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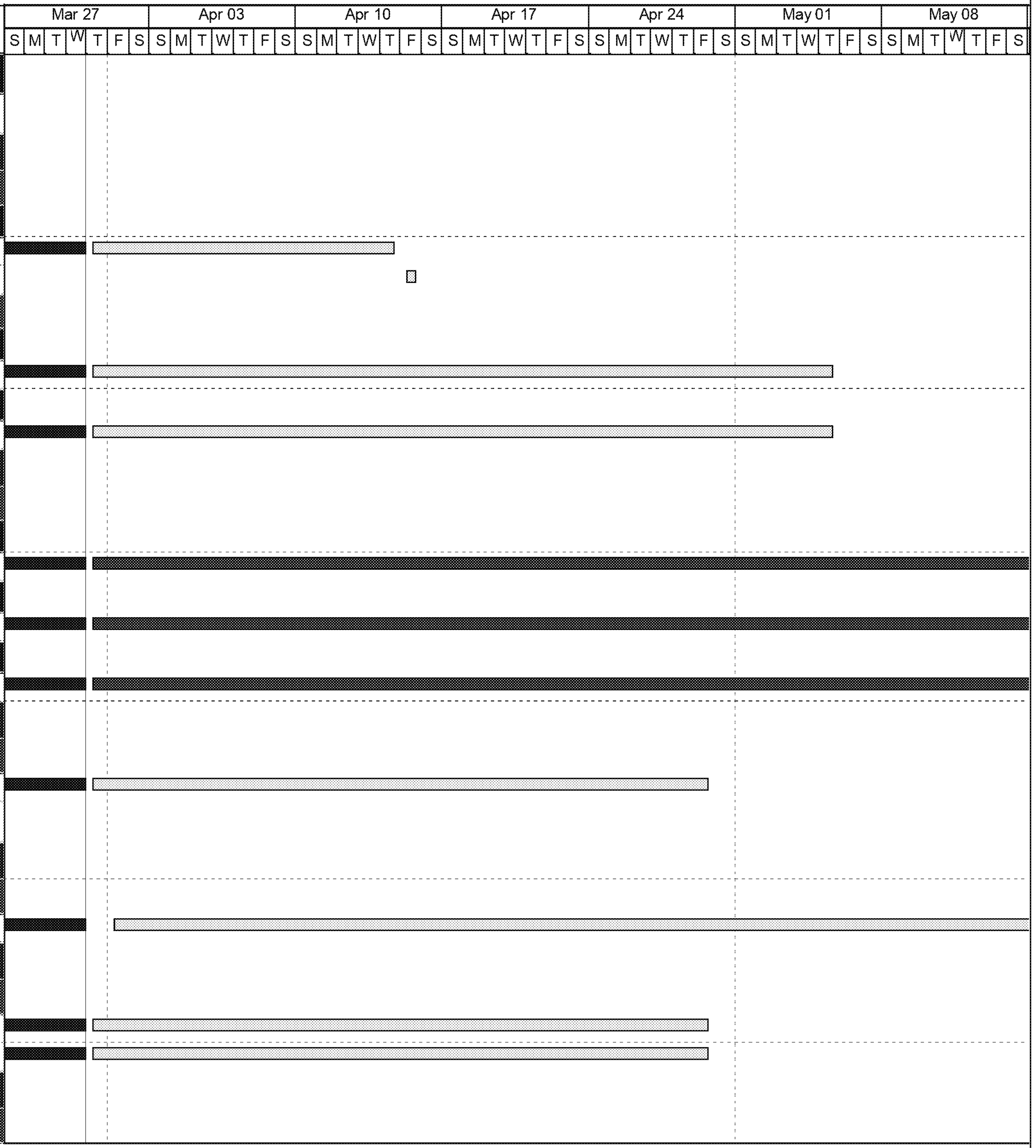
Sites Reservoir Project

4 Week Lookahead

#	Activity ID	Activity Name	Remaining Duration	Start	Finish
1		**Sites Reservoir Project DD: 31-Mar-2022**	695	01-Sep-20 A	30-Dec-24
2		**Geotech Program**	75	01-Mar-21 A	15-Jul-22
3		**Permitting**	26	01-Mar-21 A	05-May-22
4		**Federal Agency Agreements & Permits**	12	02-Aug-21 A	15-Apr-22
5		**SHPO Consultation - Priority 1 Geotech**	12	02-Aug-21 A	15-Apr-22
6	SHPO-240	Prepare SHPO Initiation Package for Priority 1 Geotech	11	02-Aug-21 A	14-Apr-22
7	SHPO-250	Reclamation Submits SHPO Initiation Package for Priority 1 Geotech	1	15-Apr-22	15-Apr-22
8		**State Agency Agreements & Permits**	26	01-Mar-21 A	05-May-22
9		**CVFPB Levee Encroachment - Priority 1 Geotech**	26	01-Nov-21 A	05-May-22
10	CVFPB-100	Prepare CVFPB Permit - Priority 1 Geotech	26	01-Nov-21 A	05-May-22
11		**SWB CWA Section 401 Water Quality Certification - Priority 1 Geotech**	26	01-Mar-21 A	05-May-22
12	401-100	Prepare 401 Application - Geotech	26	01-Mar-21 A	05-May-22
13		**Real Estate**	75	22-Mar-22 A	15-Jul-22
14		**Land Access Agreements**	75	22-Mar-22 A	15-Jul-22
15		**Colusa County**	75	22-Mar-22 A	15-Jul-22
16	LAAC-1100	Colusa Co. Landowners Access Agreements for Geotech Work Pkg #1	75	22-Mar-22 A	15-Jul-22
17		**Yolo County**	75	22-Mar-22 A	15-Jul-22
18	LAAY-1100	Yolo Co. Landowners Access Agreements for Geotech Work Pkg #1	75	22-Mar-22 A	15-Jul-22
19		**Glenn County**	75	22-Mar-22 A	15-Jul-22
20	LAAG-1100	Glenn Co. Landowners Access Agreements for Geotech Work Pkg #1	75	22-Mar-22 A	15-Jul-22
21		**Geotechnical Engineering**	22	07-Mar-22 A	29-Apr-22
22		**Key Deliverables**	22	07-Mar-22 A	29-Apr-22
23	KD-2000	Early Evaluation Geotech Investigations & Report	22	07-Mar-22 A	29-Apr-22
24		**Overall Project**	695	01-Sep-20 A	30-Dec-24
25		**Planning**	194	01-Sep-20 A	09-Jan-23
26		**NAHC/Local Tribes AB 52 Consultation**	194	01-Sep-20 A	09-Jan-23
27	STA-120	NAHC/Local Tribes AB 52 Consultation	194	01-Sep-20 A	09-Jan-23
28		**Reservoir Operations & Modeling**	22	01-Nov-20 A	29-Apr-22
29		**BA/ITP Modeling**	22	01-Nov-20 A	29-Apr-22
30	OP-450	BA/ITP Modeling Support	22	01-Nov-20 A	29-Apr-22
31	OP-360	Appendices for BA/ITP	22	01-Apr-21 A	29-Apr-22
32		**Project Agreements & Funding**	338	01-Jun-21 A	31-Jul-23
33		**Inter-Agency Agreements**	338	01-Jun-21 A	31-Jul-23



▬ Remaining Level of Effort	▭ Remaining Work
▬ Actual Level of Effort	▨ Critical Remaining Work
■ Actual Work	◆ ◆ Milestone

Project ID: Sites April 2022 / Project Name: Sites Reservoir Project DD: 31-Mar-2022
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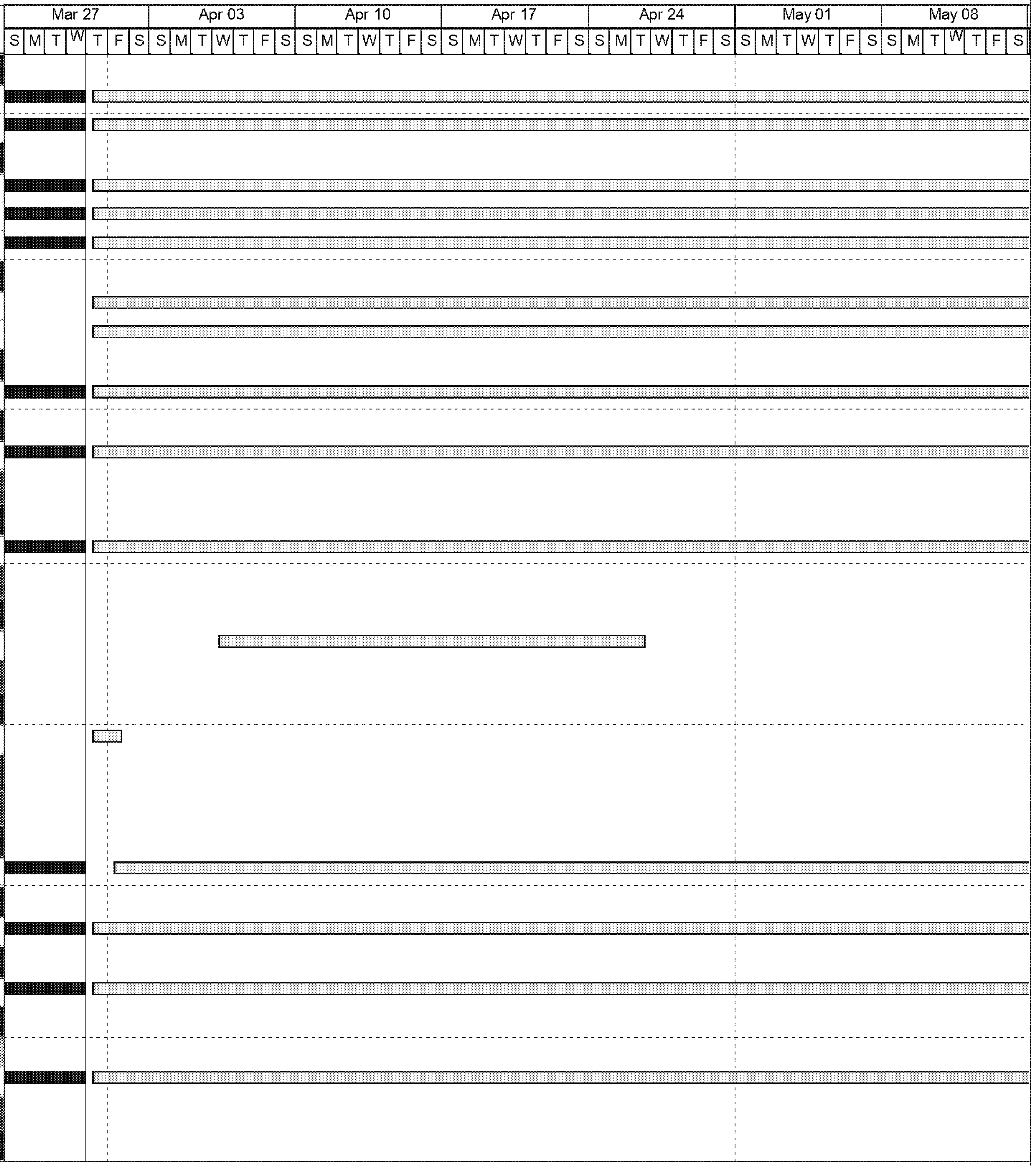
4 Week Lookahead

#	Activity ID	Activity Name	Remaining Duration	Start	Finish
34		**Benefits & Obligations Contract with Participants**	190	01-Mar-22 A	30-Dec-22
35	BO-1100	Finalize Guiding Principles	65	01-Mar-22 A	30-Jun-22
36	BO-1200	Finalize Plan of Finance	190	01-Mar-22 A	30-Dec-22
37		**Facility Use Agreements**	332	27-Aug-21 A	21-Jul-23
38	FO-1020	Final TCCA Facility Use Agreement	332	27-Aug-21 A	21-Jul-23
39	FO-1030	Final GCID Facility Use Agreement	332	27-Aug-21 A	21-Jul-23
40	FO-1040	Final CBD Facility Use Agreements	332	27-Aug-21 A	21-Jul-23
41		**Agreements for Administration of Public Benefits**	338	31-Mar-22	31-Jul-23
42	PB-1100	Develop & Execute Agreement for Administration of Public Benefits with DWR	338	31-Mar-22	31-Jul-23
43	PB-1200	Develop & Execute Agreement for Administration of Public Benefits with CDFW	338	31-Mar-22	31-Jul-23
44		**Federal Funding Committment**	71	07-Feb-22 A	11-Jul-22
45	WIIN-1150	Reclamation Submits OMB Addendum to Policy Office	71	07-Feb-22 A	11-Jul-22
46		**US Bureau of Reclamation Warren Act**	318	01-Jun-21 A	30-Jun-23
47	FED-090	Final Warren Act Contract (Ali, JP)	318	01-Jun-21 A	30-Jun-23
48		**Federal Funding**	108	17-Jan-22 A	31-Aug-22
49		**WIIN Act FAA**	108	17-Jan-22 A	31-Aug-22
50	WIIN-1120	Review by Bureau of Reclamation	108	17-Jan-22 A	31-Aug-22
51		**State Funding (Water Storage Investment Program, WSIP)**	15	06-Apr-22	26-Apr-22
52		**WSIP Early Funding Administration**	15	06-Apr-22	26-Apr-22
53	WSIP-1210	WSIP Quarterly Report (Period Jan 1, 2022 through March 31, 2022)	15	06-Apr-22	26-Apr-22
54		**Local Funding**	2	31-Mar-22	01-Apr-22
55		**Authority Board (Dues)**	2	31-Mar-22	01-Apr-22
56	AB-2100	2022 Invoice Due Date 4/1/2022	2	31-Mar-22	01-Apr-22
57		**Permitting**	256	04-Jan-21 A	04-Apr-23
58		**Federal Agency Agreements & Permits**	256	11-Jan-21 A	04-Apr-23
59		**Clean Water Act Section 404**	255	04-Feb-21 A	04-Apr-23
60	404-050	Prepare Draft 404 Application	255	04-Feb-21 A	04-Apr-23
61		**Advisory Council on Historic Preservation NHPA Section 106**	100	14-Mar-22 A	19-Aug-22
62	106-081	Prepare Final PA	100	14-Mar-22 A	19-Aug-22
63		**USFWS & NMFS Endangered Species Act Section 7**	45	11-Jan-21 A	02-Jun-22
64	BA-200	Prepare Draft BA	45	11-Jan-21 A	02-Jun-22
65		**USFWS Bald Eagle Protection Act**	85	03-Jan-22 A	29-Jul-22
66		**Short Term Permit**	85	03-Jan-22 A	29-Jul-22
67	USFWS-110	Prepare Short Term Permit Application	85	03-Jan-22 A	29-Jul-22
68		**State Agency Agreements & Permits**	256	04-Jan-21 A	04-Apr-23
69		**Central Valley Flood Protection Board (CVFPB) Levee Encroachment**	136	13-Dec-21 A	13-Oct-22



