of Alternative 5A, would result in impacts on the study area's visual quality and character. However because the precise location of the conservation and stressor reduction measures are unknown, this impact is not carried forward for further analysis of environmental justice effects.

4.3.24.4 Cultural Resources

The potential impact on minority and low-income communities associated with changes to cultural resources Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in Chapter 18, *Cultural Resources*, Section 18.3.5.9 of the Draft EIR/EIS addresses cultural resources in the study area. The impacts on cultural resources have the potential to disproportionately affect minority or low-income populations. The following adverse effects and mitigation measures are relevant to this analysis:

Impact CUL-1: Effects on Identified Archaeological Sites Resulting from Construction of Conveyance Facilities

Impact CUL-2: Effects on Archaeological Sites to Be Identified through Future Inventory Efforts

Impact CUL-3: Effects on Archaeological Sites That May Not Be Identified through Inventory Efforts

Impact CUL-4: Effects on Buried Human Remains Damaged during Construction

Impact CUL-5: Direct and Indirect Effects on Eligible and Potentially Eligible Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-6: Direct and Indirect Effects on Unidentified and Unevaluated Historic Architectural/Built-Environment Resources Resulting from Construction Activities

Impact CUL-7: Effects of Environmental Commitments on Cultural Resources

Mitigation Measure CUL-1: Prepare a Data Recovery Plan and Perform Data Recovery Excavations on the Affected Portion of the Deposits of Identified and Significant Archaeological Sites

Mitigation Measure CUL-2: Conduct Inventory, Evaluation, and Treatment of Archaeological Resources

Mitigation Measure CUL-3: Implement an Archaeological Cultural Resources Discovery Plan, Perform Training of Construction Workers, and Conduct Construction Monitoring

Mitigation Measure CUL-4: Follow State and Federal Law Governing Human Remains If Such Resources Are Discovered during Construction

Mitigation Measure CUL-5: Consult with Relevant Parties, Prepare and Implement a Built Environment Treatment Plan

Mitigation Measure CUL-6: Conduct a Survey of Inaccessible Properties to Assess Eligibility, Determine if These Properties Will Be Adversely Impacted by the Project, and Develop Treatment to Resolve or Mitigate Adverse Impacts

Mitigation Measure CUL-7: Conduct Cultural Resource Studies and Adopt Cultural Resource Mitigation Measures for Cultural Resource Impacts Associated with Implementation of CM2–CM21

The impact that the loss of cultural resources from within the study area could have on minority and low-income populations under Alternative 5A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As discussed in greater detail under Alternative 4, the loss or damage to prehistoric cultural resources would result in a disproportionate effect on Native American populations and potentially other minorities. Despite the required mitigation measures and Native Consultation processes, construction of Alternative 5A is likely to result in adverse effects on prehistoric archaeological resources and human remains because the scale of the construction activities makes avoidance of all eligible resources infeasible. The effect on minority populations that may ascribe significance to cultural resources in the Delta would remain disproportionate even after mitigation because mitigation cannot guarantee that all resources would be avoided, or that effects on affected resources would be reduced. For these reasons this effect would be adverse because the effect would disproportionately accrue to a minority population.

4.3.24.5 Public Services and Utilities

The potential impact on minority and low-income communities associated with changes to the availability of public services and utilities under Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in Chapter 20, *Public Services and Utilities*, Section 20.3.3.9 of the Draft EIR/EIS addresses potential effects on utility infrastructure and public service providers, such as fire stations and police facilities. The following adverse effects on public services and utilities are relevant to the analysis:

Impact UT-6: Effects on Regional or Local Utilities as a Result of Constructing the Proposed Water Conveyance Facilities

Impact UT-8: Effects on Public Services and Utilities as a Result of Implementing the Proposed Environmental Commitments 3, 4, 612, 15, and 16

The impacts on public services and utilities located within the study area that could disproportionately affect minority and low-income populations under Alternative 5A would be the same as indicated disclosed under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As discussed in greater detail under Alternative 4, the impact of constructing the proposed water conveyance facilities on public services and utilities would not result in a disproportionate effect on minority or low income populations because relocation of an existing known utility would affect the entire service area of that utility. This effect would not be anticipated to result in a disproportionate effect on a minority or low-income population.

