Appendix 3I
BDCP Compliance with the 2009 Delta Reform Act

The purpose of this appendix is to explain the requirements in the 2009 Delta Reform Act for incorporating the Bay Delta Conservation Plan (BDCP) into the Delta Plan and enabling the BDCP to be eligible for state funding. This appendix addresses how the BDCP and the accompanying EIR/EIS will meet the Delta Reform Act requirements and guide readers to where this information is contained within the EIR/EIS.[1]

If approved, the BDCP will be incorporated into the Delta Plan and be eligible for state funding once it is (1) approved by the California Department of Fish and Wildlife (CDFW) as a Natural Community Conservation Plan (NCCP), (2) approved as a Habitat Conservation Plan (HCP) by the U.S. Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS], and (3) found by CDFW to meet the requirements of California Water Code section 85320(b), which requires that the EIR for the BDCP comply with CEQA and comprehensively review and analyze particular subjects, as discussed below. CDFW's determinations are subject to appeal to the Delta Stewardship Council (DSC).

3I.1 Approval as an NCCP

Approval as an NCCP requires compliance with California Fish and Game Code Sections 2800 et seq. (the Natural Community Conservation Planning Act [NCCPA]), a review by CDFW and a determination by CDFW that the proposed plan meets the NCCPA requirements. (Cal. Water Code § 85320, subd. (b)(1).)

Chapter 6, Section 6.4.1.2 of the BDCP, "Plan Implementation," describes the regulatory assurances that must be met under the NCCPA. Chapter 1, Section 1.3.3 of the BDCP provides an overview of the NCCPA and describes how the BDCP has been developed to ensure consistency and compliance with the Act. As this section states, the BDCP addresses all the requirements of the NCCPA for aquatic, wetland, and terrestrial covered species of fish, wildlife, and plants and Delta natural communities affected by covered communities.

The specific requirements of the NCCPA and the corresponding sections of the BDCP are listed in Table 1-2 of the BDCP. Titled "Checklist for Natural Community Conservation Planning Act Requirements," this lengthy table lays out in detail the numerous requirements for complying with the NCCPA, and identifies the applicable BDCP sections that address these requirements.

[1] For further discussion on the Delta Reform Act and its relationship to the BDCP, see Appendix 3A, Section 3A.3.3, "Application of the Sacramento-San Joaquin Delta Reform Act," and Chapter 1, Section 1.4.3 of the BDCP, "Relationship to the Delta Reform Act and Delta Plan."

3I.2 Approval as an HCP

The Delta Reform Act also requires that the "BDCP has been approved as a habitat conservation plan pursuant to the federal Endangered Species Act (16 U.S.C. 1531 et seq.)"[2] In particular, section 10 of that act (*id.*, § 1539). The review and determination of compliance with the federal ESA will be conducted by USFWS and NMFS.

3I.2.1 Meeting the Requirements of California Water Code Section 85320(b)(2)

The Delta Reform Act establishes as state policy that the Delta should be managed in support of the co-equal goals of water supply reliability and ecosystem restoration in a manner that acknowledges the evolving nature of the Delta as a place for people and communities. Similarly, the BDCP has been designed as a comprehensive conservation strategy to improve ecological functions of the Delta and improve water supply reliability for the state of California.

California Water Code Section 85320(b)(2) says in summary that the BDCP shall not be incorporated into the Delta Plan and the public funding benefits associated with the BDCP shall not be eligible for state funding unless the BDCP complies with the NCCPA (Division 3, Chapter 10 of the California Fish and Game Code – see discussion above) and complies with CEQA (Division 13 of the California Public Resources Code), including a comprehensive review and analysis of seven specifically listed items in section (b)(2). The seven specific items listed include the following:

(A) reasonable range of flow criteria, rates of diversion, and other operational criteria required for an NCCP, and other operational requirements and flows necessary for recovering the Delta ecosystem and restoring fisheries under a reasonable range of hydrologic conditions, which will identify the remaining water available for export and other beneficial uses;

(B) reasonable range of conveyance alternatives including through-Delta, dual conveyance, and isolated conveyance, and including further capacity and design options of a lined canal, unlined canal, and pipelines;

(C) potential effects of climate change, possible sea level rise up to 55 inches, precipitation changes and runoff patterns on the alternatives and habitat restoration activities considered in the EIR;

(D) potential effects on migratory fish and aquatic resources;

(E) potential effects on Sacramento River and San Joaquin River flood management;

(F) resilience and recovery of the conveyance alternatives in the event of catastrophic loss caused by earthquake or flood or other natural disaster; and,

(G) potential effects of each conveyance alternative on Delta water quality.

The Table 3I-1 provides each of the seven requirements and summarizes how the BDCP meets these requirements. A detailed discussion of how the BDCP EIR/EIS meets each of these follows below.

[2] California Water Code §85320(e).

Table 3I-1. BDCP EIR/EIS Compliance with California Water Code § 85320(b)(2)

California Water Code 85320(b)	BDCP Compliance
Comprehensive review and analysis of a reasonable range of flow criteria, rates of diversion, and other operational criteria required to satisfy the criteria for approval of a natural communities conservation plan, and other operational requirements and flows necessary for recovering the Delta ecosystem and restoring fisheries under a reasonable range of hydrologic conditions, which will identify the remaining water available for export and other beneficial uses.	• BDCP: ○ Chapter 1, *Introduction* (1.1, Table 1.2) ○ Appendix 3A, *Background on the Process of Developing the BDCP Conservation Measures* (3A.7.2.3.7) ○ Chapter 5, *Effects Analysis* • BDCP EIR/EIS: ○ Chapter 2, *Project Objectives and Purpose and Need* (2.3) ○ Chapter 3, *Description of Alternatives* (3.2, 3.2.1.4, 3.2.1.5, 3.2.2, 3.4.1.2, 3.6.4.2) ○ Appendix 3A, *Identification of Water Conveyance Alternatives Conservation Measure 1* (3A.1.4, 3A.8, 3A.8.1, 3A.9, 3A.9.3, 3A.9.4.2, 3A.9.6, 3A.10, 3A.10.2, 3A.10.3, 3A.10.5, Table 3A-15, Table 3A-21) ○ Chapter 5, *Water Supply* (5.2.2, 5.3.1, Figure 5-13, Figure 5-14) ○ Chapter 6, *Surface Water* (6.2) ○ Chapter 7, *Ground Water* (7.2) ○ Chapter 8, *Water Quality* (8.2) ○ Chapter 11, *Fish and Aquatic Resources* (11.2)
Comprehensive review and analysis of a reasonable Range of Delta Conveyance alternatives including: • Through-Delta alternative • Dual Conveyance alternative • Isolated Conveyance alternative • Further Capacity and design options of ○ Lined canal ○ Unlined canal ○ Pipelines	• BDCP EIR/EIS: ○ Chapter 3, *Description of Alternatives* (3.2) ○ Appendix 3A, *Identification of Water Conveyance Alternatives Conservation Measure 1* (3A.1.3, 3A.3.1.1, 3A.3.1.2, 3A.3.1.3, 3A.6, 3A.7, 3A.10.2, 3A.10.3, Table 3A-15)
Comprehensive review and analysis of the potential effects of the following ON the conveyance alternatives and habitat restoration activities considered in the EIR: • Climate change • Possible sea level rise up to 55 inches • Possible changes in total precipitation and runoff patterns	• BDCP EIR/EIS: ○ Climate Change (Ch. 29) ○ Air Quality and Climate Change Appendices
Comprehensive review and analysis of the potential effects on: • Migratory fish • Aquatic Resources	• BDCP: ○ Chapter 5, *Effects Analysis* • BDCP EIR/EIS: ○ Chapter 11, *Fish and Aquatic Resources*
Comprehensive review and analysis of the potential effects on flood management for: • Sacramento River • San Joaquin River	• BDCP EIR/EIS: ○ Chapter 5, *Water Supply* (5.3.3) ○ Chapter 6, *Surface Water* (6.3.1.2, 6.3.1.3, 6.3.2, 6.3.3, 6.3.4, Table 6-7)