▬ Remaining Level of Effort
▬ Actual Level of Effort
▬ Actual Work
▭ Remaining Work
▨ Critical Remaining Work
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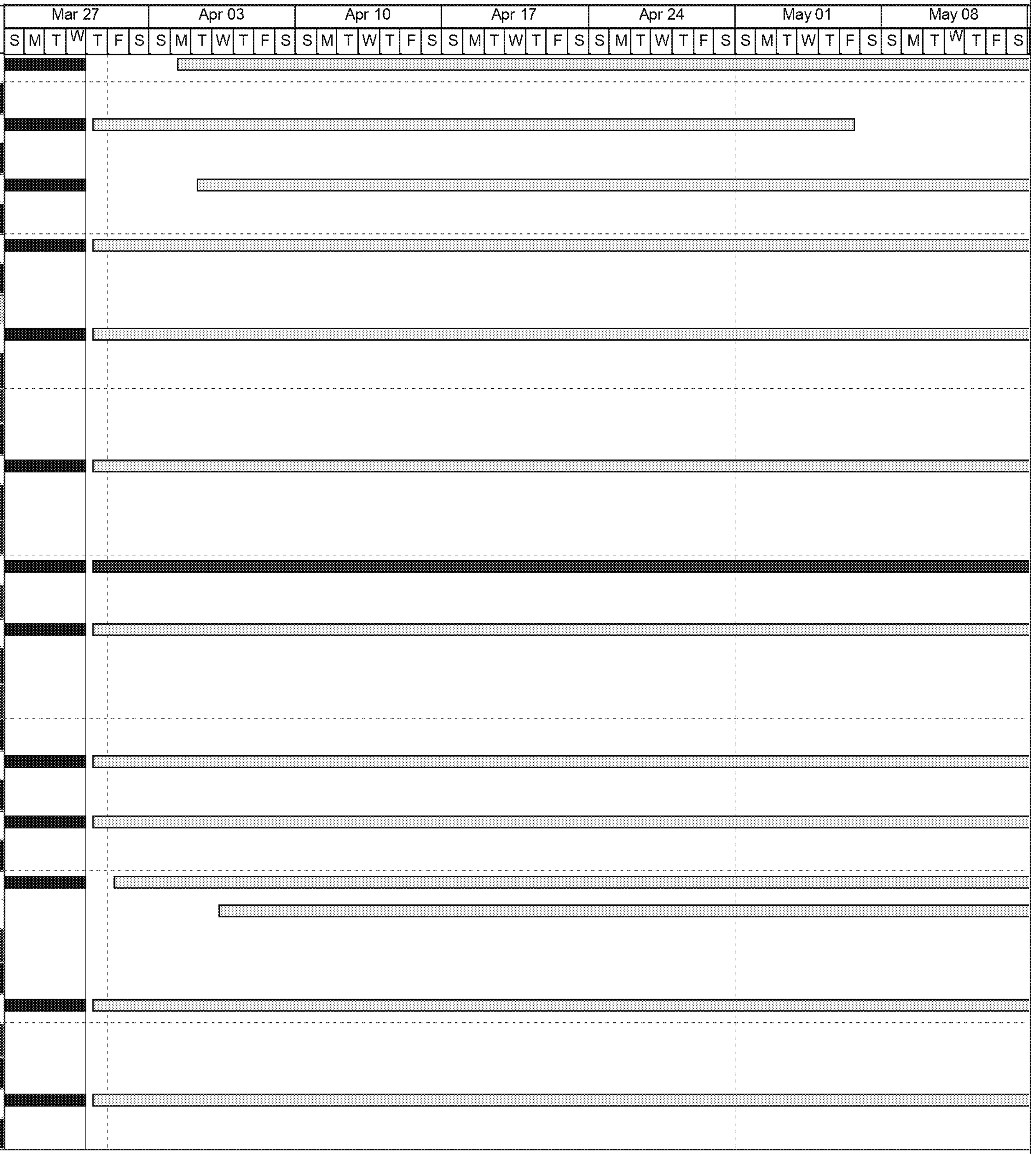
4 Week Lookahead

#	Activity ID	Activity Name	Remaining Duration	Start	Finish
70	CVFPB-200	Prepare CVFPB Permit	136	13-Dec-21 A	13-Oct-22
71	**SWRCB Water Right Permit**		27	01-Feb-21 A	06-May-22
72	WRP-100	Prepare Water Right Permit Application	27	01-Feb-21 A	06-May-22
73	**SWB CWA Section 401 Water Quality Certification**		253	04-Jan-21 A	04-Apr-23
74	401-200	Prepare Draft CWA 401 Permit Application	253	04-Jan-21 A	04-Apr-23
75	**CDFW Streambed Alteration Agreements**		160	10-Jan-22 A	14-Nov-22
76	1600-200	Prepare LSAA Application	160	10-Jan-22 A	14-Nov-22
77	**CDFW Incidental Take Permits**		52	11-Jan-21 A	13-Jun-22
78	**ITP - CESA (Se 2081) Operations**		52	11-Jan-21 A	13-Jun-22
79	2081-100	Prepare ITP Application - Operations	52	11-Jan-21 A	13-Jun-22
80	**Environmental**		132	03-Jan-22 A	05-Oct-22
81	**EIR/EIS**		132	03-Jan-22 A	05-Oct-22
82	**Final EIR/Final EIS**		132	03-Jan-22 A	05-Oct-22
83	EIR-210	Preparation of Admin Final EIR/EIS	132	03-Jan-22 A	05-Oct-22
84	**Real Estate**		278	02-Nov-20 A	04-May-23
85	**Key Deliverables**		190	03-Jan-22 A	30-Dec-22
86	KD-1495	Complete ROW Manual	190	03-Jan-22 A	30-Dec-22
87	**USBR - Land Agreement**		278	02-Nov-20 A	04-May-23
88	FED-100	USBR Land Agreements	278	02-Nov-20 A	04-May-23
89	**Preliminary Engineering**		695	03-Jan-22 A	30-Dec-24
90	**Conveyance (Pipelines, Pump Stations, Canals)**		694	03-Jan-22 A	27-Dec-24
91	**DWR Operations Oversight & Review (KLOG)**		694	03-Jan-22 A	27-Dec-24
92	A1130	Coordination & Oversight with Department of Water Resources	694	03-Jan-22 A	27-Dec-24
93	**RD 108 Oversight & Review**		694	03-Jan-22 A	27-Dec-24
94	A1140	Coordination & Oversight with Reclamation District 108	694	03-Jan-22 A	27-Dec-24
95	**Design & Analyses**		72	01-Feb-22 A	13-Jul-22
96	KD-1140	Create Master Survey & Topo Map	72	01-Feb-22 A	13-Jul-22
97	KD-1150	Finalize TRR Location	46	06-Apr-22	09-Jun-22
98	**Reservoir (Dams, Tunnels)**		695	01-Feb-22 A	30-Dec-24
99	**DSOD Oversight & Review**		695	01-Feb-22 A	30-Dec-24
100	KD-1100	Initiate Application for Permit to Construct from DSOD	695	01-Feb-22 A	30-Dec-24
101	**Electrical (Substation, Switchyard, Transmission Line)**		695	03-Jan-22 A	30-Dec-24
102	**WAPA Oversight & Review**		695	03-Jan-22 A	30-Dec-24
103	A1150	Coordination & Oversight with WAPA	695	03-Jan-22 A	30-Dec-24
104	**CAISO Oversight & Review**		695	03-Jan-22 A	30-Dec-24



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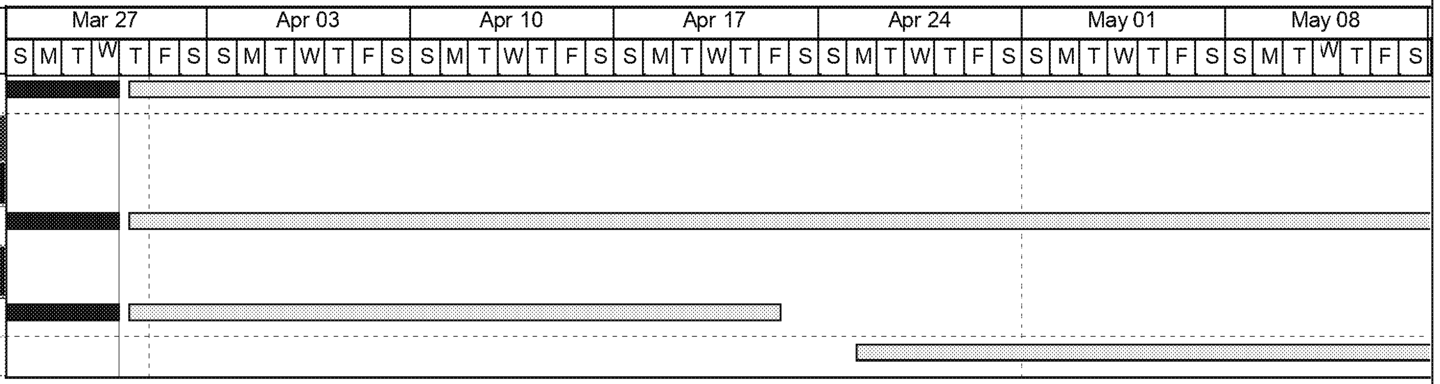
105	A1160	Coordination & Oversight with CAISO	695	03-Jan-22 A	30-Dec-24
106	**Roads & Bridges**		695	03-Jan-22 A	30-Dec-24
107	**County Oversight & Review**		695	03-Jan-22 A	30-Dec-24
108	A1170	Coordination & Oversight with County Authorities	695	03-Jan-22 A	30-Dec-24
109	**Contracting Strategy**		37	03-Jan-22 A	20-May-22
110	CS-1100	Define Contracting Values	17	03-Jan-22 A	22-Apr-22
111	CS-1200	Establish Recommended Contract Packages	20	25-Apr-22	20-May-22



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Reclamation Manual

Directives and Standards

Subject: Water and Related Resources Feasibility Studies

Purpose: To provide the basic requirements and framework for conducting water and related resource feasibility studies in order to formulate, evaluate, and select project plans for implementation. The benefits will include improved consistency in the content and quality of feasibility studies and reports prepared by or for the Bureau of Reclamation.

Authority: In addition to specific feasibility study authorizations, Reclamation Act of June 17, 1902 (ch. 1093, 32 Stat. 388; 43 U.S.C. § 372, et seq.), and acts amendatory thereof and supplementary thereto, including Reclamation Project Act of August 4, 1939 (ch. 418, 53 Stat. 1187); Section 8 of the Flood Control Act of December 22, 1944 (ch. 665, 58 Stat. 887); Federal Water Project Recreation Act of July 9, 1965 (Pub. L. 89-72; 79 Stat. 213; 16 U.S.C. §§ 460l-12, et seq.), as amended; Reclamation Rural Water Supply Act of December 22, 2006 (Pub. L. 109-451, Title I; 120 Stat. 3346; 43 U.S.C. § 2401, et seq.); SECURE Water Act of March 30, 2009 (Pub. L. 111-11, Title IX, Subtitle F; 123 Stat. 1332; 42 U.S.C. § 10361, et seq.).

Approving Official: Director, Policy and Administration (Policy Director)

Contact: Reclamation Law Administration Division (84-55000)

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1. **Introduction.** This Directive and Standard (D&S) establishes responsibilities, requirements, and procedures for conducting a planning study for the purpose of recommending congressional authorization or funding of a water and related resources implementation plan. This D&S also includes the requirements for preparing, coordinating, and reviewing feasibility-level planning reports. This D&S presents requirements that will be used to implement the *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies* (PR&G), and Executive Order 12322, *Water Resources Projects*.

2. **Applicability.** This D&S applies to all Reclamation employees involved in the performance or approval of feasibility level studies and reports.

   A. This D&S establishes requirements for studies authorized by Congress as feasibility studies, including feasibility studies conducted under Reclamation's Rural Water Supply Program and feasibility studies conducted under the authority of the SECURE Water Act of 2009.

   B. This D&S applies to all studies conducted for the purpose of supporting a report, proposal, or plan submitted to Congress for approval, appropriations, or legislative action, except as noted in Paragraph 2.D.

C. This D&S applies to the formulation process used to develop and evaluate risk reduction alternatives under the Reclamation Dam Safety Program. In cases of conflict, the policies, D&Ss, requirements, and procedures of the Dam Safety Program take precedence over the requirements of this D&S. See Reclamation Manual (RM) Policy, *Decisions Related to Dam Safety Issues* (FAC P02) and RM D&Ss, *Review/Examination Program for High- and Significant-Hazard Dams* (FAC 01-07) and *Reclamation Dam Safety Program* (FAC 06-01).

D. This D&S does not apply to studies conducted under Reclamation's Title XVI Program. See RM D&S, *Title XVI Water Reclamation and Reuse Program Feasibility Study Review Process* (WTR 11-01), for the requirements of the Title XVI program.

3. Level of Effort Required for Feasibility Studies.

A. **General.** Feasibility studies support the formulation and evaluation of a range of alternative plans to meet established planning objectives and lead to the selection of a recommended plan or a recommendation to take no action. Feasibility studies are used to assess how the recommended plan and alternatives will perform under present and projected future conditions, to substantiate estimated monetary and non-monetary costs of and benefits derived from the project, and to establish a credible estimate of the total cost to implement the proposed project or action. Feasibility studies will be performed to the minimum level necessary to:

   (1) support an overall project concept that will not change substantially when the project is advanced to final design;

   (2) support a Construction Cost Estimate (CCE)/Project Cost Estimate (PCE) based on assumptions that are sufficiently constrained such that reasonable variations in the ranges of these assumptions will not have a major impact on the final total cost of the project;

   (3) support a CCE/PCE that will provide Congress the necessary basis to set a suitable appropriations ceiling for the project, establish an appropriate Federal cost share, and determine appropriate repayment obligations, as appropriate; and

   (4) develop a project implementation schedule comparable to that needed to implement the final design.

B. **Data Collection.** Data gathered through investigations and field surveys will be the minimum necessary to reasonably assess if a plan can be implemented and to determine the social effects, environmental impacts and benefits, and economic and financial viability. Data collected for feasibility studies are generally not of sufficient detail to support final specifications and designs.

C. **Scientific and Technical Analysis.** Major functional categories of scientific and technical analysis include, but are not limited to, hydrology and hydraulics; environmental analysis; social impact assessment; civil, mechanical, geotechnical, and electrical engineering; operations; economics and finance; surveying; and cost estimating. The interdisciplinary study team will determine what level of scientific and technical analyses are necessary and appropriate for the feasibility study.

D. **Design Documentation.** The feasibility design report will present the essential features of the project alternatives that were analyzed in detail. Feasibility design drawings are for the purpose of depicting facility layout at a level of detail sufficient to define major cost drivers and obtain quantity takeoffs for cost estimating purposes. Design drawings for each of the analyzed alternatives will be prepared to equivalent levels of detail to allow for a fair comparison of technical adequacy and cost.

(1) The level of detail is sufficient to conduct an environmental analysis consistent with the National Environmental Policy Act (NEPA) of the analyzed alternatives and begin identifying the range of appropriate compliance and mitigation actions.

(2) The level of detail presented for the recommended plan has sufficient detail to support the development of a feasibility level CCE/PCE, including the layout of proposed facilities (e.g., plan and profile, elevations, typical sections, etc., as applicable); major structural, mechanical, and electrical details; and begin identifying regulatory compliance and mitigation measures.

4. **General Requirements.**

A. Feasibility studies are initiated by congressional direction through specific authorization or under general authorities provided in legislation, such as the Rural Water Supply Act of 2006 and the SECURE Water Act of 2009.

B. A feasibility study requires systematic planning, engineering, environmental, economic, and social analyses of alternative plans for Federal water and energy projects consistent with the PR&Gs, an assessment of the impact of the alternative plans on the environment in compliance with NEPA and other applicable environmental laws, and a determination of the financial capability of the non-Federal project beneficiaries to pay the non-Federal share of costs associated with designing, constructing, operating, and maintaining a proposed project. The completed feasibility study will culminate in a feasibility report to form the basis for Reclamation's recommendation to the Secretary regarding whether the proposed project should be authorized for implementation. A feasibility study requires detailed investigations, including collection and development of study-specific data, and communication and collaboration with the stakeholders to systematically formulate and evaluate a reasonable range of alternative solutions in order to recommend a plan to Congress for authorization and implementation.

C. The development and use of scientific and scholarly information by and on behalf of Reclamation for feasibility studies will comply with Departmental Manual (DM), *Integrity of Scientific and Scholarly Activities*, Series 5, 305 DM 3, and RM Policy, *Scientific Integrity* (CMP P13).

D. Initial information pertinent to the feasibility study steps described in Paragraph 5 will be carried forward from an appraisal study conducted prior to the feasibility study. If an appraisal study has not been conducted, appraisal-level analyses will be conducted at the outset of the feasibility study during the feasibility scoping phase (see Paragraph 5.G. for a description of study phases) to determine if there is at least one viable alternative that warrants continued study at the feasibility level. Alternatives found to be viable in an appraisal study or during the feasibility scoping phase may not prove to be viable after detailed analyses are performed.

E. Identification of project-specific features or activities that present higher levels of risk or uncertainty for planning, design, and construction will be made as early in the feasibility study process as possible. Tradeoffs between additional data collection and assessments of risk and uncertainty will be considered, addressed, and documented in the feasibility report.

F. When necessary and appropriate for reasons of economy or prudent water management, water supply for project purposes will assume periodic shortage conditions.