4.3.24.6 Air Quality and Greenhouse Gas Emissions

Alternative 5A would include the same physical/structural components as Alternative 4, described in Appendix A of this RDEIR/SDEIS, but would include two fewer intakes, similar to Alternative 5. Accordingly, construction emissions generated by Alternative 5 in the Sacramento Metropolitan Air Quality Management District (SMAQMD) would be less than Alternative 4 due to the reduced number of intakes, and would likely range between those generated under Alternatives 4 and 5. See the discussion of Impact AQ-1 under Alternatives 4 and 5. See the discussion of Impact AQ-16 under Alternatives 4 and 5 of the DEIR/DEIS. The following adverse effects and mitigation measure are relevant to this analysis:

Impact AQ-16: Exposure of Sensitive Receptors to Health Threats from Diesel Particulate Matter in Excess of BAAQMD's Chronic Non-Cancer and Cancer Risk Thresholds

Mitigation Measure AQ-14: Relocate Sensitive Receptors to Avoid Excess Cancer Risk

Alternative 4 would not exceed the BAAQMD's chronic non-cancer or cancer thresholds. However, Alternative 5 may expose receptors adjacent to haul routes to heath treats in excess of BAAQMD thresholds (based on modeling conducted for Alternative 1A).

Mitigation Measure AQ-14 would be available to reduce exposure to substantial cancer risk by relocating affected receptors. If a landowner chooses not to accept DWR's offer of relocation assistance, an adverse effect in the form excess cancer risk above air district thresholds would occur. Therefore, this effect would be adverse. If, however, all landowners accept DWR's offer of relocation assistance, effects would not be adverse.

The impacts on air quality during construction of the water conveyance facilities and resulting effects on minority and low-income communities under Alternative 5A would be similar to but less than Alternative 4 due to the decreased number of intakes, and would likely range between those generated under Alternatives 4 and 5 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of less magnitude due to construction of two fewer intakes. As discussed in greater detail under Alternative 4 in Appendix A of this RDEIR/SDEIS, constructing the water conveyance facilities would result in an adverse impact on air quality that would remain adverse after application of mitigation. Given that the construction and restoration and conservation areas along this alignment are proximate to census blocks and block groups where meaningfully greater minority and low-income populations occur, it is expected that generation of criteria pollutants in excess of local air district thresholds would result in a potentially disproportionate effect on minority and low-income populations.

4.3.24.7 Noise

The potential impact on minority and low-income communities associated with noise occurring under Alternative 5A would be the same as described for Alternative 4, but of slightly less magnitude due to construction of only one intake. The discussion of Alternative 4 in Chapter 23, Noise, Section 23.4.3.9 of the Draft EIR/EIS identifies the following adverse effects associated with new sources of noise and vibration that would be introduced into the study area under Alternative 4. The following adverse effects and mitigation measure are relevant to this analysis.

Impact NOI-1: Exposure of Noise-Sensitive Land Uses to Noise from Construction of Water Conveyance Facilities

Impact NOI-2: Exposure of Sensitive Receptors to Vibration or Groundborne Noise from Construction of Water Conveyance Facilities

Impact NOI-4: Exposure of Noise-Sensitive Land Uses to Noise from Implementation of Proposed Environmental Commitments 3, 4, 6, 7, 9, and 10

Mitigation Measure NOI-1a: Employ Noise-Reducing Construction Practices during Construction

Mitigation Measure NOI-1b: Prior to Construction, Initiate a Complaint/Response Tracking Program

Mitigation Measure NOI-2: Employ Vibration-Reducing Construction Practices during Construction of Water Conveyance Facilities

The impacts of noise and vibration generated during construction of the water conveyance facilities and resulting effects on minority and low-income communities occurring under Alternative 5A would be the same as indicated under Alternative 4 in Chapter 28, *Environmental Justice*, of the Draft EIR/EIS because the period of construction, construction methods, and design of the water conveyance facility would be similar between the two alternatives, but of slightly less magnitude due to construction of only one intake. As discussed in greater detail under Alternative 4, constructing the water conveyance facilities would generate nose in exceedance of daytime and nighttime noise standards in areas zoned as sensitive land uses including residential, natural/recreational, agricultural residential, and schools. Similarly, ground borne vibration from impact pile driving would exceed vibration thresholds in areas zoned for residential, including agricultural residential. This effect of noise and vibration generated during construction would remain adverse after application of mitigation. Because the alignment of the water conveyance facility is proximate to census blocks and block groups where meaningfully greater minority and low-income populations occur it is expected that generation of noise and vibration in exceedance of thresholds would result in a potentially disproportionate effect on minority and low-income populations.