California Water Code 85320(b)	BDCP Compliance
	○ Appendix 3D, *Defining Existing Conditions – No Action Alternative – No Project Alternative – and Cumulative Impact Conditions* (Table 3D-A) ○ Appendix 5B, *Responses to Reduced South of Delta Water Supplies* (5B.2.2)
Comprehensive review and analysis of the resilience and recovery of Delta conveyance alternatives in the event of catastrophic loss caused by: • Earthquake • Flood • Other natural disaster	• BDCP: ○ Chapter 6, *Plan Implementation* (6.4.2.2, 6.4.2.2.1–6.4.2.2.5, 6.5.2.2.7) • BDCP EIR/EIS: ○ Appendix 3B, *Environmental Commitments* ○ Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies* ○ Chapter 5, *Water Supply* ○ Appendix 5B, *Responses to Reduced South of Delta Water Supplies* ○ Chapter 6, *Surface Water* (6.3.1–6.3.3) ○ Chapter 9, *Geology and Seismicity* (9.1.1.1.4.1–9.1.1.4.6, 9.2, 9.2.2.4, 9.3, 9.3.1.1, 9.3.3, 9.3.3.2) ○ Chapter 29, *Climate Change*
Comprehensive review and analysis the potential effects of each Delta conveyance alternative on Delta water quality.	• BDCP EIR/EIS ○ Appendix 3B, *Environmental Commitments* (3B.2.1, 3B.2.1.1, 3B.2.1.2) ○ Chapter 8, *Water Quality* (8.3, 8.3.1, 8.3.2.1, 8.3.2.3, 8.3.3, 8.3.4, Table 8-61) ○ Appendix 8C, *Screening Analysis,* Table SA-11 ○ Chapter 11, *Fish and Aquatic Resources* ○ Chapter 14, *Agricultural Resources* ○ Chapter 25, *Public Health*

[a] Alternatives reviewed and analyzed in the EIR/EIS are listed below.
No Action Alternative
Alternative 1A – Dual Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario A)
Alternative 1B – Dual Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario A)
Alternative 1C – Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario A)
Alternative 2A – Dual Conveyance with Pipeline/Tunnel and Five Intakes (15,000 cfs; Operational Scenario B)
Alternative 2B – Dual Conveyance with East Alignment and Five Intakes (15,000 cfs; Operational Scenario B)
Alternative 2C – Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario B)
Alternative 3 – Dual Conveyance with Pipeline/Tunnel and Intakes 1 and 2 (6,000 cfs; Operational Scenario A)
Alternative 4 – Dual Conveyance with Pipeline/Tunnel and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)
Alternative 5 – Dual Conveyance with Pipeline/Tunnel and Intake 1 (3,000 cfs; Operational Scenario C)
Alternative 5A – Isolated Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario D)
Alternative 6B – Isolated Conveyance with East Alignment and Intakes 1–5 (15,000 cfs; Operational Scenario D)
Alternative 6C – Isolated Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario D)
Alternative 7 – Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Enhanced Aquatic Conservation (9,000 cfs; Operational Scenario E)
Alternative 8 – Dual Conveyance with Pipeline/Tunnel, Intakes 2, 3, and 5, and Increased Delta Outflow (9,000 cfs; Operational Scenario F)
Alternative 9 – Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G)

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3I.3 California Water Code Section 85320(b)(2)(A) – Flow Criteria, Rates of Diversion & Operational Criteria

Water Code section 85320 of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP comply with the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq) (CEQA), including a "comprehensive" review and analysis of:

> A reasonable range of flow criteria, rates of diversion, and other operational criteria required to satisfy the criteria for approval of a natural community conservation plan as provided in subdivision (a) of Section 2820 of the Fish and Game Code [the California Natural Community Conservation Planning Act], and other operational requirements and flows necessary for recovering the Delta ecosystem and restoring fisheries under a reasonable range of hydrologic conditions, which will identify the remaining water available for export and other beneficial uses.[3]

If approved, the BDCP would serve as a natural community conservation plan (NCCP) developed in compliance with the NCCPA, as well as a habitat conservation plan (HCP) under the federal Endangered Species Act (ESA). The NCCPA and ESA provide for incidental take of covered species within the 50-year life of the BDCP's permit authorization. The NCCPA and ESA authorizations are expected to determine a maximum incidental take of threatened and endangered species from BDCP covered activities while preventing jeopardy and contributing to recovery and conservation of the covered species. The BDCP's project objectives include ensuring the plan meets the standards for an NCCP by, among other things, preserving, restoring and enhancing aquatic, riparian and associated terrestrial natural communities and ecosystems that support covered species within the BDCP, through conservation, partnerships with local, state and federal agencies, as well as other entities. (See BDCP Chapter 1, Sections 1.1 and 1.3.3 and Table 1-2; EIR/S Chapter 2, Section 2.3; see also BDCP Appendix 3A, Section 3A.7.2.3.7.)

The requirement from Water Code section 85320 pertaining to the comprehensive evaluation of a reasonable range of flows, diversions and operating criteria has been satisfied in part through the portion of the BDCP EIR/EIS alternatives analysis focused on water supply operations. This section of this appendix gives an overview of the evolution and analysis of project alternatives insofar as they deal with water operations, followed by a detailed breakdown of the high points of that analysis, including timing, process, and evaluation of input from the State Water Resources Control Board, the Federal and State agencies, and environmental organizations.

The analysis of operations considers the timing and capacity of water diversions from the Sacramento River watershed and the existing SWP and CVP intakes in the south Delta, and the impacts on covered species and natural communities, as well as water supply. Other, separate aspects of the alternatives analysis consider alternative conveyance alignments. The analyses were used in development of the fifteen action alternatives evaluated in the EIR/EIS.

As explained in Chapter 3 of the EIR/EIS, each of the fifteen BDCP action alternatives proposes to modify existing CVP and SWP Delta water operations to serve the co-equal purposes of accommodating new Delta water conveyance facilities and protecting fish populations and restoring habitat.[4] The existing Delta operations of the CVP and SWP are governed by rules and objectives that

[3] Cal. Water Code § 85320, subd. (b)(2)(A).

[4] See Chapter 3, Section 3.4.1.2.

are described at length in Chapter 3, Section 3.4.1.2; Chapter 5, Sections 5.2.2 and 5.3.1; Chapter 6, Section 6.2; Chapter 7, Section 7.2; Chapter 8, Section 8.2; and Chapter 11, Section 11.2.

These rules and objectives control allowable exports of water, as well as minimum required Delta outflow to protect beneficial uses of Delta water for fish habitat and to meet salinity and water quality objectives. The existing rules are included in the No Action alternative, and are incorporated in the evaluation of the BDCP action alternatives. In addition, a third category of proposed new operational rules (known as "bypass flow rules") for fish protection at the proposed North Delta Intake diversions has been incorporated into the evaluation of each BDCP action alternative.

With this regulatory background and these project objectives in mind, the evaluations conducted by the Lead Agencies with respect to potential alternatives have addressed the following questions in relation to ecosystem restoration and water supply quality and reliability:

- How much Delta inflow can be exported at the south Delta CVP and SWP pumping plants?
- How much Delta inflow can be diverted at the BDCP north Delta intakes?
- How much Delta inflow must be left for Delta outflow?

Appendix 3A of the EIR/EIS describes the comprehensive review and analysis involved in the screening and analysis of potential alternatives leading to the ultimate selection of 15 alternatives to be carried forward for analysis in the EIR/EIS. In particular, Sections 3A.8, 3A.9, and 3A.10 of Appendix 3A summarize the range of flow criteria, rates of diversion, and other operational requirements evaluated as part of the screening process for purposes of meeting regulatory requirements, including those set forth in Section 2820 of the Fish and Game Code (Natural Community Conservation Planning Act) (NCCPA).

3I.4 Water Operations Alternatives Analysis

The analysis for developing the operational alternatives for the EIR/EIS began in 2007 and proceeded alongside the development of the alignment alternatives through the second administrative draft.[5] The operations analysis focused on the following operational issues, and their effects on covered species, as well as water supply quality and availability:

- Diversion criteria for the new North Delta intakes along the Sacramento River
- West Delta outflow criteria
- Summer-fall flow criteria on the San Joaquin River at Vernalis
- Two alternative spring X2 operating assumptions
- Fluctuating Delta salinity
- Flooding Sherman Island
- Preferential diversion on the Sacramento River at Hood versus south Delta diversions
- Increased spring river flows
- Increased spring Delta outflow

[5] See Appendix 3A, Section 3A.8.1.

- Increased Fall X2 Delta Outflow
- Preferred South Delta Diversion
- Fully Isolated Hood Diversion[6]

Pursuant to the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP), which is a conceptual ecosystem and species evaluation process, the Lead Agencies conducted modeling studies and other analysis to refine restoration actions and provide implementation guidance, program tracking, performance evaluation and adaptive management feedback. Based on the DRERIP analysis results, further evaluations were conducted in 2009 to analyze changes in hydrology in the Delta watershed due to climate change and increased sea level rise, salinity, North Delta bypass flows and operations related to tidal operations under low flood conditions, tidal marsh restoration, daily operations, and Delta island consumptive use and drainage. A preliminary Effects Analysis, which developed long-term water operations criteria for both a dual conveyance alternative and an isolated conveyance alternative, was presented to the BDCP Steering Committee in February 2010[7].