G. A feasibility study will be concluded if at any time Reclamation and the cost-share partner(s) determine that there is no feasible Reclamation project or there is no longer clear Reclamation interest in a project. A concluding report will be prepared to briefly summarize the relevant information up to the conclusion of the study and to document the reasons for terminating or deferring the study.

5. **Process and Content Requirements.**

A. **Study Authorization and Appropriation.** Feasibility studies must be authorized by Congress as required in Section 8 of the Federal Water Project Recreation Act of 1965. A feasibility study must also be funded through congressional appropriations prior to initiating work.

B. **Cost-Sharing.** Unless directed otherwise by Congress, all investigation, report preparation, and review costs must be shared with a non-Federal cost-sharing partner. Regional directors manage cost-sharing agreements. Costs will be accounted for and in-kind services valued in accordance with *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* (2 CFR 200).

(1) Prior to any significant expenditure of Federal funds, a signed cost-sharing agreement with the non-Federal partner(s) is required. The agreement will

specify the method and schedule for payment or in-kind services. The cost-share agreement must include reporting requirements for Reclamation and the non-Federal partner(s).

(2) Cost-sharing must be in the form of in-kind services, cash payments, or a combination of the two. Unless authorizing legislation specifies a cost-share formula, the minimum non-Federal cost-share will be 50 percent of the total study costs. The Federal cost-share must not exceed the non-Federal cost-share at any time. Exceptions to the cost-share requirement are described in Paragraphs 5.B(3).

(3) Cost-sharing for feasibility studies involving Indian Tribes will be negotiated on a case-by-case basis.

(4) Refer to RM D&S, *Implementing Cost Sharing Authorities for Recreation and Fish and Wildlife Enhancement Facilities* (LND 01-01) for the cost-share requirements for planning, development, modification, and expansion of recreation facilities or fish and wildlife enhancement facilities.

(5) The study manager will maintain records of the non-Federal partner's contributions considered for cost-sharing purposes and will review the contributions of the non-Federal partner to verify applicability and value of in-kind services. At the conclusion of the feasibility study, the study manager will prepare documentation of Federal and non-Federal contributions, with supporting information. For studies that are multi-year, annual cost-sharing documentation will be prepared.

C. **Study Management.** Regional directors will budget for and oversee feasibility studies, and assign the responsibility of managing feasibility studies to qualified study managers who meet Reclamation's requirements for project managers. Feasibility studies will be managed as projects in accordance with RM Policy, *Project Management* (CMP P07) and RM D&S, *Project Management* (CMP 07-01).

D. **Plan of Study (POS).** The study team will work with the non-Federal project sponsor(s) to develop a POS describing specific study tasks and how each task will be carried out, including who is responsible, the approach, and schedule.

(1) An internal study team will be comprised of the appropriate Reclamation staff to ensure NEPA, Endangered Species Act of 1973 (ESA), National Historic Preservation Act of 1966 (NHPA), intergovernmental, and any other Federal or state regulatory compliance measures are properly addressed.

(2) The POS will be written and agreed to by Reclamation and the non-Federal sponsor(s) at the outset of the feasibility study. The initial draft will be the POS developed previously during the appraisal study and modified to comply with the

authorizing legislation. If a feasibility study does not follow an appraisal study, a preliminary POS will be drafted based on the authorizing legislation.

(3) The POS will be regularly reviewed by the study manager and study team and modified when data and technical analyses result in an improved understanding of relevant constraints and opportunities, when new solution alternatives are developed, or as needed to incorporate partner and public comments.

E. **Study Team and Advisory Committees.** The study manager will form an interagency and interdisciplinary study team at the beginning of the study that will include members from Reclamation, cooperating agencies, the non-Federal partner(s), and state regulatory agencies, as appropriate. All relevant disciplines will be represented on the study team. If advisory committees are established, they will be managed according to the requirements of the Federal Advisory Committee Act of 1972 and RM D&S, *Committee Management – Federal Advisory Committee Act (FACA)* (ADM 01-01).

F. **Coordination, Consultation, and Communication.** The study manager will identify and coordinate with representatives of other Federal agencies, state, local, and tribal governments, non-governmental organizations, civic groups, and other interested stakeholders, as appropriate.

(1) Consultations and coordination for NEPA, ESA, NHPA, intergovernmental compliance and agreements will be directed by the appropriate Reclamation staff in accordance with all applicable laws and policies.

(2) The internal study team will develop a public involvement plan, if necessary, in accordance with RM D&S, *Public Involvement in Reclamation Activities* (CMP 04-01).

(3) Communications and records that are subject to public disclosure shall be maintained in accordance with the Freedom of Information Act of 1966 and RM D&S, *Freedom of Information Act (FOIA)* (RCD 01-01).

G. **Feasibility Study Phases and Milestones.** Feasibility studies generally consist of a feasibility scoping phase (also called the initial alternatives phase) and an alternative formulation and evaluation phase. Appendix A provides a process diagram with interim review milestones for feasibility studies.

(1) **Feasibility Scoping (Initial Alternatives) Phase.** The study team will review the previous appraisal analysis, if available, and determine what additions or revisions are necessary based on the authorizing legislation, project needs, alternatives to be considered, availability of new data, and current understanding of project constraints and opportunities. If an appraisal study was not conducted before the feasibility study, the study team will perform and document the

necessary appraisal-level analyses in order to verify that a viable solution or set of alternatives exists before moving forward with the detailed feasibility analysis.

(2) **Alternative Formulation and Evaluation Phase.** Preliminary concepts and alternative plans not eliminated during the feasibility scoping phase will be studied and further refined using more detailed analysis. Additional alternatives that emerge through the iterative formulation and evaluation process will also be developed, then carried forward or eliminated. The final set of alternatives considered in detail during the feasibility phase will be only those plans that both meet the planning objectives and reasonably protect environmental resources.

H. **Planning Process.** Feasibility studies will be performed in accordance with the iterative planning process described in the PR&Gs. Because the planning and NEPA compliance processes run concurrently and major actions often require an Environmental Impact Statement (EIS), the steps below are linked to relevant activities in the EIS process. The NEPA compliance process will be different and less rigorous for an Environmental Assessment (EA) with a Finding of No Significant Impact (FONSI), but it will follow the same procedure. See Appendix A for a graphic representation of the relationship between the planning steps of a feasibility study and the corresponding NEPA analysis actions.

(1) **Identify Problems, Needs, and Opportunities.** Specific problems and opportunities within the study area will be identified, planning goals and objectives established, and significant constraints identified. This first step corresponds to the NEPA requirement to define the purpose and need. In addition to the requirements of the PR&Gs:

(a) the study will identify the Federal Objective, as set forth in the Water Resources Development Act of 2007 and defined in the PR&G, specifying that Federal water resources investments shall reflect national priorities, encourage economic development and project the environment;

(b) the planning goals and objectives will reflect the direction provided in the authorizing legislation, as well as the views of the study team, the study cost-share partner, cooperating agencies, various stakeholders, and the public;

(c) this step will identify the purpose of the feasibility study and Reclamation's involvement in the study;

(d) this step will define the study area and describe how the affected stakeholders will be involved;

(e) problems and opportunities will be incorporated into a brief statement specifying the underlying need for water, power, or both, to which Reclamation is responding; and

(f) a brief summary of the process used to define the problems, opportunities, planning objectives, and constraints will be prepared to aid in the preparation of the feasibility report. This summary will include a discussion of stakeholder, partner, and public inputs.

(2) **Inventory Existing Resources and Forecast Future Conditions.** "Inventory Existing Resources" and "Forecast Future Conditions" correspond to the NEPA requirements to identify and assess the affected environment and environmental consequences.

(a) This step will quantify relevant water and related resource conditions as they currently exist within the study area and forecast future conditions over the period of analysis. This step confirms the problems, needs, and opportunities to be addressed in the subsequent steps. The inventory and forecast will provide information for understanding existing conditions and establishing a baseline for forecasting with- and without-plan conditions.

(b) Reclamation will work with the feasibility study cost-share partner to determine an appropriate period of analysis that meets PR&G requirements.

(c) Within the context of Reclamation planning studies, "Forecast Future Conditions" (also termed "without-plan conditions") is defined as characterizing future conditions without this Reclamation action, but includes actions that are expected by others.

(d) The inventory used to describe existing conditions and to provide a baseline for forecasting future with- and without-plan conditions will also be used to verify that the initially identified problems and opportunities are relevant to the water and related resources of the study area.

(e) The existing conditions baseline will be established using peer-reviewed and accepted projections of income, employment, output, and population that are national, state, or regional in scope.

(f) The potential impacts of climate change will be considered when developing projections of environmental conditions, water supply and demand, and operational conditions at existing facilities as part of the without-plan future condition. Climate change impacts will be further analyzed, as appropriate, as part of the feasibility study when the following conditions are true:

(i) there is a reasonable likelihood of significant variation in hydroclimatic conditions over the planning horizon, between alternatives, or both; and

(ii) available regional models have been down-scaled to a resolution adequate for the study area, or can be produced within reasonable time and cost constraints.

(g) To aid in the preparation of the feasibility report, a brief summary of the process used to define the relevant existing conditions and reasonably foreseeable future conditions will be prepared. This will include discussion of stakeholder, partner, and public inputs.

(3) **Formulate Alternative Plans.** Alternative plan formulations will focus on solutions that are practicable, feasible, and meet the planning objectives. A reasonable range of potential plans are initially investigated, and as those plans are refined, some will be eliminated. The plans that are retained for additional analysis are termed the "analyzed alternatives." The analyzed alternatives developed at this stage will determine the range of reasonable alternatives, as required for the NEPA analysis.

(a) Alternative plans will clearly identify and evaluate the trade-offs among stakeholders and resources. The viability of an alternative will be determined through an evaluation of its acceptability, efficiency, effectiveness, and completeness as required in the PR&Gs. Alternative plans will be formulated based on most likely future conditions expected with and without implementation of a plan.

(b) Each alternative plan formulated for the feasibility study will be included in the EIS or EA/FONSI, or the differences will be explained and justified. The period of analysis will be the same for each alternative plan and will be agreed to by Reclamation and the study cost-share partner. Documentation of the rationale for eliminating any alternative plan will be provided.

(c) Investigations, data collection, and analysis will be ongoing and integrated early in the planning process. Investigations will be relevant to the study's planning objectives and constraints. The interdisciplinary study team will consider the following areas for investigation: engineering and design; surface water and groundwater hydrology; hydraulics; geology; operations; water quality; land resources and irrigability; power generation and conservation; economics; financing; environmental, social, and cultural impacts and mitigation; opportunities for recreation; and cost estimation for construction, operation, maintenance, replacement, and energy consumption. Additional investigations will be performed if necessary.

(4) **Evaluate Effects of Alternative Plans.** The beneficial and adverse effects of each alternative plan will be evaluated through comparison to the without-plan scenario in accordance with the PR&Gs. The evaluation of alternatives is part of the NEPA alternatives analysis, in which the No Action Alternative and Action Alternatives are described, evaluated, and compared. The effects of alternative plans are displayed in terms of public costs and benefits. Evaluation of benefits must consider current and expected market value of water, and other goods and services produced by the project during the period of analysis to more accurately depict benefits in accordance with the PR&G.

(5) **Compare Alternative Plans.** Plans will be compared in accordance with the PR&Gs and will include a comparison of responses and adaptability of the project to the uncertainties of climate changes previously identified in the without-plan scenario. The comparison of alternatives is part of the NEPA alternatives analysis. The plan that reasonably maximizes net public benefits will be identified.

(6) **Select the Recommended Plan.** The study team will recommend a decision to take no Federal action or to select the recommended plan. The recommended plan must maximize net public benefits, in accordance with the PR&Gs.

   (a) A recommended plan that does not provide net public benefits requires a Secretarial Exception.

   (b) The major structural and non-structural features of the recommended plan, any special considerations for construction, and the estimated cost of implementation will be provided in the feasibility report.

   (c) The identification of an environmentally preferable alternative is required in the Record of Decision (ROD), in accordance with NEPA. It is not necessary that the environmentally preferable alternative identified be the same as the recommended plan identified in the feasibility report.

   (d) If the cost-share partners prefer an alternative plan different from that of Reclamation, the plan will be identified as the locally preferred plan. The locally preferred plan will be required to have a comparable level of detail and follow the same format as Reclamation's recommended plan, to allow close comparison by decision makers.

I. **Risk and Uncertainty.** Long-range planning efforts rely on assumptions about supply and demand, and the selection of an alternative depends on expected future conditions. Feasibility studies will account for the uncertainty of future conditions by incorporating risk and uncertainty analysis into the formulation, evaluation, and comparison of alternatives.

J. **Cost Estimates.** Cost estimates for the final analyzed alternatives will be prepared at feasibility level. Refer to RM Policy, *Cost Estimating* (FAC P09) and RM D&Ss, *Cost Estimating* (FAC 09-01), FAC 09-02, and *Representation and Referencing of Cost Estimates in Bureau of Reclamation Documents Used for Planning, Design and Construction* (FAC 09-03).

K. **Cost Allocation.** Costs will be allocated among project purposes in accordance with the PR&Gs and RM D&S, *Project Cost Allocations* (PEC 01-02). Common allocable project purposes are listed below, followed by references to principal legislation in parentheses. Special project purposes not provided for in law but included in the recommendations for project authorizing legislation will also be considered, as appropriate.

(1) Domestic, municipal, and industrial water supply (Reclamation Project Act of 1939, Water Supply Act of 1958, Rural Water Supply Act of 2006).

(2) Irrigation (Reclamation Project Act of 1939, RM Policy, *Water-Related Contracts-General Principles and Requirements* (PEC P05)).

(3) Flood control (Reclamation Project Act of 1939, Flood Control Act of 1944). Includes agricultural floodwater, erosion, and sedimentation reduction, as well as urban flood damage reduction.

(4) Hydroelectric power (Reclamation Project Act of 1939).

(5) Navigation (Reclamation Project Act of 1939).

(6) Recreation (Federal Water Project Recreation Act of 1965, as amended by the Water Resources Development Act of 1974 and Title 28 of the Reclamation Projects Authorization and Adjustment Act of 1992). Reclamation does not have general authority for the construction and operation of recreation facilities or for the acquisition of lands for recreation purposes. Specific project authorization is required. See also RM Policy, *Recreation Management* (LND P04) and RM D&Ss, *Recreation Program Management* (LND 01-03), *Land Acquisition* (LND 06-01), and LND 01-01.

(7) Fish and wildlife enhancement (Fish and Wildlife Coordination Act of 1934, as amended, and the Federal Water Project Recreation Act of 1965, as amended by the Water Resources Development Act of 1974 and Title 28 of the Reclamation Projects Authorization and Adjustment Act of 1992). The Fish and Wildlife Coordination Act provides authority for Reclamation to construct fish and wildlife enhancement facilities in conjunction with an authorized project. See also LND 01-01.

(8) Water quality enhancement (Federal Water Project Recreation Act of 1965, as amended by Title 28 of the Reclamation Projects Authorization and Adjustment Act of 1992). Reclamation's authority to allocate costs to water quality enhancement activities is generally limited to the authority provided in the two acts referenced.

(9) Road improvement, maintenance, reconstruction, and relocation (Reclamation Project Act of 1939, Section 208 of the Flood Control Act of 1962). Existing public roads may be improved, maintained, reconstructed, or relocated in kind by Reclamation when deemed necessary for the construction of any authorized project for the development of water resources.

(10) Historical and archeological resources identification, analysis, data recovery, and preservation (NHPA, Archeological and Historic Preservation Act of 1974). Refer to RM Policy, *Cultural Resources Management* (LND P01) and RM D&S, *Cultural Resources Management (CRM)* (LND 02-01) for compliance requirements and Reclamation requirements regarding reimbursable and non-reimbursable costs and requests to waive the 1-percent funding limit.