Impacts of implementing conservation and stressor reduction components (Environmental Commitments 3, 4, 6, 7, 9–12, 15, and 16) under Alternative 5A would be expected to be similar to impacts of implementing CM2–CM11 under Alternative 4. However, because fewer acres would be restored under Alternative 5A, it is expected that noise and vibration generated would be less when compared to Alternative 4. Nevertheless, it would be difficult to analyze potential disproportionate effects on environmental justice population because similar to CM3–CM11, the location of the conservation and stressor reduction components are not known. However, because of the distribution of minority and low-income populations in the study area, there is a potential for noise and vibration impacts to disproportionately affect these populations.

4.3.24.8 Public Health

Section 4.4.21, *Public Health*, of this RDEIR/EIS, identifies the potential for construction, operation, and maintenance of Alternative 5A to mobilize or increase constituents known to bioaccumulate. The following adverse effects are relevant to this analysis.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

The amount of habitat restoration completed under Alternative 5A would be substantially less than under Alternative 4. One intake would be constructed and operated under Alternative 5A rather than three under Alternative 4. Sediment-disturbing activities during construction and maintenance of the intake and other water conveyance facilities proposed near or in surface waters under this alternative could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury. The effects of Alternative 5A on pesticide levels in surface waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Service Areas relative to Existing Conditions and the No Action Alternative (ELT) would be similar to or slightly less than those described for the Alternative 4. Alternative 5A would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments.

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term resuspension of sediment and an increase in turbidity that may contain elemental or methylated forms of mercury. Please see Chapter 8, Section 8.1.3.9, *Mercury,* in Appendix A of the RDEIR/SDEIS for a discussion of methylmercury concentrations in sediments.

Changes in methylmercury concentrations under Alternative 5A are expected to be small. As described in Section 4.5.4, *Water Quality,* the greatest annual average methylmercury concentration for drought conditions under Alternative 5A would be 0.169 ng/L for the San Joaquin River at Buckley Cove, which would be slightly higher than the No Action Alternative (ELT) (0.168 ng/L). Fish tissue estimates show only small or no increases for mercury concentrations relative to the No Action Alternative (ELT) based on long-term annual average concentrations in the Delta. Mercury concentrations in fish tissue expected for Alternative 5A (with Equation 1), show increases of 5 percent or less, relative to the No Action Alternative (ELT), in all modeled years. Mercury concentrations in fish tissue expected for Alternative 5A (with Equation 2), are estimated to be <1 percent relative to the No Action Alternative (ELT), in all modeled years. Because these increases are relatively small, and because it is not apparent that substantive increases are expected throughout the Delta, these estimated changes in mercury concentrations in fish tissue under Alternative 5A are expected to be within the uncertainty inherent in the modeling approach and would not likely be measureable in the environment. See Appendix 8I, *Mercury*, of the Draft EIR/EIS for a discussion of the uncertainty associated with fish tissue estimates of mercury.

Because some of the affected species of fish in the Delta are pursued during subsistence fishing by minority and low-income populations, this increase creates the potential for mercury-related health effects on these populations. Asian, African-American, and Hispanic subsistence fishers pursuing fish in the Delta already consume fish in quantities that exceed the US Environmental Protection Agency reference dose of 7 micrograms (μg) per day total (Shilling et al. 2010:5). This reference dose is set at 1/10 of the dose associated with measurable health impacts (Shilling et al. 2010:6). The highest rates of mercury intake from Delta fish occur among Lao fishers (26.5 μg per day, Shilling et al. 2010:6). Increased mercury was modeled based upon increases modeled for one species: largemouth bass. These effects are considered unmitigable (see Chapter 8, *Water Quality,* Mitigation Measure WQ-13).