In 2010, the State Water Resources Control Board (SWRCB) developed "flow criteria for the Delta ecosystem necessary to protect public trust resources," pursuant to a requirement in the Delta Reform Act (Water Code section 85086). As explained in Appendix 3A, Section 3A.8, the flow criteria suggested the flows that would be needed in the Delta ecosystem if fishery protection were the sole purpose for which its waters were put to beneficial use under existing conditions. The summary determination was presented as 75 percent of unimpaired net Delta outflow for January through June. No other public trust resources or uses were considered in development of these criteria. [8]

In 2009, the Legislature expressed its intent in the Delta Reform Act for the flow criteria developed by the SWRCB to be used in "informing" planning decisions for the BDCP. (See Water Code section 85086[c]_1].) During the EIR/EIS alternatives screening process, as discussed below, the Lead Agencies determined that an alternative based solely on these flow criteria would be infeasible. (See Appendix 3A, Section 3A.9.4.2.) Even so, the flow criteria became the basis for one of three proposed operational conveyance alternatives put forth by environmental organizations in 2011.[9] The flow criteria also served to inform discussion and analysis of an environmental tradeoff if the criteria were imposed: increased Delta outflows under the criteria created the potential for adverse impacts on salmonid survival due to reduced cold water storage releases from Shasta Reservoir.

In addition to the alternative incorporating the State Water Board's flow criteria report, several other potential conveyance operations alternatives also were identified in 2011, two of which involved increases in Delta outflows for the purpose of fish protection and corresponding reductions in diversions. They included the "Enhanced Ecosystem Conveyance Operations" approach developed by the Federal and State Agencies to protect migrating fish and the "Enhanced Spring Delta Outflow" approach, put forth by the State Water Resources Control Board to protect fish and wildlife beneficial uses.[10] These additional alternatives were included in the screening process and have been carried forward for analysis in the EIR/EIS, where they contribute to the Lead Agencies'

[6] Appendix 3A.8.1.
[7] See Appendix 3A, Section 3A.8.
[8] Appendix 3A, Section 3A.9.3.
[9] Appendix 3A, Section 3A.9.
[10] See Appendix 3A, Section 3.A.9. and Chapter 3, Section 3.2.1.4.

"bookend" approach to analyzing alternatives. Under this approach, the EIR/EIS evaluated alternatives that ranged from higher export deliveries at one end, and reduced exports and higher outflows to protect fish species at the lower end.[11]

The bookend approach was consistent with recommendations by the State Water Resources Control Board, which is a responsible agency for CEQA purposes. In its 2009 scoping comments, the State Water Board urged that the BDCP EIR/EIS analyze a broad range of alternative water quality objectives and operational strategies, including reducing exports, to create greater Delta outflows that could be more protective of fish and wildlife.[12]

In 2011, following development of the 2010 flow criteria for the Sacramento-San Joaquin Delta Ecosystem, the State Water Board sent a letter to the Deputy Secretary of the Natural Resources Agency cautioning that the flow criteria do not reflect a balancing of public interest needs for water or other public trust resources, such as the need to manage cold-water resources in reservoirs tributary to the Delta. The letter went on to state, however, that the flow criteria report, along with other agency conclusions, could serve a useful purpose by establishing "one side" of a reasonable range of alternatives. After subsequent communications with DWR, the State Water Board ultimately recommended the "Enhanced Spring Delta Outflow" alternative, which would require outflows representing 55 percent of unimpaired flow. Through modeling, this alternative (Alternative 8 in the EIR/EIS) was shown to increase mean annual Delta outflow by 1.6 million acre feet per year with a corresponding cost to exports of nearly the same amount.[13]

As noted above, the development of operational alternatives involving flow, diversions and other operational criteria proceeded alongside the development of alignment alternatives, which had gone through an initial screening process. In addition, the EIR/EIS process developed a range of capacities for the water facilities.[14] When the range of conveyance operations was combined with the conveyance alignment and capacity alternatives, it resulted in 21 Delta Conveyance Alternatives that then were subjected to the screening criteria in the Second Screening Process. (See Appendix 3A, Section 3A.3.1.4.)

Table 3A-15 of Appendix 3A compares the Second Screening process to the "Range of Alternative Provisions" in the Delta Reform Act. This chart breaks down the text of Water Code Section 85320, subdivision (b)(2)(A) and (B), into discrete measures of consistency and describes how the measures are met in the BDCP EIR/EIS alternatives analysis. It indicates that the alternatives analysis is compliant with the Delta Reform Act provisions pertaining to these measures. [15]

As the discussion that follows indicates, the water operations alternatives analysis included a range of alternative approaches to maximize benefits to the ecosystem while also balancing water supply needs, and was weighted at one end of the range of alternatives with operations scenarios to significantly increase Delta outflows for species protection.

As described in Appendix 3A, the 21 potential alternatives included three alternatives with higher flows for fisheries and lower flows for exports. They included one alternative that employed the "Enhanced Ecosystem Conveyance Operations" alternative proposed by the State and Federal

[11] See Appendix 3A, Section 3A.9 and Chapter 3, Section 3.2.1.4.
[12] Appendix 3A, Section 9.3.
[13] See Appendix 3A, Section 3A.9.3.
[14] See Appendix 3A, Section 3A.9.6.
[15] Table 3A-15 of Appendix 3A.

Agencies, a second encompassing the State Water Board's "Enhanced Spring Delta Outflow" operations alternative, and a third based on criteria as defined by the State Water Board's 2010 flow report for the Delta Ecosystem. (See Chapter 3, Section 3.2.1.5; Appendix 3A, Table 3A-21.) These potential alternatives would reduce Delta exports from their current levels to provide greater outflows for species protection, and thus represent the low end of the alternative range for providing water supplies. (See Appendix 3A, Section 3A.10.2.)

The low-end bookend alternative encompassing criteria as defined by the State Water Board's 2010 flow report for the Delta was eliminated from further analysis through the Second Screening process, as explained in Appendix 3A, Section 3A.10.3. The decision was based on preliminary modeling results presented in a draft report by the State Water Board. Those results indicated the possibility of reductions in cold water pool storage in Trinity Lake, Shasta Lake, Oroville Reservoir, and Folsom Lake that would lead to increased levels of non-compliance with the NMFS Biological Opinion and adverse impacts to salmonids in the Sacramento and Feather rivers as compared to Existing Conditions or No Action Alternative. The preliminary model runs, as discussed in Section 3A.9.4.2, resulted in the possibility of these adverse impacts following the reduction of water available to pre-1914 water rights holders in the Sacramento River basin. This would have the potential to require changes in the legal Sacramento River water rights or water entitlements of third parties other than BDCP permit applicants that are beyond the scope of the regulatory authority of the agencies charged with considering approval of the proposed BDCP (including CDFW, which approves the NCCP, and USFWS and NMFS, which approve the HCP). [16]

In addition, the State Water Board specifically stated in the 2010 report that the report provided an assessment of the flows needed to protect the Delta and its ecological resources, but did not address other public trust considerations. More specifically, the final report states: "Any process with regulatory or adjudicative effect must take place through the State Water Board's water quality control planning, water rights processes, or public trust proceedings in conformance with applicable law." For these reasons, it was determined that, in addition to failing to meet the purpose and need for the BDCP, this alternative was likely to violate federal and state statutes or regulations and was not evaluated in detail as an alternative in the EIR/EIS. (Appendix 3A, Section 3A.10.3.)

By contrast, the other two "low-end bookend" alternatives—the "Enhanced Ecosystem Conveyance Operations" alternative proposed by the State and Federal Agencies and the State Water Board's "Enhanced Spring Delta Outflow"—have been retained among the 15 Action Alternatives as Action Alternatives 7 and 8 and are evaluated in detail in the EIR/EIS.[17] The ultimate inclusion of these two alternatives in the EIR/S serves to create a reasonable range of operations heavily emphasizing the Delta Reform Act's co-equal goal of ecosystem restoration by analyzing the effects of large net Delta outflow increases intended to benefit fisheries.