L. **Financial Analysis.** To determine the financial feasibility of an alternative, the study team will consider each project beneficiary's capability to pay for its share of the costs to construct, operate, and maintain the proposed project in accordance with the applicable cost-share or repayment obligations. During the feasibility scoping phase of the study, an initial approximate determination of financial feasibility will be made. If the initial determination does not support the financial feasibility of a project, the study will not continue without the approval of the regional director. After costs are allocated among the project purposes for the recommended plan, a second, detailed analysis will be performed. This detailed analysis will account for the estimated capital costs and annual operation, maintenance, and replacement costs, as well as any existing financial obligations of the project beneficiaries. See RM D&S, *Water Rates and Pricing* (PEC 05-01) for additional requirements specific to contracts for the delivery and storage of project and non-project water, for the use of Federal facilities, and for the recovery of reimbursable project costs.

6. **Feasibility Report and NEPA.** The completed results and findings of a feasibility study will be provided in a report submitted to the regional director for consideration and recommendation to the Commissioner. An EIS or EA/FONSI must accompany the feasibility report when the feasibility report is submitted to the regional director for review. A feasibility report that integrates the associated EIS or EA/FONSI also satisfies this requirement.

A. The feasibility report will either support recommending congressional authorization to implement the recommended plan or will support taking no Federal action.

B. The feasibility report will identify known data gaps that require further investigation during the final design of the recommended plan, including, but not limited to, information related to site selection and improvement (e.g., topography, geology, seismic activity, flood hazards, water quality, and environmental conditions, etc.); right-of-way, easement, and land acquisitions; environmental compliance; public safety and security; construction costs; and operations and maintenance.

C. NEPA regulations (40 CFR 1500-1508 and 43 CFR 46 and RM Policy, *National Environmental Policy Act* (ENV P03)) define the requirements for NEPA compliance documentation. For ESA compliance, see RM Policy, *Bureau of Reclamation Consultation Under the Endangered Species Act of 1973, as Amended* (ENV P04).

D. Interim documents will be developed at the discretion of the regional director to highlight important decision points, facilitate team review, inform the public of study progress, and solicit input. The need for interim documents will be determined during scoping and documented in the POS.

7. **Performance and Results Reporting.** The manager conducting the feasibility study will be responsible for complying with the reporting requirements of the Government Performance and Results Act of 1993, as amended.

8. **Quality Assurance/Quality Control (QA/QC).** The regional director will require QA/QC practices to ensure that data collection, technical analyses, cost estimates, and designs for each fully analyzed alternative are performed at the feasibility level.

A. **Peer Reviews.** The study manager will establish an independent team of technical experts to conduct any necessary reviews of the investigation or study. Peer reviews will be conducted in accordance with the Information Quality Act of 2001, Office of Management and Budget requirements, and Department and Reclamation policies.

B. **Policy Review.** Prior to the second interim milestone described in Paragraph 8.E.(2), the Policy Director and regional director will jointly designate a policy compliance review team to review the feasibility report to ensure that all applicable policy requirements and directives have been addressed.

(1) The policy compliance review team will consist of a minimum of three members who have not directly participated in the study being reviewed, including the Policy Director's representative, the regional director's representative, and a third agreed to by the directors.

(2) The Policy Director's representative will coordinate the review and serve as team lead. The anticipated level of effort (in staff days), schedule, and funding required to perform the policy compliance review will be documented jointly by the study manager and the policy compliance review team lead.

(3) The policy compliance review team will document findings in a review report submitted to the Policy Director for approval. The approved review report will be submitted to the regional director for concurrence, and then sent to the Commissioner by the regional director at the same time the feasibility report is transmitted to the Commissioner. The feasibility report and the policy compliance review report must be transmitted together.

C. **Design, Estimating, and Construction (DEC) Review.** The regional director will identify feasibility studies to be submitted for independent oversight and review under the direction of the Senior Advisor, DEC. Refer to RM Policy, *Independent Oversight of Design, Cost Estimating, and Construction* (FAC P10) and RM D&S, *Identifying Design, Cost Estimating, and Construction Projects for Which Independent Oversight Review is Required, and Performing those Reviews* (FAC 10-01) for applicable DEC review requirements and procedures.

D. **Value Analysis.** The regional director will identify feasibility studies for inclusion in Reclamation's annual Value Program Plan of Action in accordance with RM Policy, *Reclamation Value Program* (CMP P05) and RM D&S, *Reclamation Value Program*, (CMP 06-01) for applicable Value Program requirements and procedures.

E. **Study Milestones.** The following milestones represent points along the study timeline at which the regional director or a representative reviews the progress of the study, including the alternatives examined, decisions made, and public, cooperating agency, and stakeholder input received. Regional directors ensure that feasibility reports and supporting documentation are technically adequate, conform to Federal law, comply with all applicable RM and DM releases, and meet the minimum requirements necessary for the study to be considered "feasibility level." The regional director's review also includes interim policy and legal compliance checks. Appendix A includes a study process diagram with the required milestones indicated.

(1) **Regional Director's First Interim Review.** At the completion of the feasibility scoping phase, the study manager will meet with the regional director or regional director's representative(s) to present the plans to be considered in greater detail at the feasibility level and to summarize the preliminary alternatives considered, public input received from scoping meetings, coordination and consultation with other agencies, and stakeholder input.

(2) **Regional Director's Second Interim Review.** After the study team and cost-share partners have completed a review of alternatives and determined that evaluations are sufficient to develop a plan that provides net public benefits, the study manager will meet with the regional director or regional director's representative(s), and the policy compliance review team. The study manager will present the proposed recommended plan and the locally preferred plan, if different from the proposed recommended plan. The study manager will also review the public involvement process leading up to this milestone. If a

planning-level value analysis is required, the regional director will submit the study for inclusion in Reclamation's annual Value Program Plan of Action in accordance with CMP P05 and CMP 06-01.

(3) **Regional Director's Final Review and Approval.** Once the draft feasibility report and the associated EIS or EA/FONSI are completed by the study team, the study manager submits the report to the regional director and the policy compliance review team. The regional director coordinates with Senior Advisor, DEC, for a review, and the policy compliance review team conducts its review. An internal meeting among the Commissioner's Office, the Policy Director's office, the regional director, and others, will be held after the DEC and policy compliance reviews are complete to discuss the study results and proposed recommendations. This is followed by the regional director's transmittal of the draft feasibility report, EIS (or EA/FONSI), and the approved policy compliance review report to the Commissioner for consideration of the regional director's and the Policy Director's recommendations to determine if the feasibility report should be recommended to the Secretary, or the Secretary's designee possessing delegated authority, for approval. Recommended feasibility reports are submitted to the Office of Management and Budget prior to submittal to Congress, coordinated by the Director, Program and Budget. The Director, Program and Budget, provides feedback from OMB to the regional director relating to the acceptability of the feasibility report and the consistency of its recommendations with the policies and programs of the President.

9. **Definitions.**

A. **Appraisal-Level.** The level of analysis and data collection needed to initially determine the nature of water and related resource problems and needs in a particular area, formulate and assess preliminary alternatives, determine Reclamation interest, and recommend subsequent actions.

B. **Appraisal Study.** An initial planning investigation performed to determine the nature of water and related resource problems and needs in a particular area, formulate and assess preliminary alternatives, determine Reclamation interest, and recommend subsequent actions. Appraisal studies are based primarily on available existing data.

C. **Climate Change.** Reclamation uses the Intergovernmental Panel on Climate Change definition: "…a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer."[1]

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[1] IPCC, 2007: *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K and

D. **Concluding Report.** A report on the findings of a feasibility study supporting the decision to terminate or defer an investigation.

E. **Construction Cost Estimate.** A detailed estimate of the costs to construct the physical features of a project, including the acquisition of land and rights, relocation of existing real properties, clearing and restoring lands, service facilities, technical and scientific investigations, engineering (preparation of designs and specifications, construction management, and contract administration), environmental compliance and mitigation, operation and maintenance costs while a feature is in construction status, and other general expenses. See RM D&S, *Construction Cost Estimates and Project Cost Estimates* (FAC 09-02).

F. **Cost Allocation.** The distribution of all financial costs of a multi-purpose project among its authorized purposes. An allocation of project costs is necessary to determine whether project beneficiaries are capable of repaying the reimbursable costs assigned to them. Cost allocation allows estimated costs of each reimbursable and non-reimbursable purpose to be compared to anticipated revenues in order to determine the appropriateness of the Federal investment in individual components and the project overall. The allocation provides the basis for establishing the repayment obligations specified in water-related contracts.

G. **Cost-Share Partner.** Entity that shares in the cost and responsibilities of a study or project. Cost-share partners are generally non-Federal entities; however, in some cases, there may be one or more Federal cost-share partners.

H. **Feasibility.** A measure of the viability of a proposed plan or project based on an evaluation of:

(1) how well the planning objectives are met;

(2) the economic justification;

(3) the validity of the scientific, technical, and design assumptions;

(4) the ability to construct a project, implement a non-structural plan, or both, according to Reclamation standards and practices, within the estimated cost and schedule;

(5) the reliability of the estimated costs and benefits;

(6) the reliability of the proposed construction schedule; and

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Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. Accessed at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml.

(7) the capability and willingness of the project partner(s) to financially support the project.

I. **Feasibility Design Report.** An appendix to the feasibility report that identifies technically feasible construction alternatives and estimates of the associated capital costs.

J. **Feasibility Level.** The level of analysis and data collection needed to prepare a recommendation to Congress regarding the implementation of a project or plan and, unless no action is recommended, the estimated total cost of implementation. Feasibility level is more fully defined in Paragraph 3 of this D&S.

K. **Feasibility Report.** A report describing the results of a completed feasibility study and identifying the recommended plan.

L. **Feasibility Study.** An evaluation of the technical, economic, and financial feasibility of a proposed alternative based on detailed investigations requiring the acquisition of primary data, and including an assessment of environmental impacts as required by the National Environmental Policy Act of 1969. A feasibility study provides the basis for making recommendations to Congress about whether a proposed project should be authorized for construction.

M. **Federal Objective.** The purpose of the Federal government's involvement in water and related resources planning, which Reclamation identifies and describes using the definition of Federal Objective established in the PR&Gs.

N. **Locally Preferred Plan.** The project sponsor's preferred alternative, which may differ from the recommended plan.

O. **Non-reimbursable Costs.** The portions of project and study costs paid by the Federal government that are not required to be repaid to the Federal government.

P. **Preferred Alternative.** The alternative identified as Reclamation's preferred action in the NEPA analysis. The preferred alternative is not required to be the same as the environmentally preferable alternative in the ROD.

Q. **Project Cost Estimate.** A summary report of the costs provided in the CCE. The PCE is not a separately developed estimate. See also the definition of PCE in FAC 09-02.

R. **Project Purpose(s).** A purpose that a Federal water resource project is legislatively authorized to serve.

S. **Quality Assurance/Quality Control or QA/QC.** Management and quality improvement activities that ensure technical quality standards are met in accordance with laws, regulations, policies, and agreed-upon requirements of the customer and partners.

T. **Reclamation Interest.** The determination that the proposed action is consistent with Reclamation mission areas and standing authorities, which allow for participation in water and related resources development projects.

U. **Recommended Plan.** The alternative identified through the planning process as best meeting the planning objectives and providing net public benefits, in accordance with the PR&Gs.

V. **Reimbursable Costs.** The portion of project and study costs that are required to be repaid to the Federal government.

10. **Review Period.** The originating office will review this release every 4 years.

7-2522A.1 (09-2014)
Bureau of Reclamation

RECLAMATION
Managing Water in the West

RECLAMATION MANUAL TRANSMITTAL SHEET

Effective Date: 12/12/2019 Release No. 448

Ensure all employees needing this information are provided a copy of this release.

Reclamation Manual Release Number and Subject

CMP 09-02 Water and Related Resources Feasibility Studies

Summary of Changes

Minor revisions approved to:

- **comply with RM format;**
- **change POLICY to Policy throughout;**
- **correct hyperlink to the Principles, Requirements and Guidelines (PR&G);**
- **remove language discussing the RM deviation process as it is outlined in RM D&S RCD 03-03;**
- **remove reference to "Figure 1" in the Appendix as there is only one figure;**
- **clarify the requirements of the PR&G by noting**
  - **o "the study will identify the Federal Objective, as set forth in the Water Resources Development Act of 2007 and defined in the PR&G, specifying that Federal water resources investments shall reflect national priorities, encourage economic development and protect the environment";**
  - **o "evaluation of benefits should consider current and expected market value of water, and other goods and service provided by the project during the period of analysis to most accurately depict benefits";**
  - **o and changed the definition of Recommended Plan to note that it will "maximize" net public benefits, not simply "provide";**
- **update definition of Concluding Report to remove reference to "appraisal reports," as these are no longer separate documents per Draft RM D&S, Water and Related Resources Appraisal and Special Studies (CMP 09-01);**
- **add definition of Reclamation Interest consistent with the definition in CMP 09-01;**
- **update definition of Feasibility Study to say "alternative" instead of "project" so as not to presuppose a structural solution;**
- **update definition of Preferred Plan to "Preferred Alternative," and changed "environmentally preferred alternative" to "environmentally preferable alternative" consistent with the language in the National Environmental Policy Act. This definition also now clarifies that the environmentally preferable alternative is identified in the Record of Decision.**

NOTE: This Reclamation Manual release applies to all Reclamation employees. When an exclusive bargaining unit exists, changes to this release may be subject to the provisions of collective bargaining agreements.

Filing instructions

Remove Sheets	Insert Sheets
CMP 09-02 pp 1-19	**CMP 09-02 pp 1-18**
Appendix A pp 1-2	**Appendix A pp 1-2**

All Reclamation Manual releases are available at http://www.usbr.gov/recman/

Filed by: ____________________ Date: ____________

From: Arthur,Damon [Damon.Arthur@redding.com]
Sent: 5/3/2022 5:33:08 PM
To: Kevin Spesert [kspesert@sitesproject.org]
CC: Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]; Sara M. Katz [skatz@katzandassociates.com]
Subject: RE: Sites Reservoir questions

Thank you for those responses, Kevin.

Damon Arthur
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From: Kevin Spesert <kspesert@sitesproject.org>
Sent: Tuesday, May 03, 2022 2:12 PM
To: Arthur,Damon <Damon.Arthur@redding.com>
Cc: Jerry Brown <jbrown@sitesproject.org>; Alicia Forsythe <aforsythe@sitesproject.org>; Sara M. Katz <skatz@katzandassociates.com>
Subject: Re: Sites Reservoir questions

Hi Damon,

As we discussed…I talked with our Environmental Planning & Permitting to address your additional questions which are provided below…

The Authority is conducting an evaluation of all of the comments submitted on the Revised Draft EIR/Supplemental Draft EIS. Thorough responses to all of the comments will be provided in the Authority's Final EIR/EIS, which is expected to be completed in early 2023. The Authority takes these concerns seriously and is evaluating the information provided in the comments along with the best available scientific information as we analyze and respond to the comments and prepare the Final EIR/EIS. To provide any detailed response on these comments now would be premature.

However, we do note that the Trinity River (which is a tributary to the Klamath River) is operated by the Bureau of Reclamation under a number of different statutory, legal and contractual obligations, including but not limited to the Trinity River Record of Decision (ROD), the 2017 ROD for the Long-Term Plan for the Lower Klamath River, and the provisions of the Trinity River Division CVP Act of 1955. The Project would not affect or result in changes in these obligations or Reclamations operations of the Trinity River system. In addition, the Authority is not requesting a water right to divert water from the Trinity River system. And finally, the RDEIR/SDEIS and the Project's water rights do not consider or allow for Reclamation to move water from the Trinity River system and "re-store" that water in Sites Reservoir. This is not covered in the environmental document and the reservoir is outside of where CVP water (including water from the Trinity River system) can be used. All of these factors, indicate that the Sites Project would not result in changes in the operations of the Trinity River system. Reclamation will continue to operate the Trinity River system consistent with all of its statutory, legal and contractual obligations regardless of the Project and the Authority is not seeking to divert any water from the Trinity River system.

We are currently anticipating the start of construction in mid-2024.

You are correct on the current federal and state funding levels for the project. In addition to what you listed; the Authority has received $104 million in funding from the WIIN Act.

Give me a call if you have any additional questions

Thanks!