The associated increase in human consumption of mercury caused by these alternatives would depend upon the selection of the fishing location (and associated local fish body burdens), and the relative proportion of different Delta fish consumed. Different fish species would suffer bioaccumulation at different rates associated with the specific species, therefore the specific spectrum of fish consumed by a population would determine the effect of increased mercury body burdens in individual fish species. These confounding factors make demonstration of precise impacts on human populations infeasible. However, because minority populations are known to practice subsistence fishing and consume fish exceeding US EPA reference doses, any increase in the fish body burden of mercury may contribute to an existing adverse effect. Because subsistence fishing is specifically associated with minority populations in the Delta compared to the population at large this effect would be disproportionate on those populations for Alternative 5A. This effect would be adverse.

4.3.24.9 Summary of Environmental Justice Effects under Alternative 5A

Alternative 5A would result in disproportionate effects on minority and low-income communities resulting from land use, socioeconomics, aesthetics and visual resources, cultural resources, noise, air quality, and public health effects. Mitigation and environmental commitments are available to reduce these effects; however, effects would remain adverse. For these reasons, effects on minority and low-income populations would be disproportionate and adverse.

4.5.25 Climate Change

This section is organized differently from the other sections above because analyzing how Alternative 5A would affect the Delta's resiliency and adaptability to climate change is a fundamentally different analysis than those presented in other resource analyses. Whereas the other sections are organized to identify effects of Alternative 5A and how to mitigate any significant impacts, this section's function is to analyze and disclose how Alternative 5A would affect the Delta's resiliency and adaptability to expected climate change. While climate change is already ongoing and would occur under the ELT timeframe, effects of Alternative 5A on the resiliency and adaptability would be greater under LLT conditions as climate change effects are expected to be more pronounced[9]. Nevertheless, an assessment of conditions under the ELT timeframe is provided below.

Alternative 5A would provide resiliency and adaptation benefits over the No Action/No Project alternative for dealing with the combined effect of increases in sea level rise and changes in upstream hydrology. The benefits would be similar to those anticipated under Alternative 4A (see Section 4.3.25, *Climate Change*, of this RDEIR/SDEIS) and are primarily derived from the alternative's dual conveyance structure and location of the north Delta facility, which allow for more flexible water movement and protection from potential salinity intrusion. Alternative 5A would also provide more reliable water supplies and increased flexibility to adaptively manage the Delta so that conditions can be optimized across all Delta water uses and habitat conditions.

In addition to added water management flexibility, Alternative 5A includes several environmental commitments that will improve habitat in certain areas and reduce the effects of stressors. Provided benefits would be similar to those anticipated under Alternative 4A and include expanded habitat options during periods of high or low freshwater inflow, increased habitat connectivity, and potential buffers against rising water temperatures. Alternative 5A would also provide additional adaptability to catastrophic failure of Delta levees. Please refer to Section 4.3.25, *Climate Change*, of this RDEIR/SDEIS for more detailed discussion on anticipated resiliency and adaptation benefits.

As described for Alternative 4A, Alternative 5A would not be anticipated to add resiliency to existing levees; levee fragility would remain high and increase with time as in the No Action/No Project Alternative. Similarly, construction and operation of the proposed water conveyance facilities and implementation of environmental commitments under Alternative 5A would not affect the ability of agencies to implement plans and proactive measures associated with climate change resiliency (see Chapter 29, *Climate Change,* Section 29.7, *Compatibility with Applicable Plans and Policies*, of the Draft EIR/EIS for a discussion of individual plans and policies). Accordingly, the project would be compatible with these federal and state plans to address climate change.

[9] The ELT timeframe is modeled at 2025. The LLT timeframe is modeled at 2060.

4.5.26 Growth Inducement and Other Indirect Effects

4.5.26.1 Direct Growth Inducement

Construction Jobs

Construction of Alternative 2D would require a peak of approximately the same number of workers as those described for Alternative 4 in Chapter 30, *Growth Inducement and Other Indirect Effects*, in the Draft EIR/EIS. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly lower project-related employment effects when compared to Alternative 4. It is estimated that approximately 30 percent of these workers would come from out of state (due to the specialized nature of some of the jobs) and reside temporarily in the vicinity. Given the availability of housing in the project vicinity, out-of-state workers would be readily accommodated by existing housing; therefore the influx of these workers during project construction would not induce substantial new housing development.