Eight different water conveyance operational scenarios (A through H) were developed for each of the action alternatives included in the EIR/EIS.[18] The criteria in these scenarios included north Delta diversion bypass flow criteria, south Delta OMR flow criteria, south Delta Export / Inflow Ratio, flow criteria over Fremont Weir into Yolo Bypass, Delta inflow and outflow criteria, Delta Cross Channel gate operations, Rio Vista minimum instream flow criteria, operations for Delta water quality and

[16] Appendix 3A, Section 3A.10.3.
[17] See Appendix 3A, Sections 10.3 and 10.5 and Table 3A-21.
[18] See Chapter 3, Section 3.6.4.2.

residence criteria, and water quality criteria for agricultural and municipal / industrial diversions.[19] Scenario H applies to Alternative 4, the CEQA Preferred Alternative. To address uncertainties involving spring outflow and fall outflow and their relationship to the survival of smelt species, the Delta outflow criteria under Scenario H would be determined based on additional monitoring and research that would support "decision tree" outcomes.[20]

3I.5 California Water Code Section 85320(b)(2)(B) – Reasonable Range of Alternatives

Water Code section 85320, subdivision (b)(2)(B), of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP EIR/EIS comply with the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq) (CEQA), including a "comprehensive" review and analysis of:

> A reasonable range of Delta conveyance alternatives, including through-Delta, dual conveyance, and isolated conveyance alternatives and including further capacity and design options of a lined canal, an unlined canal, and pipelines.

Between 2006 and 2010, the BDCP Steering Committee developed and evaluated a wide range of alternatives related to conveyance and other conservation measures. The BDCP EIR/EIS scoping process occurred in 2008 and 2009, resulting in 1,051 comments related to the development of alternatives. All of this input was compiled to create an initial list of 15 conveyance alternatives to be considered in the first level screening process of the EIR/S. The alternatives included a range of facilities types and alignments: eastern and western alignments, dual conveyance, isolated conveyance, lined and unlined canals, tunnels, pipelines, and various other intake and diversion components.[21]

Appendix 3A, Section 3A.7, provides a detailed summary of the initial screening of the 15 conveyance alternatives, which focused on the legal considerations under CEQA and NEPA. CEQA and NEPA require that an EIR and EIS include a detailed analysis of a reasonable range of alternatives to a proposed project.[22]

The First Level of Screening criteria are listed in Appendix 3A, Section 3A.1.3. The initial screening eliminated eight alternatives on the basis of seismic, navigation, salinity, and water supply concerns, and potential harm to species including entrainment, false attraction and habitat effects. The remaining seven alternatives are listed in Appendix 3A, Section 3A.7. They included three dual conveyance alternatives with new North Delta intakes and continued use of the South Delta intakes – one with a tunnel, one with a lined or unlined western canal, and one with a lined or unlined eastern canal; three isolated conveyance alternatives with new North Delta intakes and abandonment of the existing South Delta intakes – one with a tunnel, one with a lined or unlined western canal, and one with a lined or unlined eastern canal; and a through-Delta alignment alternative.[23]

[19] See Chapter 3, Sections 3.4.1.2 and 3.6.4.2.
[20] See Appendix 3A, Section 3A.10.5.3.
[21] See Appendix 3A, Section 3A.6, for further discussion.
[22] Chapter 3, Section 3.2.
[23] Appendix 3A, Section 3A.7.

As described above, these conveyance alternatives were combined with the eight operations analysis scenarios to create 21 alternatives that were subjected to the Second Screening.[24] Section 3A.1.3 describes in detail the reasons for elimination of seven alternatives, which include alternatives that were duplicative or would fail to meet the purpose of the BDCP and would likely violate federal and state statutes.

Table 3A-15 of Appendix 3A compares the Second Screening process to the "Range of Alternative Provisions" in the Delta Reform Act. As noted above, this chart breaks down the text of Water Code Section 85320, subdivision (b)(2)(A) and (B), into discrete measures and describes how the measures are met in the BDCP EIR/EIS alternatives analysis. It indicates that all of the specific requirements of Section 85320, subdivision (b)(2)(B) involving the "comprehensive review and analysis" of a "reasonable range of Delta conveyance alternatives" were met. The alternatives carried forward for analysis in the EIR/EIS include through-Delta, dual conveyance, and isolated conveyance alternatives, as well as further capacity and design options of a lined canal, an unlined canal, and pipelines.[25]

3I.6 California Water Code Section 85320(b)(2)(C) – Climate Change, Sea Level Rise Impacts On BDCP Alternatives

Water Code section 85320, subdivision (b)(2)(C), of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP EIR/EIS comply with the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq) (CEQA), including a "comprehensive" review and analysis of:

> The potential effects of climate change, possible sea level rise up to 55 inches, and possible changes in total precipitation and runoff patterns on the conveyance alternatives and habitat restoration activities considered in the environmental impact report.

To meet this requirement in the BDCP analyses, potential sea level increases of 6" at 2025 (Early Long Term) and 18" at 2060 (Late Long Term) were evaluated as was a sea level rise of 55" (which is not projected to occur until 2099, but is evaluated consistent with the requirements of California Water Code Section 85320).[26] Best available information suggests a range of potential SLR from 17 to 66 inches (42 to 167 centimeters) by 2100 (National Research Council 2012). Given the inherent variability in anticipated future scenarios, a broad range of potential sea level changes (from 6 to 55 inches) was analyzed. SLR projections for the 2025 and 2060 were developed based on research available during the analysis design and based on the requirements of Water Code Section 85320, which required that BDCP evaluate a sea level rise of 55 inches (well in excess of the expected sea level described by any major study for 2060). The SLR projections used in the BDCP analysis at 2025 and 2060 are consistent with the findings of the NRC and fall within the range of expected SLR that could be extrapolated from the NRC analyses at each analysis time period. The inclusion of additional analysis for 55 inches (140 centimeters) of SLR provides a conservative analysis of potential SLR late in the 21st century.

[24] Appendix 3A, Sections 3A.10.2 and 3A.10.3.

[25] Table 3A-15 of Appendix 3A.

[26] See Chapter 29, Section 29.6.1.1.

Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, further details the specific modeling assumptions used for the BDCP EIR/EIS analysis to address the Water Code requirements, including other climate change effects. Specifically, Section A.7 discusses climate change scenarios.

Appendix 5A also includes in depth explanations of how the modeling assumptions were determined for incorporation in the BDCP modeling analysis.[27] At each long-term BDCP analysis timeline (Early Long-Term: 2025 and Late Long-Term: 2060), five regional climate change projections are considered for the 30-year climatological period centered on the analysis year (i.e., 2011-2040 to represent 2025 timeline). DSM2 model simulations have been developed for each habitat condition and sea level rise scenario that is coincident with the BDCP timeline. New Artificial Neural Networks (ANNs) have been developed based on the flow-salinity response simulated by the DSM2 model. These sea level rise-habitat ANNs are subsequently included in CALSIM II models. The CALSIM II model has been simulated with each of the five climate change hydrologic conditions in addition to the historical hydrologic conditions for the No Project/No Action Alternative and Alternative 1A, to understand the sensitivity of projected operations to the range of climate change scenarios.

Further, Chapter 29 of this EIR/EIS discusses how the BDCP alternatives affect the resiliency and adaptability of the Plan Area (the area covered by the BDCP) to the effects of climate change. In this context, resiliency and adaptability mean the ability of the Plan Area to remain stable or flexibly change, as the effect of climate change increases, in order to continue providing water supply benefits with sufficient water quality and supporting ecosystem conditions that maintain or enhance aquatic and terrestrial plant and animal species. As climate change impacts many other resources areas analyzed in this EIR/EIS, Table 29-1 shows the linkages between these other resources/chapters and potential climate change effects.

Section 29.5.1.3 of Chapter 29 details the potential effects of climate change in the Plan Area including recent local trends, projections through 2100, water temperatures, precipitation and runoff, and sea level rise. This section includes a discussion of three interrelated elements of sea level rise (inundation, salinity gradient and tidal variations) that are relevant to the BDCP analysis. As discussed in Appendix 5A, *BDCP EIR/EIS Modeling Technical Appendix*, several models were used to assess and quantify the effects of SLR on the BDCP alternatives. Figure 29-2 identifies the three primary models used in the analysis, as well as how these models interact to predict tidal variations and other corresponding SLR effects in the Plan Area.