Kevin

Kevin Spesert
External Affairs Manager
Sites Project Authority
Phone (530) 632-4071

From: Arthur,Damon <Damon.Arthur@redding.com>
Sent: Wednesday, April 27, 2022 5:45 PM
To: Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Sites Reservoir questions

Hi Kevin,
Thank you for getting back to me with answers to those questions.
I read through comments that the U.S. EPA, California Department of Fish and Wildlife and California Water Resources Control Board provided in response to the draft environmental impact report for the proposed reservoir. In the comments, those agencies expressed numerous concerns over the environmental effects the reservoir would have on water quality and wildlife in the Sacramento River and in the Delta.
In general, the agencies were concerned releases from the Sites Reservoir would increase water temperatures in the river and Delta, reduce levels of dissolved oxygen in the water, increase the likelihood of harmful algae blooms and increase levels of pesticides in the water. The EPA also asked why the effects of the projects on the Klamath and Trinity rivers were not included in the scope of the environmental impact report. Environmental groups I talked to had similar concerns about all of the above.
Does the Sites Project Authority agree with the EPA, state Water Resources Control Board and Department of Fish and Wildlife comments noted above? How does the authority plan to address those comments, as well as concerns raised by environmental groups?
I think Jerry Brown, said work is expected to begin on the project by mid-2024. Do I have that correct?
Here is what I have listed for possible funding sources for the project right now: $875 million in bond money from the state. The Sites Authority also is eligible for up to $2.2 billion in loans from the EPA; The project is in line for another $450 million loan from the U.S. Department of Agriculture. Is all that correct? Let me know if the figures are off or if I left off any other funding sources.
Thank you again,

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From: Kevin Spesert <kspesert@sitesproject.org>
Sent: Friday, April 22, 2022 8:37 AM
To: Arthur,Damon <Damon.Arthur@redding.com>
Cc: Jerry Brown <jbrown@sitesproject.org>; Alicia Forsythe <aforsythe@sitesproject.org>; Sara M. Katz <skatz@katzandassociates.com>
Subject: RE: Sites Reservoir questions

Hi Damon,

Thanks for reaching out to us, these are very good questions. Below is the response to your questions. I apologize for the length of the response, but wanted to make sure we covered your questions.

Please feel free to give me a call if you have any other questions.

Water can be pumped into the reservoir when 10,700 cfs minimum is flowing down the Sacramento River at Wilkins Slough, is that right? Is Wilkins Slough east of Arbuckle?

Yes, the Authority adopted revised diversion criteria for the Project at its March 2022 Board meeting. These revised criteria require that there be at least 10,700 cfs in the Sacramento River at Wilkins Slough in the months of October through June and 5,000 cfs in September for the Project to divert. Project diversions would only occur from September 1 to June 15. And yes, Wilkins Slough is a gaging station on the Sacramento River east of Arbuckle.

Water is pumped from the Glenn-Colusa and Tehama-Colusa canals to a forebay and then from there to the reservoir? Where and how does the water go from the river into the canals? At the pumping plants in Red Bluff and Hamilton City?

Yes. Water from the Sacramento River is pumped into the Tehama-Colusa Canal at the Red Bluff Pumping Plant. Once in the Tehama-Colusa Canal, water flows via gravity down the canal to the existing Funks Reservoir. Water for the Project would then be pumped up into Sites Reservoir from Funks Reservoir.

Water from the Sacramento River is pumped into the Glenn-Colusa Irrigation District's (GCID's) Main Canal at GCID's Hamilton City Pump Station. From there, it flows via gravity down the Main Canal and would flow via gravity into the Project's new Terminal Regulating Reservoir. Water for the Project would then be pumped up into Sites Reservoir from the Terminal Regulating Reservoir.

Both the Red Bluff Pumping Plant and GCID's Hamilton City Pump Station have state of the art fish screens at the Sacramento River that meet both National Marine Fisheries Service and CA Department of Fish and Wildlife's fish screening criteria for salmonids.

Does the Bureau of Reclamation plan to release more water from Shasta and Keswick reservoirs at certain times of the year so the river will flow at the necessary level to allow you to withdraw water from the Sacramento River?

No. Water released by Reclamation from Shasta/Keswick is generally Central Valley Project water, developed under Reclamation's water rights and not available for diversion by the Sites Project. The water available for diversion by the Sites Project would primarily come from the streams that flow into the Sacramento River below Keswick. The exception to this is when Shasta/Keswick is releasing flood flows – or water that is not able to be stored in Shasta as the reservoir is reaching its mandatory flood control curve. These flood releases from Shasta, which generally only occur in very wet water year conditions, would be available for diversion by the Sites Project. However, Reclamation would not change its operations to make these flood releases more available for the Sites Project – the Sites Project would simply be able to take advantage of these high flows when the opportunities exist. Diverting flood releases from Shasta into Sites is only a small amount of water that would be diverted into the reservoir – the majority of the water that would be diverted for the Project originates in the streams that flow into the Sacramento River below Keswick.

Is the maximum that can be withdrawn from the river at any time 4,000 cfs?

Generally – the Project's water right will seek a maximum of 4,200 cfs. This is comprised of 2,100 cfs plus losses at the Red Bluff Pumping Plant/Tehama-Colusa Canal and 1,800 cfs plus losses at the Hamilton City Pump Station/GCID Main Canal. We are assuming about 400 cfs losses, combined, in the two canal systems.

What happens if pumping 4,000 cfs from the river in Red Bluff drops the river flow below 4,000 cfs at Wilkins Slough?

The Project's revised diversion criteria require that there be 10,700 cfs in the Sacramento River at Wilkins Slough from October to June for Project diversions to occur. If the Project is diverting 4,000 cfs at Red Bluff and Hamilton City between October to June, and average daily Sacramento River flow at Wilkins Slough drop below 10,700 cfs, then Project diversions will have to reduce such that average daily flows in the Sacramento River at Wilkins Slough stay at or above 10,700 cfs. This may mean that the Project has to reduce diversions (take less than 4,000 cfs) or stop diverting off all together.

What are the 23 agencies that will be purchasing water from Sites Reservoir? Can other agencies sign on to receive water from the reservoir? Do you think there will be more agencies signing on to get water from the reservoir?

The agencies that are participating in the project can be found on our website at the following link - https://sitesproject.org/participants/ - the 23 agencies that are investing in the project for a water supply benefit are listed under the Reservoir Committee.

Additional agencies may participate if water from the project become available. The Authority currently has a waiting list of agencies throughout the state who have expressed in interest in participating/investing in the project.

The environmental impact report lists alternatives on the reservoir. Which alternative is moving forward?

At the Authority's March 2022 Board meeting, the Authority selected Alternative 3 as its preferred alternative for the purposes of CEQA and preparation of the Final EIR/EIS. The Authority Board will make its final decision on the Project after it considers and addresses public comments and prepares and certifies the Final EIR. This final decision on whether or not to move forward with the Project and if so, which alternative to move forward with, will be reflected in the Authority's adoption of the Project (which occurs after the Authority certifies the Final EIR), currently anticipated to occur in early 2023. So while the Authority's preferred alternative is Alternative 3, the final decision on the Project and alternative will be made in early 2023.

How does the water get out of the reservoir and where does it go? Underground pipes, new canals? Does it go back into the river or into a canal? If it is a canal, which canal?

Water from Sites Reservoir is released back into the Terminal Regulating Reservoir via a pipeline where the water is then conveyed through GCID's Main Canal for delivery to GCID project participants.

Water from Sites Reservoir is released into the existing Funks Reservoir and then conveyed through the Tehama-Colusa Canal for delivery to project participants along the canal.

Sites water is delivered to South-of-Delta participants and for environmental purposes (Proposition 1) via the Tehama-Colusa Canal. This water is conveyed to the terminus end of the Tehama-Colusa Canal in the Dunnigan area where it's released into a newly constructed Dunnigan Pipeline which runs east approximately 4 miles and is released into the Colusa Basin Drain. The water then continues down the Colusa Basin Drain approximately 6 miles and releases into the Sacramento River or flows into the Knights Landing Ridgecut and into the Yolo Bypass.

Sites water to South-of-Delta Participants would be conveyed through the Delta during time windows where there is available pumping capacity in the existing export facilities while also maintaining Delta water quality. Sites operations DOES NOT rely on the proposed Delta tunnel project and the tunnel project DOES NOT rely on the Sites Reservoir being in place – these two projects are independent facilities serving completely different and independent purposes

Are there conditions in the Sacramento River or the Delta under which water must be released from the reservoir back into the Sacramento River, or to wherever it goes when it is released from the reservoir?

We are not sure that we totally understand this question. There is no requirement or condition that water from Sites Reservoir must be released from the reservoir back to the River. We do expect certain safety measures that may require releases from the reservoir as we work with the CA Division of Safety of Dams – but these would be standard dam safety measures and considerations.

When we do release water from the reservoir, we will have conditions for downstream water quality and temperature monitoring. For example, we will monitor the quality and temperature of the releases to ensure that releases are suitable for agricultural uses along the Tehama-Colusa Canal and GCID Main Canal. We will also monitor the quality of releases that flow into the Yolo Bypass to ensure that we are not moving water into the Bypass that would be detrimental to Delta Smelt. We will also monitor the temperature of releases into the Colusa Basin Drain to ensure that we are not raising water temperatures in the drain in a way that would exceed certain water temperature requirements set out by the Regional Water Quality Control Board (and thus, would be detrimental to salmon in the Sacramento River as the drain flows into the River). Overall, there will be extensive water quality and water temperature monitoring in the reservoir and of water released from the reservoir, especially in the early years of the Project.

Thanks!

Kevin

Kevin Spesert
External Affairs Manager
Sites Project Authority
Phone: 530.632.4071
Email: kspesert@sitesproject.org
Web: www.SitesProject.org
P.O. Box 517
122 Old Hwy 99W
Maxwell, CA 95955

From: Arthur,Damon <Damon.Arthur@redding.com>
Sent: Wednesday, April 20, 2022 6:22 PM
To: Kevin Spesert <kspesert@sitesproject.org>
Subject: Sites Reservoir questions

Hi Kevin,
I just wanted to run a few questions by you to clarify a couple things regarding the Sites Reservoir.
Water can be pumped into the reservoir when 10,700 cfs minimum is flowing down the Sacramento River at Wilkins Slough, is that right? Is Wilkins Slough east of Arbuckle? Water is pumped from the Glenn-Colusa and Tehama-Colusa

canals to a forebay and then from there to the reservoir? Where and how does the water go from the river into the canals? At the pumping plants in Red Bluff and Hamilton City?
Does the Bureau of Reclamation plan to release more water from Shasta and Keswick reservoirs at certain times of the year so the river will flow at the necessary level to allow you to withdraw water from the Sacramento River?
Is the maximum that can be withdrawn from the river at any time 4,000 cfs?
What happens if pumping 4,000 cfs from the river in Red Bluff drops the river flow below 4,000 cfs at Wilkins Slough?
What are the 23 agencies that will be purchasing water from Sites Reservoir? Can other agencies sign on to receive water from the reservoir? Do you think there will be more agencies signing on to get water from the reservoir?
The environmental impact report lists alternatives on the reservoir. Which alternative is moving forward?
How does the water get out of the reservoir and where does it go? Underground pipes, new canals? Does it go back into the river or into a canal? If it is a canal, which canal?
Are there conditions in the Sacramento River or the Delta under which water must be released from the reservoir back into the Sacramento River, or to wherever it goes when it is released from the reservoir?

Thanks again,

Damon Arthur
Reporter
Record Searchlight | USA TODAY NETWORK
Mobile: 530.338.8834
damon.arthur@redding.com
www.redding.com

JACOBS

Memorandum

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Sacramento, California 95833-2937
United States
T +1.916.920.0300
F +1.916.920.8463
www.jacobs.com

Project Name	Sites Reservoir Project	
Subject	Model Results to Support the 2022 Biological Assessment: No Action Alternative at 2035CT, Alternative 3A at 2035CT, and Alternative 3B at 2035CT – RecTemp	
Attention	Ali Forsythe/Sites Project Authority	Monique Briard/ICF
	Erin Heydinger/HDR	Mike Hendrick /ICF
From	Robert Leaf/JACOBS	Steve Micko/JACOBS
	Reed Thayer/JACOBS	Samaneh Saadat/JACOBS
Date	May 4, 2022	

1. Introduction

The Sites Reservoir Project team has developed model simulations to support quantitative analysis of Sites long-term operations as part of developing a Biological Assessment, for completion in 2022.

The results of these model simulations are provided for informational and review purposes. If there are any questions regarding the results of these simulations, please contact the modeling team.

2. Modeled Scenarios

Model results are provided for the alternatives tabulated below.

Model Name	**Label Name (as seen in spreadsheet)**	**Description**
No Action Alternative 041122 2035CT	NAA 041122 2035CT	Baseline simulation (Reclamation 2021 Benchmark at 2035CT and 15 cm of sea level rise)
Alternative 3A 041122 2035CT	ALT3A 041122 2035CT	1.5 MAF Reservoir with 345 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise
Alternative 3B 041122 2035CT	ALT 3B 041122 2035CT	1.5 MAF Reservoir with 230 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise

The Reclamation Temperature Model (Feather River model) was used to simulate reservoir and riverine temperature conditions based on the results of the CalSim II models (provided on April 12th, 2022).

This model (Reclamation Temperature Model) has been jointly developed by Reclamation and the California Department of Water Resources (DWR) over many years. These models are useful so long as the results are interpreted consistent with the model limitations.

3. Model Simulations for Modeled Scenarios

3.1 Reclamation Temperature Model Simulations

A Trend Reporting spreadsheet, NODOS_Trend_Reporting_rev06cye_DV6_2035CT_HEC5Q_ RecTemp_NAA_041122_2035CT_ALT3A_041122_2035CT_ALT3B_041122_2035CT.xlsm, is provided.

Note that this trend reporting spreadsheet does not include storage, nor flow results. Some storage and flow locations in temperature models may coincide with storage and flow locations available in CalSim II. For consistency, please observe storage and flows from CalSim II at boundary condition or controlled flow locations.

4. Trend Reporting Spreadsheet

The trend reporting spreadsheet is designed to provide easy viewing of multiple scenarios. Please focus on the "Report - ALL (DASHBOARD)" tab. At this tab, you can select the parameter that you wish to evaluate, the type of statistic that you would like to view (e.g. averages, water-year type averages, dry periods), and the seasonal period (e.g. individual months, water year, CVP contract year, selected seasons). If flow results are presented, there is an option to convert flow data in CFS to volume in TAF/month.

The "Report - ALL (DASHBOARD)" presents data in the following formats:

- Results Table
- Bar chart of results
- Timeseries of selected statistic
- Exceedance plot (displays all data for the selected seasonal period; is not affected by "select statistic")
- Monthly Pattern (displays the selected statistic for each month; is not affected by "select seasonal period")
- Overall timeseries (includes entire timeseries, not affected by "select statistic" or "select seasonal period").

Not all statistics or seasonal periods should be used for all parameters. For example, seasonal averages or annual averages of reservoir storage do not provide value.

If reviewing results by water year type, please note that water year type averages are calculated based on calendar year, not water year.

Attachment X

Coordination with Facility Owners

The Sites Reservoir Project (Project) would use existing and new facilities to divert water from the Sacramento River and convey that water to the new Sites Reservoir. These facilities include the existing Red Bluff Pumping Plant, the existing Tehama-Colusa Canal (including the existing Funks Reservoir), the existing Hamilton City Pump Station, and existing Glenn-Colusa Irrigation District Main Canal. Ownership and access to each of these facilities is described below.

Red Bluff Pumping Plant, Tehama-Colusa Canal and Funks Reservoir

The Red Bluff Pumping Plant, Tehama-Colusa Canal and Funks Reservoir (which is a part of the Tehama-Colusa Canal) facilities are owned by the Bureau of Reclamation (Reclamation) and operated by the Tehama-Colusa Canal Authority (TCCA) under contract to Reclamation. Reclamation and the Sites Project Authority (Authority) have been working in partnership to develop the Project. Throughout 2021, Reclamation and the Authority discussed terms and conditions for the Project to ensure that the Project would not result in impacts to the Central Valley Project (CVP), including those CVP contractors along the Tehama-Colusa Canal. These discussions are expected to continue in 2022.