Permanent Jobs

Alternative 5A would require permanent operations and maintenance workers, who would be anticipated to live in the Delta region. This number would be similar to those required under Alternative 4. However, under Alternative 5A two fewer intake facilities would be constructed, which would likely result in slightly higher effects on employment effects when compared to Alternative 4. It is likely that this small number of new jobs would readily be filled by the local labor force and would not induce additional growth in the area. Assuming some or all of the jobs were specialized and required workers from outside the local labor pool, given the availability of housing in the project vicinity, these workers would be readily accommodated by existing housing; therefore the influx of these workers during project operation would not induce substantial new housing development.

4.5.26.2 Indirect Growth Inducement Associated with Facility Construction and Operation

Access Roads within the BDCP Plan Area

Construction of Alternative 5A water conveyance facilities will be similar to Alternative 4. Effects of construction of access roads for this alternative would be similar to that described for Alternative 4A under Section 4.3.26.2, of this RDEIR/SDEIS.

Flood Risk Reduction

Actions under Alternative 5A are not anticipated to have any substantial impact or change on potential for flooding within the Plan Area and downstream areas (RDEIR/SDEIS Section 4.4.2. *Surface Water*). Effects of this alternative would be similar to that described for Alternative 4A under Section 4.3.26.2, *Indirect Growth Inducement Associated with Facility Construction and Operation*, of this RDEIR/SDEIS. There is not anticipated to have any indirect effect on growth.

4.5.26.3 Indirect Growth Inducement Potential: Summary of Modeling Results

The following sections highlight changes in SWP and CVP deliveries associated with the BDCP alternatives based on modeling conducted using CALSIM II, focusing on changes in municipal and industrial (M&I) deliveries (also referred to as urban deliveries). Figure 4.4.1-26 in this RDEIR/SDEIS summarizes overall changes in SWP deliveries to both agricultural and M&I contractors for Alternative 5A relative to Existing Conditions (the CEQA baseline) and the No Action Alternative (ELT) (which reflects with sea level rise and climate change (i.e., effects of precipitation and snowpack). Figure 4.4.1-25 in this RDEIR/SDEIS summarizes changes in CVP deliveries under Alternative 5A relative to Existing Conditions as well as the No Action Alternative (ELT).

For purposes of analyzing the project's potential to induce growth, this analysis focuses on the net increase in annual average deliveries; all information on water deliveries presented below is for average annual deliveries in normal hydrologic years. The SWP modeling results reflected in the tables and figures presented in this section include Table A water as well as Article 21 water.[10]

This analysis does not address potential effects of redistribution of SWP water supply among SWP water contractors that might occur from an SWP contract amendment or funding agreements for implementing BDCP, other than as possible multi-year or permanent agricultural to urban water transfer of SWP water. A SWP contract amendment or funding agreement could include provisions for allocating benefits such as a more reliable water supply, to contractors who pay for BDCP and could create the potential for redistributing SWP water. At this time, because a specific SWP amendment or funding agreement has not been developed, it would be too speculative per Section 15145 of the State CEQA Guidelines to evaluate changes in SWP water distribution at this time. If the SWP amendment or agreement, after it is developed, may have potential to have an environmental effect not already contemplated in the Draft EIR/EIS, DWR would prepare additional analysis.

As described in Section 4.1.4., Alternative 5A would include the construction of one new intake, among other facilities and would follow the operational criteria described as Scenario C, including implementation of the Fall X2 standard.

The addition of a new north Delta intake as well as changes to Delta regulatory requirements under Alternative 5A would provide operational flexibility that would allow the SWP and CVP to increase Delta exports. However, inclusion of the Fall X2 standard in Alternative 5A leads to a reduction in deliveries in some cases compared to existing conditions, which does not include the Fall X2 standard. In addition, Alternative 5A and the No Action Alternative (ELT) also assume that there would be an increase in M&I water rights demands north of the Delta, which would increase overall system demands and reduce the amount of CVP water available for export south of the Delta.