Climate and sea level change are global phenomena that can have unique impacts on local systems. As shown in Figure 29-2, the UnTRIM Bay-Delta Model (MacWilliams et al., 2009), a three dimensional hydrodynamics and water quality model, was used to simulate localized impacts on hydrodynamics and salinity transport in the Delta for a range of selected sea-level scenarios (6 to 55 inches [15 to 140 centimeters]). The results from the UnTRIM model were used to corroborate (adjust coefficients to match) the RMA Bay-Delta Model (RMA 2005) and Delta Simulation Model (DSM2) to correctly simulate tidal marsh restoration effects with and without SLR. Finally, the DWR/ Reclamation CALSIM II planning model was adjusted to match the salinity effects from SLR to simulate CVP and SWP operation over the range of projected hydrologic conditions. Higher Delta outflows were calculated to be required to meet the existing salinity objectives. Please refer to Appendix 29A, *Effects of Sea-Level Rise on Delta Tidal Flows and Salinity*, for additional information on modeling procedures and assumptions.

[27] See Appendix 5A, Section A.7.3.

Potential changes in inundation at high tide as a consequence of 55 inches (140 centimeters) of SLR are shown in Figure 29-1. Figure 29-1 is based on tidal elevation data developed as part of the Delta Risk Management Strategy, Phase 1 (Phase 1 datasets) (California Department of Water Resources). The Phase 1 datasets are projections of floodplain depths as a function of SLR scenarios (including 55 inches [140 centimeters]). Areas shaded in light yellow are at or below the high tide elevation based on the current sea level. Areas shaded in orange are additional areas at or below high tide elevation when a 55 inch (140 centimeters) rise in sea level is considered. Note that the yellow and orange areas are not necessarily inundated due to control structures such as levees. Figure 29-1 provides insight as to which additional areas in the Delta may need to introduce or augment control structures to avoid inundation should mean SLR increase by 55 inches (140 centimeters).

As shown in Figure 29-1, several communities with elevations greater than 17 feet (e.g., Fairfield, Manteca, Tracy, and Brentwood) (5.2 meters) will likely not be directly affected by a 55 inch (140 centimeters)SLR. However, some of the Delta islands and other low lying areas may incur additional inundation risk if 55 inches of SLR were to occur, especially if levees or other control structures were to fail.

Appendix 29B of the EIR/EIS describes climate change effects on hydrology in the study area used for CALSIM modeling analysis. This appendix summarizes projected climate change modeling analyses of surface runoff conditions conducted for Chapter 5, *Water Supply*, and Chapter 6, *Surface Water*. This information was used to support the qualitative analysis of climate change effects on seasonal runoff patterns described in Chapter 29, *Climate Change*, and used throughout the EIR/EIS resource chapters.

Appendix 29C of the EIR/EIS describes climate change and the effects of reservoir operations on water temperatures in the study area. It summarizes projected climate change modeling of water temperature analyses conducted for Chapter 8, *Water Quality*, and Chapter 11, *Fish and Aquatic Resources*. This information was used to support the quantitative analysis of climate change effects on water temperatures described in Chapter 11, *Fish and Aquatic Resources*.

Additionally, the BDCP Chapter 5, *Effects Analysis*, details how climate change was incorporated into the Bay Delta Conservation Plan. Table 5.2.5 of the Effects Analysis describes the analytical conditions of the model scenarios. Section 5.3.4 describes adaptation to climate change. The BDCP will not counter or reverse expected physical trends in climate change. Conservation measures, however, are expected to provide numerous benefits to the Bay-Delta ecosystem, natural communities, and covered species that are anticipated to reduce their vulnerability to the adverse physical and biological effects of climate change. Table 5.3 11 identifies the expected benefits of the Plan for climate change adaptation. For example, increased wetland plant biomass, including belowground production, is expected to help promote accretion and the ability of the marsh to keep pace with sea level rise. Likewise, the tidal wetland restoration will have a wide upland transition area, providing refuge for wetland animals during the extreme high tides that are expected to increase with climate change, as well as opportunities for wetland migration upslope in response to sea level rise.

3I.7 California Water Code Section 85320(b)(2)(D) – Migratory Fish & Aquatic Resources

Water Code section 85320, subdivision (b)(2)(D), of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP EIR/EIS comply with the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq.) (CEQA), including a comprehensive review and analysis of "the potential effects on migratory fish and aquatic resources."

Chapter 11 of the EIR/EIS, Fish and Aquatic Resources, includes an extensive and detailed analysis of the impacts to migratory fish and aquatic resources. The chapter analyzes 20 fish and aquatic species – 11 of which are covered species and 9 of which are non-covered species. Covered fish species are those identified as endangered, threatened, or at risk of being listed as endangered or threatened during the BDCP permit term, for which BDCP will provide conservation and management. The covered fish species analyzed in Chapter 11 include Delta smelt, Longfin smelt, Winter-run Chinook salmon, Spring-run Chinook salmon, Fall-run/Late fall-run Chinook salmon, Steelhead, Sacramento splittail, Green sturgeon, White sturgeon, Pacific lamprey, and River lamprey. The non-covered fish and aquatic species are identified by state or federal agencies as special status or of particular ecological, recreational, or commercial importance. The non-covered fish and aquatic species analyzed in Chapter 11 include striped bass, American shad, largemouth bass, Sacramento–San Joaquin roach, hardhead, Sacramento perch, Sacramento tule perch, threadfin shad and bay shrimp.

The methods used to analyze impacts to covered and non-covered fish and aquatic species in Chapter 11 rely on the models and data included in the BDCP Effects Analysis (Chapter 5 of the BDCP). Chapter 11 references specific sections of the Effects Analysis, including Appendix 5.B, *Entrainment;* Appendix 5.C, *Flow, Passage, Salinity, and Turbidity;* Appendix 5.D, *Contaminants;* Appendix 5.E, *Habitat Restoration; and* Appendix 5.F, *Biological Stressors on Covered Fish.* The Effects Analysis describes how the BDCP will affect ecosystems, natural communities, and covered species, including the covered fish species analyzed in Chapter 11. The Effects Analysis was compiled using an extensive amount of monitoring data, scientific investigation, and analysis of the Delta. The appendices to the Effects Analysis contain a full technical description of all of the methods and results.

The 16 BDCP conservation measures (see Table 3.3 Summary of Proposed BDCP Conservation Measures of All Action Alternatives in Chapter 3, *Description of Alternatives*) that are analyzed for each species under each alternative are treated in 4 distinct categories for purposes of impact analysis. Those categories are as follows:

- Potential impacts resulting from construction and maintenance of Conservation Measure 1 (Conservation Measure 1 provides for the development and operation of a new water conveyance infrastructure and the establishment of operational parameters associated with both existing and new facilities).
- Potential impacts resulting from water operations of Conservation Measure 1.
- Potential impacts resulting from restoration activities (Conservation Measures 2, 4–7, 10 – which are primarily habitat restoration measures that provide for the protection, enhancement and restoration of habitats and natural communities that support covered species).

- Potential impacts resulting from other activities (Conservation Measures 12–19, 21 – which are primarily measures to reduce the direct and indirect adverse effects of other stressors on covered species).

The following conservation measures are not included in the analysis because they would not affect fish and aquatic resources: Conservation Measures 3 (*Natural Communities Protection and Restoration*), 8 (*Grassland Natural Community Restoration*), 9 (*Vernal Pool Complex Restoration),* 11 (*Natural Communities Enhancement and Management)*, and 20 (*Recreational Users Invasive Species Program)*.

3I.7.1 California Water Code Section 85320(B)(2)(E) – Sacramento River and San Joaquin River Flood Management

Water Code section 85320, subdivision (b)(2)(E), of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP EIR/EIS also comprehensively review and analyze the "potential effects on Sacramento River and San Joaquin River flood management." This section of this appendix will explain the EIR/EIS process used in evaluating the effects of the BDCP Action Alternatives in terms of flood management concerns, including reservoir capacity and channel capacity.

Chapter 5 of the EIR/EIS, which addresses water supply issues, discusses at length the "Potential for Abrupt Disruptions of South of Delta Water Supplies" because of flooding events. Section 5.3.3 describes the fragile conditions of the levee system in the Delta. The current system is vulnerable because of the age, materials, and substandard engineering of many levees. The risk of levee failure in the Delta is significant. Levee failure can result from many causes, including the combination of high river inflows, high tide and high winds, seismic events, subsidence, rodent damage, piping, foundation movement, seepage and erosion.