As described in the Revised Draft EIR/Supplemental Draft EIS, if the Project moves forward, Reclamation would have a number of future authorizations and/or approval actions for the Project. These would include the execution of a contract with the Authority for the use of the Red Bluff Pumping Plant and the Tehama-Colusa Canal to convey water into and out of the new Sites Reservoir. At this time, it is anticipated that Reclamation would issue this contract under its various authorities, including but not limited to its authority in the Act of February 21, 1911 (36 Stat. 925), typically referred to as the Warren Act. Reclamation regularly issues Warren Act contracts for the conveyance of non-federal water in federal facilities when excess capacity exists. The Authority anticipates reaching mutually agreeable Warren Act contract terms with the Reclamation for the Project's use and conveyance of non-federal water through the federally-owned facilities.

In addition to discussions with Reclamation, the Authority also began working with the Tehama-Colusa Canal Authority, as the operator of the Tehama-Colusa Canal, in early 2021 to reach mutually agreeable terms on a separate contract. This separate contract would, among other things, outline the costs associated with the Project's use of the Red Bluff Pumping Plant and the Tehama-Colusa Canal and how the Authority would reimburse the Tehama-Colusa Canal Authority for those costs. The Authority and the Tehama-Colusa Canal Authority met several times in the last year to discuss broad terms that form the foundation of this contract. The Authority and the Tehama-Colusa Canal Authority expect to reinitiate meetings on the contract in the near future. The Authority anticipates reaching mutually agreeable contract terms with the Tehama-Colusa Canal Authority.

Hamilton City Pump Station and Glenn-Colusa Irrigation District Main Canal

The Hamilton City Pump Station and Glenn-Colusa Irrigation District (GCID) Main Canal facilities are owned by the GCID. In early 2021, GCID and the Authority began discussions to reach mutually agreeable terms on a contract that would, among other things, outline the costs associated with the Project's use of the Hamilton City Pump Station, the Main Canal and related facilities, and how the Authority would reimburse GCID for those costs. The Authority and GCID met several times in the last year to discuss broad terms that form the foundation of this contract. The Authority expects to reinitiate meetings on the contract in the near future and anticipates reaching mutually agreeable contract terms for the Project’s use of the Hamilton City Pump Station, the Main Canal and related facilities.

Sites Reservoir Email Inquiries – 4.25.2022 DRAFT

First Name: Clyde
Email: ctwilliams2012@yahoo.com

Message:
Where is the REIR now?

--
Good afternoon Mr. Williams,

Commented [SR1]: Always formal unless you personally know the stakeholder or there is no indication of the last name.

The Revised Draft EIR/Supplemental Draft EIS was released on Nov. 12, 2021, for a 77-day public review and comment period, which ended on January 28, 2022. The Sites Project Authority and U.S. Bureau of Reclamation are preparing the Final EIR/EIS, which is expected to be completed in Fall 2022. The Final EIR/EIS will include responses to comments received during the Revised Draft EIR/Supplemental Draft EIS comment period.

Additional updates and more information will be posted on sitesproject.org as it is available.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

First Name: Will
Email: wve5eml@gmail.com

Message:
I am doing some homework to understand Sites Reservoir. Is this chart an accurate presentation of the numbers?
Thank you,
-Will

Well, apparently my chart is not permissible. Had Sites been in operation, would approximately 31,000 acre feet have been stored in Jan -Feb 2021, and 226,000 acre feet stored in Oct 2021 - Jan 2022 ?

Thank you.

Commented [SH2]: I think this is correct – can we confirm?

--
Good afternoon Will,

Thank you for contacting the Sites Project Authority.

____.

Additional updates and more information will be posted on sitesproject.org as it is available.
Thank you,

Sharon Han
Sites Reservoir Project Communications Team

Name: Erik Zinn
Email: enzinn@gmail.com

Message: I have followed this project closely for what seems like decades, as a duck hunter in the Northern Sacramento Valley and as a consulting engineering geologist in Santa Cruz. I am both happy and chagrined at the project status. It seems clear to most of us that are involved in water supply projects in California that we need the Sites Reservoir, and more water storage projects like it ASAP. In any event, thanks for pushing this project - it will probably end up being essential to our survival in California. I wish I could apply my skills as a geologist and be part of the project!

Keep up the good work.

Sincerely,

Erik Zinn

--
Good afternoon Mr. Zinn,

Thank you so much for your message. We are committed to ensuring Sites Reservoir is affordable, permittable, and buildable as we take the project from the planning phase into final design and construction. If you are on social media, please engage with us on Twitter at @sitesproject, on Facebook at @SitesProject and on Instagram at @sitesproject.

As always, updates and more information will be posted on sitesproject.org.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

Name: Anna N. Bolla
Email: annanbolla@gmail.com

Message: I am a lifelong California resident & homeowner. My primary residence is in Richmond & I own a second property in Stonyford. I have strong ties to Colusa County & I'm interested in learning more about the project & any possible job openings.

I have a Class A license (with 11 years of experience) & I have worked in the public sector now since 2010.

This neverending drought will have long-reaching consequences for future generations & I fully support the Sites Reservoir project.

--
Hi Ms. Bolla,

Thank you so much for your message. We are committed to ensuring Sites Reservoir is affordable, permittable, and buildable as we take the project from the planning phase into final design and construction. If you are on social media, please engage with us on Twitter at @sitesproject, on Facebook at @SitesProject and on Instagram at @sitesproject.

As always, updates and more information will be posted on sitesproject.org.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

First Name: Ian
Email: iantreat@gmail.com

Commented [SH3]: Please advise.

Message:
About 80% of California's developed water projects go to a handful of agribusinesses that benefit from water subsidized by taxpayers. The Sites Reservoir may market itself with pictures of residential faucets, but the people living in its watershed will never benefit from it. California's water may be another security on a trading floor, but the people will continue to resent exploitation by profiteers.

--
Good afternoon,

Thank you for reaching out with your concerns.

Once completed, the Sites Reservoir will be able to provide water for up to 1.5 million homes and businesses per year, and it will increase reliability and flexibility in California's water supply. Water agencies and municipalities across the state are investing in Sites Reservoir because of its water supply benefits, and **XX** member agencies serve urban communities and drinking water needs.

Please visit sitesproject.org for the latest information and news about the Sites Reservoir Project.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

From: John Brower <jxbxhome@gmail.com>
Sent: Thursday, March 17, 2022 3:02 PM
To: info@sitesproject.org
Subject: Sites Reservoir, Aqueduct, and Deschutes River

Commented [SH4]: Please advise.

I learned today that there will be funding for the Sites Reservoir. I would like to share something that I am sure was looked into, but wanted to make sure I shared.

Central Oregon has similar concerns about sustainability for farmers and aquatic life that California does. The Irrigation Districts have decided to pipe the irrigation canals for water taken from the Deschutes River. The estimates for evaporation in the canals are about 40%. When piped, it will significantly reduce the loss. This will give the Deschutes River increased flow.

I wonder if there has been consideration given to piping the California Aqueduct? At 13,100 cfs a reduction in loss of any magnitude even close to 40% would be amazing. Maybe less water siphoned from the Sacramento River.

Here is the environmental impact report from Central Oregon Irrigation District.

Central Oregon Irrigation District – COID Piping

Thank you, sincerely hope all works, John Brower Bend, OR

--
Good afternoon Mr. Brower,

Thank you for your interest in this project and for your inquiry.

——

Please visit sitesproject.org for the latest information and news about the Sites Reservoir Project.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

Name: Andre Hawks

Message: Good afternoon,

My name is Andre Hawks and we are interested in the Sites Reservoir project and were wondering the status of the design of the Reservoir. We are a SBE/DBE Design Build Heavy Civil construction company that would like to work on this project.

Please find attached our capability statement and COI.

Commented [SH5]: Please advise.

--

Good afternoon Mr. Hawks,

Thank you for your interest in the project and for your inquiry. Contracting and consulting opportunities will be available in the future on https://sitesproject.org/procurement/.

Please visit sitesproject.org for the latest information and news about the Sites Reservoir Project.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

Name: Elaine Whitley
Email: e.whitley058@gmail.com
Date: Fri, Apr 1, 2022 at 4:18 PM

Message: Good Afternoon,

I'm emailing in regards to the Sites Reservoir project: construction and operation of an offstream surface water reservoir to provide direct and real benefits to instream flows, the Sacramento–San Joaquin Delta ecosystem, and water supply reliability. Can you please tell me what is currently underway for this project and when right of way acquisitions and construction might begin?

Thank you in advance!
Elaine Whitley

Follow-up Message: Good Afternoon,

I apologize in advance if I've missed your response, but I'm following up in hopes that you can provide an update on this project, or direct me to the correct person please.

Sincerely,
Elaine

--

Good afternoon Ms. Whitley,

Thank you for your interest in the project and for your inquiry.

Currently, the Sites Project Authority and U.S. Bureau of Reclamation are preparing the Final Environmental Impact Report/Environmental Impact Statement, which is expected to be completed in Fall 2022. The Final EIR/EIS will include responses to comments received during the Revised Draft EIR/Supplemental Draft EIS comment period, which closed on January 28, 2022.

The Sites Project Authority released the 2021 Annual Report, which reviews our current progress and timeline. Construction is anticipated to begin in 2024.

Please visit sitesproject.org for the latest information and news about the Sites Reservoir Project.

Thank you,
Sharon Han
Sites Reservoir Project Communications Team

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/5/2022 3:31:18 PM
To: Hassrick, Jason [Jason.Hassrick@icf.com]; Spranza, John [john.spranza@hdrinc.com]
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival
Attachments: Hassrick et al. 2022_NAJFM.pdf

Hi Jason – I am just following up on previous emails from my vacation. See the email below from Doug. I think he might be miss interpreting your study results. Would you be willing to chat with him? I think we can make this very informal and I am comfortable with you just reaching out directly to him. I don't see the need for anyone from Sites to be on the phone as I want to give Doug a safe space to ask questions freely of you.

Let me know if you'd be willing to reach out to him. This, of course, is chargeable to the Sites Project.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 |
aforsythe@sitesproject.org | www.SitesProject.org

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Thursday, April 14, 2022 3:27 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Jerry Brown <jbrown@sitesproject.org>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Dear Jerry and Ali,

Thank you again for sending us the daily diversion tool, and to Jerry for coffee/tea the other morning. I wanted to follow up with two things for you:

First, I wanted to make sure that you were aware of this new peer reviewed scientific study which concludes that for juvenile winter-run Chinook salmon, migratory survival down the Sacramento River is reduced when flows are less than approximately 24,000 cfs (equivalent to 700 cubic meters per second). We've submitted this paper to CDFW (see below), and wanted to make sure that this was included in the JPA's administrative record for NEPA/CEQA since this was new information that was not available at the time of the public comment period on the EIS/EIR.

Second, we've been analyzing the potential changes in water diversions to storage using the daily diversion tool, and it appears that the proposed change to the bypass flow of 10,700 cfs from Oct to June results in an approximately 25% reduction in diversions to storage. It sounds like that is similar to what y'all are finding (our numbers are lower than what WRMWSD reported to their Board). In addition, as we have been exploring the model, we're not sure that the Delta outflow requirements in the model are actually working to limit water diversions to storage. It may be (probably is!) user error on our part, but if we're not able to get the model to work right in the next week or two we may want to check in to make sure the model is actually working correctly.

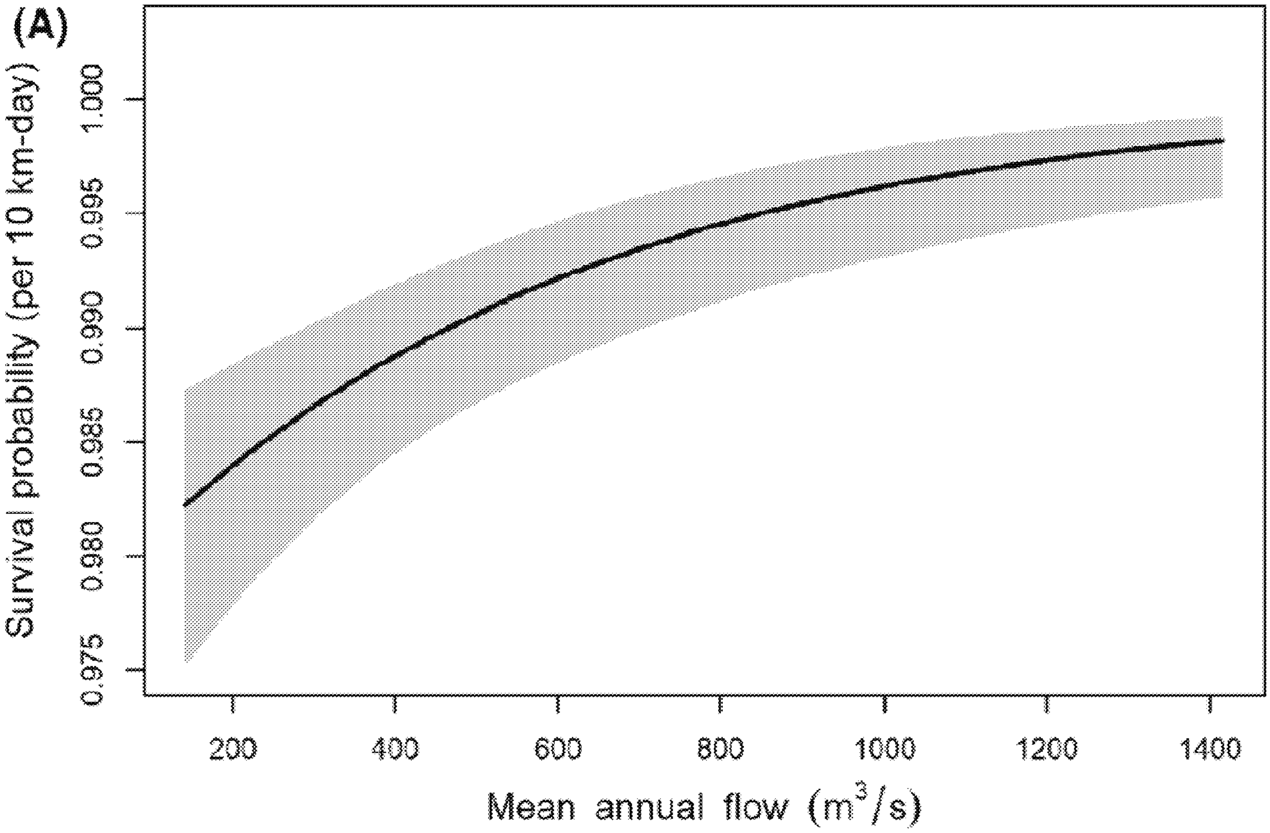
Thanks,
Doug

From: Obegi, Doug
Sent: Friday, March 25, 2022 10:52 AM
To: Kristal Davis-Fadtke <Kristal.Davis-Fadtke@wildlife.ca.gov>
Cc: jon@baykeeper.org
Subject: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Kristal,

I wanted to make sure you were aware of this new paper, which finds that for winter-run Chinook salmon, juvenile migratory survival down the Sacramento River is reduced when flows are less than around 24,000 cfs / 700 cubic meters per second:

"For example, when flow is less than about 700 m3/s, given the confidence interval, pulse flows will have a high probability of having a positive effect on survival. The relationship also indicates what the magnitude of the effect may be. For example, when mean annual flow is 600 m3/s, a pulse flow is going to have half the effect of a pulse event than when mean annual flow is 200 m3/s."



This paper indicates that at least for hatchery winter-run Chinook salmon, higher bypass flow thresholds for Sites Reservoir than 10,700 cfs are necessary to fully mitigate impacts and avoid further reductions in juvenile survival of this endangered species.

Best,
Doug

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Friday, March 25, 2022 9:23 AM

To: Obegi, Doug <dobegi@nrdc.org>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,

Attached is the published paper. Thanks for your interest.

Jason

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Tuesday, February 1, 2022 12:39 PM
To: Hassrick, Jason <Jason.Hassrick@icf.com>; arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Aha – thanks!

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Tuesday, February 1, 2022 12:38 PM
To: Obegi, Doug <dobegi@nrdc.org>; arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,

We did not work up cumulative survival because that is something that Arnold is preparing for a separate paper. As I mentioned to you before, I'll send out the finalized paper to you after I go through the proofs. I should receive them from the journal this week.