[10] Article 21 water is interruptible water allocated under certain conditions. Water supply under Article 21 becomes available only during wet months of the year (December through March). A SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of SWP; therefore not all SWP contractors can take advantage of this additional supply. Article 21 is a section of the contract between DWR and the water contractor that permits delivery of water in excess of delivery of SWP Table A. It is apportioned to contractors that request it in the same proportion as their SWP Table A water. Article 21 water is allocated under certain conditions: (a) SWP's share of San Luis Reservoir is full or projected to fill in the near term; (b) other SWP reservoirs are full or at their storage targets, or conveyance capacity to fill these reservoirs is maximized; (c) releases from upstream reservoirs plus unregulated inflow exceed the water supply needed to meet Sacramento Valley in-basin uses; (d) SWP Table A deliveries are being fully met; and (e) Banks Pumping Plant has spare capacity (California Department of Water Resources 2008b:32,39).

Consequently, in some cases SWP M&I deliveries under Alternative 5A are projected to increase due to increased capacity for Delta exports, while in some cases deliveries are projected to decrease due to inclusion of the Fall X2 standard and increased water rights demands north of Delta.

See Section 4.5.1, *Water Supply*, of this RDEIR/SDEIS, for more detail on changes in Delta exports and SWP and CVP deliveries under Alternative 5A.

Changes in Deliveries to the Hydrologic Regions.

SWP. Alternative 5A would increase deliveries to all hydrologic regions except for Tulare Lake and South Lahontan, which may potentially experience a decrease in deliveries, and the San Joaquin River region, which would experience no change in deliveries. South Coast would realize the largest net increase (between 45.7 and 145.0 TAF) among the regions, and represents 66–77% of the net increase in M&I deliveries. San Francisco Bay represents 11–14% of the increase and Colorado River represents 8–12% of the increase, and Sacramento River represents 1% of the increase. Deliveries to Tulare Lake would range from a decrease of 2% to an increase of 4% and to South Lahontan would range from a decrease 3% to an increase of 6%. For more information, refer to results for Alternative 5 in Table 30-16 in the Draft EIR/EIS.

CVP. Alternative 5A would not change M&I deliveries for the Sacramento River, South Coast, South Lahontan and Colorado River regions because there are no affected CVP contractors located in these regions. Alternative 5A may result in increased or decreased deliveries to the other hydrologic regions depending on whether deliveries are compared to existing conditions, the Early Long Term, or the No Action Alternative. San Francisco Bay is projected to realize the largest potential increase (2.37 TAF) and also the largest decrease (4.92 TAF) among the affected hydrologic regions. For more information, refer to results for Alternative 5 in Table 30-17 in the Draft EIR/EIS.

Alternatives 5A Compared to Existing Conditions, Early Long Term.

SWP. By 2025, average annual total deliveries to all SWP contractors are projected to increase by 8% relative to Existing Conditions at ELT and 3% at LLT. Under Alternative 5A, average annual total south of Delta SWP deliveries as compared to Existing Conditions, would increase (11%) at ELT and would increase (5%) at LLT.

CVP. By 2025, deliveries to all CVP contractors are projected to increase by 2% relative to Existing Conditions at ELT and decrease by up to 1% at LLT. Under Alternative 5A, average annual total south of Delta CVP deliveries as compared to Existing Conditions, would decrease by up to 2% at ELT and by up to 6% at LLT.

Alternatives 5A Compared to No Action Alternative (ELT).

SWP. By 2025, average annual total deliveries to all SWP contractors are projected to increase by 15% relative to the No Action Alternative (ELT). Under Alternative 5A, average annual total south of Delta SWP deliveries as compared to No Action Alternative (ELT), would increase (by about 21%).

CVP. By 2025, total deliveries to all CVP contractors as compared to No Action Alternative ELT are projected to increase by up to 3% relative the ELT and by up to 2% at LLT. Under Alternative 5A, average annual total south of Delta CVP deliveries as compared to No Action Alternative (ELT), would increase by up to 5%.

4.5.27 References

4.5.1 Water Supply

None.

4.5.2 Surface Water

None.

4.5.3 Groundwater

None.

4.5.4 Water Quality

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None.

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None.

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None.

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