Section 5.3.3 of Chapter 5 also provides in-depth descriptions of the possible scenarios in the event of seismically induced levee failures and flood-related failures. A moderate to strong earthquake could cause simultaneous levee failures on several Delta islands, with resulting island flooding. An earthquake of magnitude 6.7 or greater has a 62 percent probability of occurring in the San Francisco Bay Area before 2032, and could cause 20 or more islands to flood at the same time, according to a study by the Working Group on California Earthquake Probabilities. A breach of one or more levees and the associated island flooding could affect Delta water quality and SWP and CVP operations. The flooding of certain islands could lead to drastic decreases or even complete shutdown of Delta exports to avoid drawing saline water toward the Banks and Jones pumping plants.[28]

Chapter 6 of the BDCP EIR/EIS, *Surface Water*, describes the potential effects of the action alternatives on surface water resources within the Delta, areas upstream of the Delta, and portions of the SWP/CVP Export Service Areas. Quantitative surface water analysis was conducted using the CALSIM II model, a monthly time-step model described in Chapter 5, *Water Supply*, that is used for planning purposes in a comparative manner.[29]

[28] See further extensive discussion in Appendix 5B, Section 5B.2.2.

[29] Chapter 6, Section 6.3.1.2.

The analysis of Flood Management uses monthly outputs from CALSIM II. CALSIM II can provide information about how the CVP/SWP reservoirs would be operated under assumptions developed for BDCP alternatives. The model provides two types of information that can be used as indicators of potentially increased flood risk:

1. Increased upstream storage due to change in storage operations under BDCP alternatives could be interpreted as a reduction in flexibility of real-time operations to capture flood flows.
2. Increased instream flow releases (monthly average flows) during spring months could be interpreted as potential higher peak flows that could exceed channel capacity.

To analyze changes in flood potential related to reservoir storage, a qualitative evaluation was conducted by comparing high storage conditions from October through June (to cover the wettest winters and late spring precipitation events). The analysis evaluates changes in storage for Shasta Lake, Lake Oroville, and Folsom Lake. This portion of the analysis does not evaluate changes in storage for reservoirs on the San Joaquin River because the operations of Millerton Lake were not changed in the alternatives.

To evaluate changes in flood potential within the Sacramento and San Joaquin Rivers, predicted peak monthly flows were compared to channel capacity in the Sacramento River and San Joaquin River reaches. The increase of these flows as compared to flows under the No Action Alternative was compared with the channel capacity at each reach. Although monthly flows simulated in the alternatives did not come close to the channel capacity, even a small increase in peak flows with respect to channel capacity was assumed to point to an increased risk of flooding.[30]

Assumptions for snowfall and rainfall patterns for the alternatives were modified to reflect climate change, which is anticipated to increase surface water runoff from rainfall in winter and early spring and to decrease runoff from snowmelt in late spring and early summer. However, the flood management criteria for maintaining adequate flood storage space in the reservoirs were not modified to adapt to changes in runoff due to climate change because these changes were not defined under the alternatives to achieve the project objectives or purpose and need for the BDCP. The flood management criteria are defined by the U.S. Army Corps of Engineers and DWR; if these agencies modify allowable storage values in the future to respond to climate change, it is anticipated that the surface water flows and related water supply and water quality conditions would change.[31]

Section 6.3.2 of Chapter 6 describes further the methodology used to assess the increased risk of flooding, given that flows simulated with CALSIM II do not exceed flood capacity. Section 6.3.1.3 discusses the analysis of surface water conditions due to construction and operation of conveyance facilities in the Delta. Section 6.3.1.3 notes that temporary construction and long-term operation of facilities within or adjacent to waterways could change surface water elevations or runoffs, and describes the potential for these activities to directly or indirectly affect local surface water resources.

Section 6.3.3 provides in-depth discussion and summary of the environmental consequences analysis for each of the action alternatives and the No Action Alternative, including flood management implications. The discussions describe effects and mitigation for the following impacts:

- Changes in SWP or CVP reservoir flood storage capacity;

[30] Chapter 6, Section 6.3.1.2.

[31] *Id.*

- Changes in Sacramento and San Joaquin River flood flows;
- Change in reverse flow conditions in Old and Middle Rivers;
- Substantial alteration of the existing drainage pattern or substantial increase in the rate or amount of surface runoff in a manner that would result in flooding during construction of conveyance facilities;
- Substantial alteration of the existing drainage pattern or substantial increase in the rate or amount of surface runoff in a manner that would result in flooding during construction of habitat restoration area facilities;
- Creation of runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Exposure of people or structures to a significant risk of loss, injury or death involving flooding due to construction of new conveyance facilities;
- Exposure of people or structures to a significant risk of loss, injury or death involving flooding due to habitat restoration;
- Placement within a 100-year flood hazard area of structures that would impede or redirect flood flows, or be subject to inundation by mudflow; and
- Effects of water transfers on surface water.

The analysis in the Surface Water chapter found that each of the action alternatives resulted in less than significant effects on reservoir capacity and channel capacity in the Sacramento and San Joaquin Rivers (no mitigation required). Where significant impacts were identified for alternatives regarding drainage, runoff patterns and potential exposure and risks to people or structures, mitigation measures were identified. For example, Mitigation Measure SW-4 would require that measures be designed and implemented to reduce runoff and sedimentation. Similarly, Mitigation Measure SW-8 would implement measures to prevent an increase in potential damage from wind-driven waves across expanded open water areas at habitat restoration locations, as well as design and use of other "wind fetch" reduction measures.[32]

The EIR/EIS for the BDCP conducted a Cumulative Impacts analysis that included numerous other projects, programs and policies. A complete list of the projects, programs and policies included in the Cumulative Impacts analysis can be found in Table 3D-A of Appendix 3D. Table 6-7 of Chapter 6 lists the projects considered for the cumulative effects analysis for surface water. Section 6.3.4 of Chapter 6 of the EIR/EIS describes eight potential cumulative impacts related to these other projects that could affect surface water. In each case, implementing these projects in combination with any of the BDCP Alternatives 1A through 9 would not result in a significant cumulative impact.[33]

[32] See Chapter 6, Section 6.3.3 for an alternative-by-alternative description of results from the surface water analysis.

[33] Chapter 6, Section 6.3.4.

3I.8 California Water Code Section 85320(b)(2)(F) – Delta Conveyance Alternatives and Natural Disasters

Water Code section 85320, subdivision (b)(2)(F), of the Delta Reform Act requires that, to be eligible for incorporation into the Delta Plan, the BDCP EIR/EIS comply with the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq) (CEQA), including a comprehensive review and analysis of "the resilience and recovery of Delta conveyance alternatives in the event of catastrophic loss caused by earthquake or flood or other natural disaster."

As discussed above, the Delta levee system is fragile and vulnerable to flooding. Earthquakes, big storms, high winds, high tides, and other causes of levee erosion are all possible risks that could lead to levee failures. Chapter 5 of the EIR/EIS, Appendix 5B, and Appendix 3E provide extensive discussions of these risks.

The EIR/EIS surface water analysis evaluated flood management concerns, as well as surface water conditions due to construction and operation of conveyance facilities in the Delta. Each alternative was studied to determine the potential for causing 10 different flood management impacts (listed above in the preceding subsection). The analysis includes determination of the effects and the mitigation approaches for each alternative.[34] As noted above, the analysis did not find significant impacts to reservoir capacities or river channel capacities for any of the alternatives. Where significant impacts to runoff patterns, drainage, and potential exposure to risks to people or structures, the analysis identified mitigation measures to reduce or prevent effects.[35]

Chapter 9, *Geology and Seismicity*, describes the existing geologic and seismologic conditions and associated potential geologic, seismic and geotechnical hazards in the Sacramento-San Joaquin Delta and Suisun Marsh area. The hazards include surface fault ruptures (Section 9.1.1.4.1), earthquake ground shaking (Section 9.1.1.4.2), liquefaction (Section 9.1.1.4.3), slope instability (Section 9.1.1.4.4), ground failure and seismic-induced soil instability (Section 9.1.1.4.5), and tsunami and seiche risks (Section 9.1.1.4.6). Chapter 9 also sets forth the federal, state, and local regulatory structure for mapping, monitoring, regulating, and managing these public safety concerns. (Chapter 9, Section 9.2.) State and federal design codes will regulate construction of the many structures that are part of the BDCP. These codes and standards establish minimum design and construction requirements, including design and construction of concrete and steel structures, levees, tunnels, pipelines, canals, buildings, bridges and pumping stations. The codes and standards are intended to ensure structural integrity and to protect public health and safety.

The EIR/EIS evaluates the potential effects that could result from project construction, operation, and maintenance, and restoration due to geologic and seismic-related conditions and hazards. The evaluation considers the potential for these hazards to affect the constructed and operational elements of the alternatives and the potential for the elements of the alternatives to increase human health risk and loss of property or other associated risks.[36] DWR has developed geologic and

[34] Chapter 6, Sections 6.3.1–6.3.3.