Jason

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Tuesday, February 1, 2022 12:17 PM
To: arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Sorry, no, I was interested in whether y'all had calculated what the survival rate down the length of the Sacramento River would be at different flow levels, based on the survival rate per 10 km reach shown in the flow:survival curve in Figure 8A. In other words, converting the flow:survival graph in Figure 8A into survival down the entire river rather than per 10 km segment.

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 12:09 PM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,
We have overall river survival by year, and flow varies by year. Is that what you are looking for? I will pull up that data for you.
Arnold

On Tue, Feb 1, 2022 at 11:36 AM Obegi, Doug <dobegi@nrdc.org> wrote:

While I have your ear… Did y'all calculate what the overall change in survival is in the Sacramento River at the different flow levels in Figure 8A (the cumulative change in survival over the entire river at the various flow levels on that curve, rather than the change per 10 km, assuming flows and other covariables held constant)?

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 11:32 AM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Great!

On Tue, Feb 1, 2022 at 11:31 AM Obegi, Doug <dobegi@nrdc.org> wrote:

> Yeah, it came through and I'm looking at it now.
>
> ---
>
> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
> **Sent:** Tuesday, February 1, 2022 11:32 AM
> **To:** Obegi, Doug <dobegi@nrdc.org>
> **Cc:** miles.daniels@noaa.gov
> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>
> Were you able to download it? I got a system message saying it was too large.
>
> On Tue, Feb 1, 2022 at 11:24 AM Obegi, Doug <dobegi@nrdc.org> wrote:
>
>> Thanks Arnold! Look forward to reading the paper.
>>
>> Take care,
>>
>> Doug
>>
>> ---
>>
>> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
>> **Sent:** Tuesday, February 1, 2022 10:57 AM
>> **To:** Obegi, Doug <dobegi@nrdc.org>
>> **Cc:** miles.daniels@noaa.gov
>> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>>
>> Hello Doug,
>>
>> Please find attached the early online version of the paper. Let me know if you have any questions about it.
>>
>> Cheers,
>>
>> Arnold
>>
>> On Mon, Jan 31, 2022 at 1:49 PM Obegi, Doug <dobegi@nrdc.org> wrote:

Congratulations to you both on this new paper published in CJFAM! Very cool. Any chance that one of you has a pre-publication version that you could share with me?

From: Obegi, Doug
Sent: Monday, January 31, 2022 1:24 PM
To: jason.hassrick@icf.com
Subject: Request for pre-publication copy of your recent manuscript

Hi Jason,

I hope you're doing well these days. Congratulations on your new paper published in CJFAM! (https://afspubs.onlinelibrary.wiley.com/doi/abs/10.1002/nafm.10748)

Do you have a pre-publication version of the manuscript that you would be willing to share with me, since the paper is currently not open access?

Thanks,

Doug

____

DOUG OBEGI

*Senior Attorney**

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North American Journal of Fisheries Management
© 2022 American Fisheries Society
ISSN: 0275-5947 print / 1548-8675 online
DOI: 10.1002/nafm.10748

ARTICLE

Factors Affecting Spatiotemporal Variation in Survival of Endangered Winter-Run Chinook Salmon Out-migrating from the Sacramento River

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Abstract

Among four extant and declining runs of Chinook Salmon *Oncorhynchus tshawytscha* in California's Central Valley, none has declined as precipitously as the Sacramento River winter run. Migratory winter-run Chinook Salmon employ a life history strategy to reside and feed in stopover habitats on their way from freshwaters to the ocean. Migratory winter run, on their way from freshwaters to the ocean, employ a life history strategy to reside and feed in stopover habitats that have been affected by anthropogenic disturbance. Using acoustic telemetry, we examined conditions that influenced reach-specific movement and survival of out-migrating juveniles during a prolonged, multi-year drought from 2013 to 2016, followed by one of the wettest years on record (2017). We modeled how time-varying individual riverine covariates and reach-specific habitat features influenced smolt survival. Model selection favored a model with mean annual flow, intra-annual deviations from the mean flow at the reach scale, reach-specific channel characteristics, and travel time. Mean annual flow had the strongest positive effect on survival. A negative interaction between mean annual flow and intra-annual reach flow indicated that within-year deviations at the reach scale from annual mean flow had larger effects on survival in low-flow years. These factors resulted in higher survival during years with pulse flows or high flows. Changes in movement behavior in response to small-scale changes in velocity were negatively associated with survival. Covariates of revetment and wooded bank habitat were positively associated with survival, but the effect of these fixed habitat features changed depending on whether they were situated in the upper or lower part of the river. Fish exhibited density-dependent stopover behavior, with slowed downstream migration in the upper river in the wet years and extending to the lower river in the most critically dry year. This paper contributes two key findings for natural resource managers interested in flow management and targeted habitat restoration. The first is new insight into how the magnitude of pulse flows in dry and wet years affects survival of winter-run fish. The second is that density dependence influences where stopover habitat is used. Despite this, we identified an area of the river where fish consistently exhibited stopover behavior in all years.

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Received August 3, 2021; accepted January 19, 2022

Migration is a fundamentally important ecological process for animals that reproduce and forage in different places. Environmental decision making is challenging in application to migrating species because management approaches must span a vast range of distant and distinct habitats (Runge et al. 2014). Stopover behavior is an important component of migration for animals that must refuel along the migration path before continuing toward their ultimate destination. Studies of birds have found that migrants will select stopover habitats that allow refueling with maximum efficiency to remain on schedule (Alerstam and Lindström 1992). Loss of even a small amount of stopover habitat can have disproportionately large impacts on migratory populations (Iwamura et al. 2014). Effective management of migratory species therefore depends on accurate characterization of habitat use.

In diadromous fishes, migration can be long and complex (Thorstad et al. 2012), but little is known about how stopover habitats vary in quality and how they are used. The Chinook Salmon *Oncorhynchus tshawytscha* is a suitable species in which to examine this behavior because the juveniles migrate through entire watersheds from inland freshwater streams where they are born to productive coastal estuaries (Moore et al. 2016). Accordingly, rivers function as a migratory corridor during the smolt migration phase, which is considered one of the most vulnerable periods in their anadromous life history (Quinn 2005). Alternatively, juvenile salmon may stop over during transit to capitalize on foraging opportunities, seek refuge from predators, or simply rest. Quantifying how juvenile salmon allocate their time across the riverscape is foundational to understanding the relative importance of different riverine habitats (Thorpe 1994; Moore et al. 2016).

California's Central Valley represents the southern extent of the range for Chinook Salmon, where they are confronted with a number of stressors (Fisher 1994; Yoshiyama et al. 1998). Mild winters with a receding snowpack and dry summers frequently result in a hydrologic system where water availability and demand are mismatched (Berg and Hall 2017). Dams on the major rivers block access to historical habitat, and water storage and managed releases to meet human demands throughout the year result in a flattened hydrograph relative to natural flows (Kondolf and Batalla 2005). Muted peak flows in winter and increased summer flows can mask cues that salmon use to initiate migration (Bunn and Arthington 2002). Finally, climate change projections of rising temperatures in the Sacramento River (Cloern et al. 2011) show an increased likelihood and duration of drought conditions, which have been occurring in California with increasing frequency over the past two decades (Diffenbaugh et al. 2015).

All four populations of extant Chinook Salmon races in California's Central Valley have declined over the past decades and have experienced precipitous declines since the onset of the latest megadrought in the early 2000s (Johnson and Lindley 2016), which was the second-driest 20-year period since 800 CE (Williams et al. 2020). Sacramento River winter-run Chinook Salmon (hereafter, "winter run") are the most critically endangered of the four Chinook Salmon runs in the Central Valley. The spawning population crashed from 87,000 in the late 1960s to fewer than 200 in the early 1990s (Fisher 1994) and remains at risk of extinction (Lindley et al. 2009; Poytress et al. 2014).

Historically, the winter run adapted to California's dry and variable climate by holding in the coldest upper reaches of headwater tributaries of the Sacramento River during summer months, when temperatures in the Central Valley were unsuitable for spawning and rearing (Yoshiyama et al. 1998). Fry reared in thermal refuges of these tributaries throughout summer (5–10 months) and migrated as smolts during the first freshets of the following autumn (Williams 2006). For the past 75 years, access to historic spawning tributaries has been eliminated by construction of Shasta and Keswick dams, forcing three populations to mix and spawn as one in the main stem of the Sacramento River downstream of Keswick Dam (Williams 2006). In the post-dam era, otolith geochemistry provides some evidence that winter-run fish continue to rear in nonnatal tributaries extending as far downstream as the San Francisco estuary (Phillis et al. 2018).

Hatchery releases of juvenile winter-run "pre-smolts" into the river are timed to maximize survival and occur during storm events when high instream flows can facilitate rapid emigration. However, the mechanism for how survival per unit time is related to flows is not well understood. On one hand, high flows could move fish rapidly through hazardous habitat. Alternatively, if fish move in response to density-dependent habitat availability, high flows could reduce pressure to move by creating more stopover habitat. Furthermore, it is unknown whether flows affect survival the same way across all reaches. Understanding which mechanisms most influence survival and identifying the reaches in which juvenile salmon experience particularly high or low mortality can therefore help managers find ways to focus on specific, targeted actions to improve survival.

Without this information, the National Marine Fisheries Service has had to rely on out-migration information from larger, yearling hatchery late-fall-run fish as surrogates to fill data gaps in their winter-run recovery plans (Johnson and Lindley 2016; Johnson et al. 2017). However, a growing body of scientific literature cautions against inferring too much from surrogates because they often do not respond in the same way as the targeted taxa to similar environmental conditions (Caro and O'Doherty 1999; Andelman and Fagan 2000). Even within a Chinook

Salmon run, the responses of hatchery and wild fish to environmental conditions may differ, resulting in differences in mortality during out-migration (Buchanan et al. 2010).

Nevertheless, research using acoustic telemetry primarily on late-fall Chinook Salmon has yielded some important insights into some of the immediate challenges confronted by migrating salmon smolts in general, such as disorienting structures with magnetic fields that influence seaward orientation (Klimley et al. 2017), predation dynamics (Sabal et al. 2016, 2021), entrainment into the south Sacramento–San Joaquin Delta (hereafter, “Delta”; Perry et al. 2015), and loss of habitat and limited food resources (Donaldson et al. 2014). This study builds upon earlier work on flow-mediated survival relationships that are gaining prominence in the field. Flow-mediated survival during the out-migration phase of the life cycle has been shown to have a greater effect on smolt-to-adult returns than marine survival (Michel 2019). The magnitude of bidirectional, tidally influenced flows has also been recognized as an important determinant of migration routing and survival in the Delta (Perry et al. 2018; Singer et al. 2020), and intra- and interannual reach flow has a greater impact on late-fall-run survival than other riverine and predation-related covariates (Henderson et al. 2019).

This study was designed to evaluate the effects of flow on winter-run survival at multiple scales and in the presence of other habitat covariates by directly evaluating the survival of hatchery-origin winter-run out-migrants using the Juvenile Salmon Acoustic Telemetry System (JSATS). Due to their scarcity, it was not feasible to obtain natural-origin winter-run fish (i.e., offspring of adults spawned in the river); therefore, extrapolation of our findings to natural-origin fish should be considered with caution (Buchanan et al. 2010). Furthermore, because our study used smolt-sized fish released in the upper river, our understanding of movement rates will be skewed to fish that would have reared in natal habitat and then initiated their smolt out-migration rather than rearing downstream. Evidence of downstream rearing is therefore likely to be conservative.

Within this framework, we developed a suite of mark–recapture models following the approach developed for the late-fall run by Henderson et al. (2019). We examined how individual features of the fish themselves (i.e., fish size); temporal, reach-constant riparian habitat features; and spatial, time-varying hydrologic conditions affected survival of out-migrating, hatchery-origin, winter-run juveniles. The study was carried out during a 5-year period under extremely variable climate conditions: a prolonged, multi-year drought (2013–2016) followed by one of the wettest years on record (2017). Although only one wet year was represented in our study, it allowed us to contrast movement behavior and survival outside of the drought conditions that characterized all other years in this study. To quantify relationships between covariates and survival, we used mark–recapture models and information-theoretic model selection criteria to rank alternative models. Our goals were to (1) examine spatial and temporal patterns in out-migration movement and survival in the river and (2) identify which combination of environmental covariates had the greatest influence on survival.

METHODS

Study site.— The Sacramento River is the largest river in California, flowing south from Mount Shasta for 410 km before reaching the Delta. Mean daily discharge from the Sacramento River in 1955–2019 was 656 m^3/s (California Department of Water Resources, Dayflow database), draining about 68,635 km^2 of the Central Valley. Keswick Dam (river kilometer [rkm] 557 from the Golden Gate Bridge [rkm 0]) is the upper limit to anadromy on the Sacramento River. For this study, we focused on movement and survival in the Sacramento River, ending 387 rkm downstream at the city of Sacramento, prior to entering the branching Delta and tidal estuary (Figure 1).

Acoustic-tagged fish.— The acoustic tags used with the JSATS in this study were manufactured by Advanced Telemetry Systems (ATS, Isanti, Minnesota). The model used in 2013 weighed 430 mg, with dimensions of 11.9 × 5.3 × 3.8 mm and a pulse rate interval (PRI) of 7 s, while the model used in 2014–2017 weighed 310 mg, with dimensions of 10.8 × 5.3 × 3.0 mm and a PRI of 10 s. Each year, 5% of tags were randomly sampled and used to verify tag life, which ranged from 43 to 90 d, with an average of 70 d. This satisfied the assumption of closure in the mark–recapture models because the longest duration travel times occurred early in the upper to middle river and did not exceed this value over the course of migrating through the study area.

At Livingston Stone National Fish Hatchery (U.S. Fish and Wildlife Service, Shasta Lake, California), fish that were selected for acoustic tagging were taken from tanks that contained the largest fish (one to eight tanks depending on the year) to keep individual tag burden below 5.9% (Brown et al. 2010). Prior to tag implantation, each fish was anesthetized to stage IV (i.e., fish were observed to have lost equilibrium and exhibited minimal response to touch; average time to stage IV was 141 s). Anesthetized fish were weighed to the nearest 0.1 g, and FL was measured to the nearest millimeter. Fish were placed ventral side up on a V-shaped, foam surgery cradle. Anesthesia was maintained during surgery with dilute anesthetic solution pumped through a small plastic tube leading into the mouth. An incision about 7 mm long was made between