[35] See Chapter 6, Section 6.3.3 for an alternative-by-alternative description of results from the surface water analysis.

[36] Chapter 9, Section 9.3.

geotechnical information for all of the conveyance alignment alternatives under the supervision of professional engineers.

Seismic and geologic hazards are determined to be adverse under NEPA or significant under CEQA if their related effects pose a substantial risk of damage to structures or pose a substantial human health threat. The criteria used to evaluate significance require analyzing whether site conditions can be overcome through engineering design solutions that reduce the substantial risk to people and structures. The codes and design standards used to regulate the construction of BDCP structures – while not providing an absolute guarantee against damage during a major earthquake – ensure that buildings and structures are designed and constructed so that the substantial risk of loss of property, personal injury, or death due to structure failure or collapse is reduced. The CEQA/NEPA evaluation considers whether conformance with existing codes and standards, and application of accepted, proven construction engineering practices would reduce the substantial risk to people and structures.[37]

Final configuration of the BDCP proposed project will be determined when the CEQA/NEPA review is complete. After certification of the EIR/EIS, the final design of structures will be developed. This process will require additional subsurface geotechnical investigation to identify localized conditions that must be addressed in the final engineering design. Final design of all constructed components will meet the standards listed in Section 9.2.2.4 of Chapter 9, and contained in Appendix 3B. Conceptual Engineering Reports (CERs) were prepared for conveyance alignments that provide further details of design standards related to seismic risk assessments.

Section 9.3.3 of Chapter 9 describes at length the effects of seismic and geologic hazard risks that may result during both construction and operation of the conveyance project features. The following 16 impacts were evaluated for each alternative:

- Loss of property, personal injury or death from structural failure resulting from strong seismic shaking of water conveyance features during construction;
- Loss of property, personal injury or death from settlement or collapse caused by dewatering during construction of water conveyance features;
- Loss of property, personal injury or death from ground settlement during construction of water conveyance features;
- Loss of property, personal injury or death from slope failure during construction of water conveyance features;
- Loss of property, personal injury or death from structural failure resulting from construction-related ground motions during construction of water conveyance features;
- Loss of property, personal injury or death from structural failure resulting from rupture of a known earthquake fault during operation of water conveyance features;
- Loss of property, personal injury or death from structural failure resulting from strong seismic shaking during operation of water conveyance features;
- Loss of property, personal injury or death from structural failure resulting from seismic-related ground failure (including liquefaction) during operation of water conveyance features;

[37] Chapter 9, Section 9.3.1.1.

- Loss of property, personal injury or death from structural failure resulting from landslides and other slope instability during operation of water conveyance features;
- Loss of property, personal injury or death from seiche or tsunami during operation of water conveyance features;
- Ground failure caused by increased groundwater surface elevations from unlined canal seepage as a result of operating the water conveyance features;
- Loss of property, personal injury or death resulting from structural failure caused by rupture of a known earthquake fault at Restoration Opportunity Areas;
- Loss of property, personal injury or death from structural failure resulting from strong seismic shaking at Restoration Opportunity Areas;
- Loss of property, personal injury or death from structural failure resulting from seismic-related ground failure (including liquefaction) beneath Restoration Opportunity Areas;
- Loss of property, personal injury or death from landslides and other slope instability at Restoration Opportunity Areas; and,
- Loss of property, personal injury or death from seiche or tsunami at Restoration Opportunity Areas as a result of implementing the conservation actions.

After the effects for each alternative are identified, the seismic and geologic hazard analysis evaluates whether engineering design solutions could reduce the risks to people and structures, and identifies mitigation measures where necessary. For example, the analysis for Alternative 1A describes how seismically induced strong ground shaking could damage pipelines, tunnels, intake facilities, pumping plants and other facilities and result in the loss of property or personal injury. In an extreme event, an uncontrolled release of water from the damaged conveyance system could cause flooding and inundation of structures. During the final design process, however, measures to address this hazard will conform to applicable design codes, guidelines, and standards. The analysis thus concludes that the hazard would be controlled to a completely safe level. Because the impact would be less than significant, though, no mitigation is required.[38]

In addition to the current risks of flooding and seismic events, the Delta also faces long-term progressive risks of levee failures and diminishing water supply reliability from sea level rise and changes in Delta inflow hydrology driven by climate change. As discussed in Appendix 3E, climate change and its affiliated changes in precipitation patterns could affect the frequency and magnitude of extreme storms and storm-related flooding in the Delta. In addition, rising sea levels are expected to raise water levels in the Delta, placing additional stress on fragile Delta levees. These levees protect not only farmland but maintain hydrodynamic conditions in the Delta.

Chapter 29 discusses climate change, its effects on the Delta and the BDCP, and the analysis of how the BDCP alternatives affect the resiliency and adaptability of the Plan area to climate change impacts. In seeking to address the impacts of climate change, the BDCP alternatives provide important added resilience and adaptability by creating new facility components that will offer options and flexibility in conveying water. Alternative 9 adds additional resiliency to the Delta by strengthening and reinforcing levees critical to the through-Delta conveyance route. Alternatives 1A through 8 provide additional adaptability to catastrophic failure of Delta levees by providing an

[38] Chapter 9, Section 9.3.3.2; see Section 9.3 for further extensive discussions about the geologic and seismic-related hazard analysis for each alternative.

alternate conveyance route around the Delta. If the Delta were temporarily disrupted by levee failure, these alternatives would provide conveyance and interties that would enable continued water deliveries to SWP/CVP contractors and to local and in-Delta water users.

Along with impacts to water supply and water quality, the BDCP addresses changes to ecological conditions in the Delta over time. Chapter 6 of the BDCP revised administrative draft discusses the BDCP's approach to planning for reasonably foreseeable "changed circumstances" that could occur during the course of the implementation of the plan and adversely affect covered species and habitats. Chapter 6, Section 6.4.2.2 lists the following changed circumstances that the Implementation Office will be prepared to respond to:

- Levee failures
- Flooding
- New species listing
- Wildfire
- Toxic or hazardous spills
- Nonnative invasive species
- Climate change

BDCP Chapter 6, Section 6.4.2.2, describes changed circumstances and planned responses, including remedial measures.

In the event of levee failures affecting reserve system lands or conservation measures, the planned response includes remedial actions that will be taken under two types of scenarios: failure of levees constructed as part of the BDCP and failure of non-BDCP levees. BDCP Chapter 6, Section 6.4.2.2.1, describes the planned response. If BDCP levees are breached, the Implementation Office will either repair the damaged levees or undertake other measures to produce at least equivalent benefits for covered species and natural communities affected by the event. In most cases, levees will need to be repaired or replaced to maintain permit compliance. In most cases, levees will need to be repaired or replaced to maintain permit compliance. Remedial measures will include evaluations of the adverse effects, coordination with the responsible flood management entity for repairs, and recovery of costs from the appropriate responsible entity. [39]

In the event of flooding of a restoration site, the planned response includes remedial measures to repair or replace the restoration site once flood waters recede, consistent with the conservation strategy described in Chapter 3 of the BDCP, *Conservation Strategy*, and consistent with any permits acquired for the original permit.[40]

A wildfire will be considered a changed circumstance if it damages or destroys sufficient amounts of vegetation to substantially degrade the intended natural community functions of conservation lands for covered species. The planned response under the BDCP would require the Implementation Office to take a series of remedial measures, including assessments, rehabilitation actions, and the use of erosion control structures and applications such as seeding to protect against rains. The Implementation Office also will implement a post-fire monitoring plan for a two-year period

[39] BDCP Chapter 6, Section 6.4.2.2.1.
[40] BDCP Chapter 6, Section 6.4.2.2.2.

following the fire, and develop and implement a natural community restoration plan to restore natural community functions of the affected areas.[41]

In the event of a toxic or hazardous spill that adversely affects habitat functions for a covered species, the planned response states that all remedial actions implemented by the Implementation Office or other responsible parties will be carried out in a manner consistent with the existing statutory and regulatory frameworks governing cleanup of such spills.[42] BDCP Chapter 6, Section 6.4.2.2 also describes at length the BDCP's planned response in the case of contaminant spills affecting covered species and natural communities from covered activities, including construction activities.

Chapter 6, Section 6.5.2.2.7 discusses the planned response for climate change, which is addressed through the conservation strategy, monitoring and research program, and adaptive management and monitoring program of the BDCP.

3I.9 California Water Code Section 85320(b)(2)(G) – Delta Conveyance Alternatives and Water Quality

Water Code section 85320, subdivision (b)(2)(G) requires the BDCP to comprehensively review and analyze the "The potential effects of each Delta conveyance alternative on Delta water quality."

Chapter 8 of the EIR/EIS, *Water Quality*, describes the surface water quality impacts associated with all BDCP alternatives. The analysis evaluates the potential direct and indirect effects on water quality within the affected environment that would result from implementing each alternative. As described in Chapter 8, Section 8.3, the direct effects analyzed include both temporary construction-related and permanent operations-related effects.

Section 8.3.1 of Chapter 8 describes the methods for analysis. Implementation of the alternatives would result in changes to SWP and CVP facilities and operations, Delta habitats, and Delta hydrodynamics. Implementation of conservation measures also could directly affect water quality positively or negatively at certain locations. The components of the alternatives thus could collectively result in complex water quality changes within the affected environment.

The study area for purposes of the surface water quality assessment is divided into three regions: the Plan Area, including the Yolo Bypass, SWP North Bay Aqueduct Service Area, and Suisun Marsh; Upstream of the Delta, including the Sacramento and San Joaquin River watersheds; and the SWP/CVP Export Service Area (south of the Delta, areas served by the California Aqueduct, Delta Mendota Canal, and South Bay Aqueduct).

The surface water quality impact assessment addresses two key questions:

1. Would implementation of the alternatives result in water quality changes to the Plan Area, Upstream of the Delta, or SWP/CVP Export Service Areas that would result in exceedances of water quality criteria/objectives, or substantially degrade water quality by sufficient frequency,

[41] BDCP Chapter 6, Section 6.4.2.2.4.

[42] BDCP Chapter 6, Section 6.4.2.2.5.

magnitude, and geographic extent so as to cause or substantially contribute to significant adverse effects on the beneficial uses of water in these areas of the affected environment?

2. Would implementation of the alternatives result in beneficial effects on water quality in these areas?[43]

Section 8.3, *Environmental Consequences*, describes in detail the methodologies, models, geographic breakdowns, and constituent-specific considerations used in the assessment. The analysis consists of a combination of both quantitative and qualitative analyses to estimate the changes in water quality attributable to implementation of the alternatives within the three areas of the affected environment. The changes could be significant/adverse, insignificant, or beneficial, depending on the constituent and location.

As described in Appendix 8C, *Screening Analysis*, a constituent screening analysis formed the first portion of the overall analysis of water quality effects. The screening analysis was conducted relative to the effect thresholds of significance for implementing the alternatives. The screening analysis first determined which constituents had no potential to exceed the thresholds of significance and therefore did not warrant further assessment to satisfy NEPA and CEQA. The analysis then identified "constituents of concern" that were further analyzed to assess their potential water quality-related impacts under the alternatives, and to determine which could be assessed qualitatively and which could be assessed quantitatively.

Constituents assessed were identified based on the availability of historical monitoring data, applicable federal water quality criteria or state water quality objectives, inclusion in the state's U.S. EPA-approved Clean Water Act Section 303(d) listing, identification during public scoping comments, and concerns based on professional judgment. This screening analysis evaluated 182 water quality constituents (or classes of constituents). Of these, 110 were determined to have no potential to be adversely affected by the alternatives such that adverse environmental effects would be expected. They were not analyzed further.[44]

Chapter 8, Section 8.3.2.1, explains that further analysis was found to be necessary for 72 constituents.[45] Of these, 15 did not warrant alternative-specific analysis, while one – temperature – is addressed in Chapter 11, Fish and Aquatic Resources. The remaining 56 constituents carried forward for further analysis are listed in Chapter 8, Table 8-61 (some are grouped under single constituent headings; see footnotes to table). The far right column in Table 8-61 shows how these constituents were grouped for purposes of ascertaining environmental consequences for each of the alternatives. For example, several constituents were grouped under "Pesticides and Herbicides." Likewise, the constituents nitrate, nitrite and nitrite-plus-nitrate were grouped as "Nitrate" for the water quality alternatives analysis.

As described in Section 8.3.2.1, both qualitative and quantitative water quality assessments have been conducted to determine the anticipated changes in water quality that may occur throughout the affected environment from implementing each alternative. Constituents that require analysis beyond that of the initial screening and do not behave conservatively (e.g., degrade or are consumed in biochemical processes) within the system were assessed qualitatively. In contrast, constituents that are primarily conserved (i.e., do not change) as they move through the system, such as

[43] Chapter 8, Section 8.3.1.

[44] Chapter 8, Section 8.3.2.1.

[45] See table SA-11, Appendix 8C.

dissolved salts, were evaluated further using quantitative assessments. The quantitative assessments were done via comparisons of modeled scenarios that depict the Existing Conditions, No Action Alternative and the action alternatives.

Section 8.3.2.3 of Chapter 8 describes the effects determinations. The water quality effects of the action or alternative would be adverse (under NEPA) or significant (under CEQA) if implementation of an alternative would result in one of five numbered conditions listed in that section. Section 8.3.2.3 describes these effects assessments in depth.

Section 8.3.3, Effects and Mitigation Approaches, describes, for each of the alternatives, the effects on the various constituents resulting from facilities operations and maintenance, as well as those resulting from implementation of Conservation Measures 2–22, as well as mitigation measures. This lengthy section contains extensive detail for each constituent studied under each alternative. The summaries are broken down by the three geographic areas studied (upstream of the Delta, in the Delta, and the SWP/CVP Export Service Areas).

Additional discussion on water quality-related effects on fish and aquatic resources, human health, and agriculture are addressed in Chapter 11, *Fish and Aquatic Resources*; Chapter 25, *Public Health*; and Chapter 14, *Agricultural Resources*, respectively.

In some cases, impacts in the surface water quality alternatives assessment are determined to be significant and unavoidable. As part of the planning and environmental assessment process, the BDCP proponents have incorporated a number of environmental commitments and best management practices into the BDCP alternatives to avoid or minimize potential adverse effects and potential significant impacts. Appendix 3B, *Environmental Commitments*, lists and describes these environmental commitments. In particular, Section 3B.2.1 of Appendix 3B addresses commitments to partner with Delta municipal, industrial and agricultural water purveyors to develop methods for reducing potential water quality effects from operation of Conservation Measure 1 (CM1). The commitment applies specifically to those water purveyors facing increased financial costs to continue to treat and supply water to acceptable standards where it has been affected by significant increases in bromide, electrical conductivity, and chloride concentrations.

As described in Section 3B.2.1, the assistance provided by BDCP proponents is intended to fully offset any increased treatment or delivery costs attributable to CM1, and may take the form of financial contributions, technical contributions, or partnerships. Assistance for construction or operation of facilities or the procurement of replacement sources will be limited to reasonable, cost-effective solutions. These solutions would be devised by the affected purveyors in consultation with BDCP proponents after thorough investigation and completion of environmental review. This commitment would supplement, not supersede, other commitments set forth in Mitigation Measures WQ-5, WQ-7, and WQ-11, as described in Chapter 8 of the EIR/EIS. Section 3B.2.1.1 of Appendix 3B describes the commitments pertaining to the adverse effects of increased chloride concentrations and electrical conductivity for municipal and agricultural uses. Section 3B.2.1.2 of Appendix 3B describes the commitments pertaining to adverse effects of increased bromide concentrations.

Section 8.3.4 of Chapter 8 addresses the EIR/EIS cumulative analysis for water quality. Water quality conditions upstream of the Delta, in the Delta region, and in the SWP/CVP export service areas of the affected environment are expected to change as a result of past, present, and reasonably foreseeable future projects, population growth, climate change, and changes in water quality regulations. Numerous past, present, and reasonably foreseeable future projects will contribute to the degradation of certain water quality parameters, while others will serve to improve constituent-

specific water quality in certain areas. The potential for cumulative impacts on water quality is assessed for construction-related activities, facilities operations and maintenance, and implementation of Conservation Measures 2–22 for the same geographic scope as analyzed in the Effects and Mitigation section discussed above. Section 8.3.4 contains an extensive constituent-by-constituent discussion of the cumulative analysis of Delta water quality conditions.

3I.10 References

MacWilliams, M. L., F. G. Salcedo, and E. S. Gross. 2009. *Draft San Francisco Bay-Delta UnTRIM Model Calibration Report, Sacramento and Stockton Deep Water Ship Channel 3-D Hydrodynamic and Salinity Modeling Study*. Prepared for US. Army Corps of Engineers, San Francisco District. July.

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