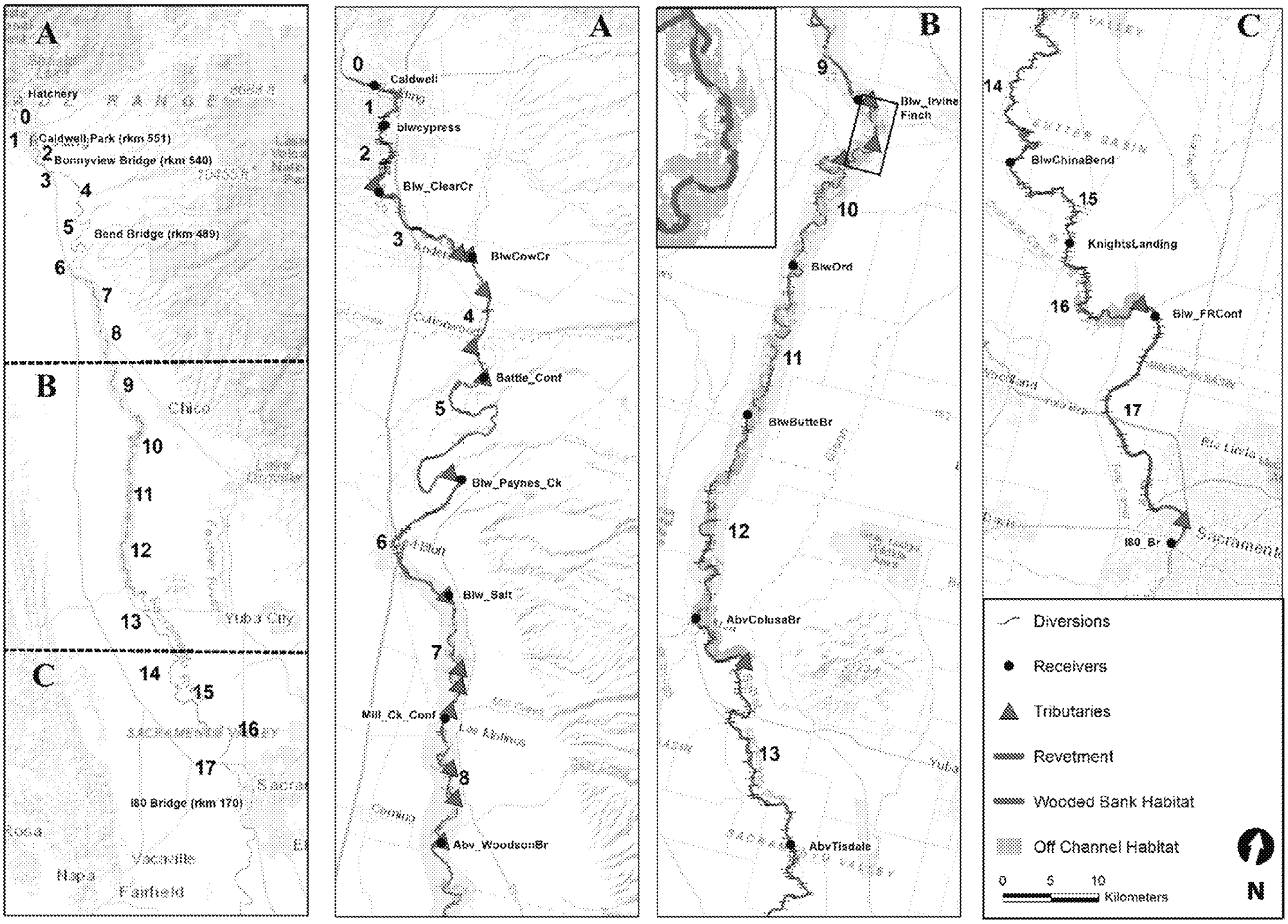

FIGURE 1. Extent of the study area from Redding to Sacramento (left panel). River reaches are numbered between acoustic receiver sites. Time-constant habitat features are mapped over the study area for the (**A**) upper, (**B**) middle, and (**C**) lower sections of the river. The inset map magnifies wooded bank habitat, revetment, and off-channel habitat that was connected within 1 km of the main-stem Sacramento River in the wet year. World topographic base map source: Esri, DeLorme, TomTom, Intermap, GeoTechnologies, General Bathymetric Chart of the Oceans, U.S. Geological Survey, Food and Agriculture Organization of the United Nations, National Park Service, Natural Resources Canada, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, Ministry of Economy, Trade and Industry (Japan), Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community.

the pelvic and pectoral fins approximately 3 mm off the ventral midline using a 3-mm scalpel (Sharpoint 15° stab knife). A disinfected acoustic tag was inserted battery first into the coelom through the incision, and the incision was closed with one or two sutures of absorbable monofilament (6/0 Monoswift). Surgery time averaged 142 s. Fish were observed to resume normal swimming behavior after an average of 236 s. Mean tag burden (tag weight expressed as a percentage of fish weight) by year ranged from 3.2% to 4.3%.

Following surgery, tagged fish were returned to tanks and held for 1–3 d until the hatchery production fish were loaded into transport trucks. Acoustic-tagged fish were transferred into portable PVC/mesh holding pens and placed within the tank of a transport truck. Transport time from the hatchery to release into the Sacramento River at Caldwell Park (Redding) was approximately 45 min; in 2016, fish were released at Bonnyview Bridge (Redding), and transport time for those fish was approximately 60 min. Acoustic-tagged fish were released simultaneously with the other hatchery-origin fish, which were released after sunset. In 2015, when hatchery fish were released over three consecutive days, acoustic-tagged fish were released on the first and third days. The number of acoustic-tagged individuals and the number of hatchery fish released varied substantially among the 5 years of this study; in particular, hatchery releases were much higher in 2014 and 2015 to compensate for anticipated severe losses of naturally produced fish due to drought, with elevated river temperatures and associated critically dry conditions (Table 1).

Acoustic receivers.— As part of the California Fish Tracking Consortium, we tracked fish by using an array of acoustic receivers beginning 3 km below the release location in Redding; extending down the Sacramento River, Delta, and San Francisco Bay; and ending at a dual line of receivers at the Golden Gate Bridge. However, for this study we were interested in examining riverine survival using outputs from the River Assessment for Forecasting Temperature (RAFT) model, which terminates at the tidal Delta, so we restricted this analysis to only receiver locations in the Sacramento River, ending at the city of Sacramento, to estimate survival and movement over 379 km (Figure 1). Receivers positioned downstream in the Delta to the point of ocean entry at the Golden Gate Bridge were therefore pooled into a single site and used to improve estimates of detection probability and survival for all reaches upstream of the final line.

Three different types of JSATS receivers were used in this study: ATS Model SR3000; Lotek Wireless (Newmarket, Ontario, Canada) Model WHS4000; and Teknologic Engineering (Edmonds, Washington) Model LER. Detection range varied from 50 to 300 m depending on river conditions (A. J. Ammann, unpublished data), with an 85% probability of recording at least four valid transmissions from a distance of 135 m (Ammann 2020). We deployed 40 receivers at 18 locations demarcating 17 river reaches (Figure 1). At most of the receiver locations, two receivers were deployed across the river to improve cross-sectional detection coverage. Receivers were held in position with a bottom anchor that was either attached to a shore cable or suspended from a bridge structure.

Postprocessing.— All receiver files contain some amount of invalid or false positive detections. These must be distinguished from true detections and removed to prevent biased interpretation of fish movement and survival (Beeman and Perry 2012). Therefore, each raw receiver file was processed using a set of algorithms to remove false detections (Deng et al. 2017) and to add location information and a unique fish identifier. The filtering algorithm was customized for each of the three receiver models. Briefly, the filtering algorithm used criteria that included the following constraints: (1) the detection code had to match that of a released fish; (2) detection time had to occur after the release time and before the tag was expected to expire; (3) detections that occurred less than 0.3 s after the previous detection (multipath) were removed; and (4) detections had to have occurred within a time window and within the tag's PRI that was specified depending on receiver make. Lotek receivers required a minimum of four detections within 16.6 times the PRI, and the observed PRIs among these detections had to be within 20% of the nominal PRI. Additionally, the SD of these PRIs had to be less than 0.025. Teknologic receivers required at least two detections within four times the PRI, the observed PRI had to be within 10% of the nominal PRI, and the difference in frequency of the two detections had to be less than 55 kHz. The ATS receivers required at least two detections within four times the PRI, the observed PRI had to be within 10% of the nominal PRI, frequencies of the two detections had to be between 416.30 and 418.75 kHz, and the difference in frequency of the two detections had to be less than 0.505 kHz. Separate receiver files were then compiled into a single table. Plots of the time of detection versus rkm were created for each fish and visually inspected for detections that were not spatially and temporally congruent with the remaining detections. We considered any upstream movements as those of predators having ingested a tagged fish. Where predation was inferred, we ended the fish's detection history at the furthest downstream detection.

Mark–recapture analysis.— We used a Cormack–Jolly–Seber survival model (Cormack 1964; Jolly 1965; Seber 1965) to analyze capture histories and estimate the effects of covariates on survival (ϕ) and detection (p). The

TABLE 1. Number and size (mean ± SD) of acoustic-tagged winter-run Chinook Salmon juveniles released each year. Fish were reared at Livingston Stone National Fish Hatchery and released at Caldwell Park (Redding, California; rkm 551) except in 2016, when the release location was Bonnyview Bridge (Redding; rkm 540). Tag burden was calculated as 100 × (tag weight/fish weight). Flow at Bend Bridge was calculated from the date of release to the date on which the last fish was detected at Tower Bridge in Sacramento.

Release date	Number of fish acoustic tagged	Weight (g)	FL (mm)	Tag burden (%; mean, range)	Hatchery winter-run fish released	Flow (m^3/s) at Bend Bridge[a] (mean, range)
Feb 7, 2013	148	10.3 ± 1.7	98 ± 5.0	4.3 (2.5–5.4)	166,967	168 (127–289)
Feb 14, 2014	358	9.4 ± 2.4	95 ± 7.7	3.9 (2.0–5.8)	190,905	187 (108–790)
Feb 4 and 6, 2015	249; 318	10.5 ± 2.0	100 ± 6.1	3.2 (2.0–5.9)	590,623	197 (105–1,453)
Feb 17 and 18, 2016	285; 285	9.3 ± 1.6	96 ± 5.1	3.6 (2.3–5.3)	415,865	432 (151–1,603)
Feb 2, 2017	569	9.1 ± 2.4	93 ± 7.5	3.7 (1.7–5.7)	141,388	1,315 (385–2,832)

[a] U.S. Geological Survey/U.S. Bureau of Reclamation (Bend Bridge hydrologic station [40.28849°, −122.186661°; rkm 489.4]; https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630).

Cormack–Jolly–Seber model was adapted from its original intended function to estimate survival over time into a spatial form of the model that could be used for animals that migrate unidirectionally (Burham et al. 1987) and could be “recaptured” in the form of acoustic detections along the migratory corridor. River reaches were bounded by receivers positioned at approximately 7–38-km intervals along the Sacramento River to the beginning of the Delta at the I-80/I-50 Bridge. In three locations where receiver positions were adjusted slightly among years (Butte City, Knights Landing, and Tower Bridge), the receivers were moved 6, 2, and 2 rkm from their original locations, respectively. For this analysis, these sites were assigned the rkm of the upstream-most receiver at each location. A capture history for each fish was created by assigning a “1” (detected) or a “0” (not detected) at each receiver location.

Survival was modeled in program MARK (White and Burnham 1999) through the RMark package (Laake 2013) within R (R Core Team 2020). By substituting space for time, we modeled reach-specific survival (S) as a logistic function using a linear structure,

$$\mathrm{logit}(S_{i,j}) = \sum_{k=0}^{K} \beta_{j,k} x_{i,j,k}, \qquad (1)$$

where logit() is the logit link function, $S_{i,j}$ is the survival probability for the ith individual in the jth reach, and $\beta_{j,k}$ is the slope coefficient of the kth covariate, $x_{i,j,k}$.

This model structure allowed for a mixture of spatially and time-varying covariates (e.g., water temperature), spatially and time-constant individual covariates (e.g., FL), spatially varying but time-constant covariates (e.g., reach length), and time-varying but spatially constant covariates (e.g., mean annual river flow). Each of the covariates we included in the analysis had an a priori hypothesized effect on smolt survival (Table 2). Fish size, as measured by FL, was the only covariate that was unique to each individual but constant across reaches and time. The time-varying, reach-constant covariate was annual mean flow at Bend Bridge, confined to the period spanning from the date of fish release to the date on which the last fish was detected in the river. Bend Bridge was chosen because it was upstream of major tributaries and diversions and therefore representative of flow in the Sacramento River watershed.

For each of the reaches, we derived spatially varying, time-constant covariates to define habitat features, many of which did not change between years and represented the best available approximation of reach-specific physical habitat for the Sacramento River (Figure 1). Each of the habitat features was mapped using ArcGIS version 10.4.1 (Esri, Redlands, California). River area and off-channel habitat were calculated as area per reach. Off-channel habitat was summarized as an annual mean from Landsat scenes corresponding to January–April, when fish were in the river. Median travel time was calculated from all observed travel times on a per-reach basis for each year. All other habitat features did not vary temporally across the study period. Shaded riverine aquatic cover (wooded bank) was defined as the nearshore aquatic area at the interface of the river and adjacent woody riparian habitat. This measure does not quantify instream cover. Specifically, to be designated as shaded riverine cover, the adjacent bank had to be composed of natural, eroding substrates supporting riparian vegetation that overhung or protruded into the water, with the water containing variable amounts of woody debris, such as leaves, logs, branches, and roots. Wooded bank and revetment were summarized as percentages of the length of the riverbank per reach. Remaining riverbank that was not classified as revetment or shaded was designated as bare bank. Other reach-specific covariates included the number of diversions, number of tributaries, and river sinuosity (Table 2).

A time-varying individual covariate was defined as the mean of the daily covariate (e.g., water flow, velocity, or temperature) over an individual’s travel time through a reach. For the purposes of defining covariate values for each fish, individuals that were undetected at a given receiver location but subsequently detected at a location further downstream had that missing arrival time imputed by using the observed arrival time at the upstream location, the observed arrival time at the next downstream location, the distance between these two locations, and the reach length between the upstream location and the missed location,

$$A_{(missed)} = A_{(upstream)} + \frac{\mathrm{RL}_{(upstream \to missed)} \times \left[A_{(downstream)} - A_{(upstream)}\right]}{\mathrm{RL}_{(upstream \to downstream)}}, \qquad (2)$$

where A is arrival time and RL is reach length (km) between locations.

There were many more reaches defined by acoustic receivers than there were flow stations in the river. Therefore, to more closely match fish presence with environmental covariates, we used the RAFT model (Pike et al. 2013), which is a one-dimensional physical hydrodynamic model that estimates laterally and vertically averaged channel water temperature, flow, depth, and velocity every 10 min at a 2-km spatial resolution. We included temperature because metabolic rates and predation rates increase at higher temperatures (Vigg et al. 1991; Killen et al. 2010).

We considered flow at the reach scale and at the watershed scale because flow dynamics have been shown to be important for survival (Michel 2018; Perry et al. 2018;

TABLE 2. Hypothesized effects of covariates on winter-run Chinook Salmon survival for covariates included in the top mark–recapture survival model.

Category	Covariate	Definition	Prediction	Hypothesis
Individual	Length[a]	FL	Positive	Larger fish have higher survival due to improved predator avoidance and gape limitation
Temporal	Annual flow[b]	Mean flow at Bend Bridge (Jan–Apr)	Positive	Higher flows produce more habitat, facilitate downstream migration, and increase turbidity, which reduces predator exposure
Spatial	Reach length	Distance between upstream and downstream receivers	Negative	Longer migration distance increases exposure to predators
	Off-channel habitat[c]	Connected wetted area per reach within 1 km of river edge	Positive	Increased off-channel habitat produces more refuge and forage habitat
	Travel time	Median travel time	Negative	Longer travel time will decrease survival because of increased exposure to predators
	Sinuosity[d]	Deviation of reach length from shortest path	Positive	Increased sinuosity creates more instream habitat
	Revetment[e]	Percent revetment	Negative	Increased revetment reduces habitat refugia
	Diversions[f]	Number of diversions per kilometer for each reach	Negative	Increased habitat structure for predators
	Tributaries[g]	Number of tributaries per kilometer exceeding a Strahler stream order of 3	Positive	Increased access to nonnatal habitat
	Wooded bank habitat[h]	Percentage of nonriprapped bank with adjacent woody vegetation	Positive	Increased cover produces more refuge habitat
	Width : depth ratio[i]	Mean ratio of wetted channel width to depth	Positive	Wider, shallow channels increase refuge habitat
	Slope[i]	Mean elevation gradient of a reach	Positive	Steeper gradients will decrease travel time

TABLE 2. Continued.

Category	Covariate	Definition	Prediction	Hypothesis
Time-varying individual[i]	Temperature	Mean river temperature per reach	Negative	Increased temperature increases predator activity and reduces aerobic scope, potentially impacting locomotion
	Depth	Mean river depth per reach	Positive	Favors avoidance of bottom-oriented predators (catfish) and surface-oriented predators (birds)
	Interannual reach flow	Mean river flow per reach	Positive	Higher flows within a reach produce more habitat in that reach
	Intra-annual reach flow	Mean river flow per reach and year	Positive	Higher flows will be associated with increased turbidity and refugia
	Reach velocity	Mean river velocity per reach	Positive	Higher velocities will shorten travel time and reduce predator exposure

[a] Measured at tagging.

[b] U.S. Geological Survey data inventory page for site 11377100–Sacramento River above Bend Bridge, near Red Bluff, California: U.S. Geological Survey Web page, accessed January 20, 2022, at https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630.

[c] Normalized difference water index using 2-week conglomerates in Landsat (https://landsatlook.usgs.gov; April 9–23, 2013; February 21–March 18, 2014; February 24–March 5, 2015; March 23–30, 2016; and February 22–March 1, 2017).

[d] Sinuosity toolbox in ArcGIS.

[e] California Department of Water Resources.

[f] California Department of Fish and Wildlife (Passage Assessment Database) and the National Oceanic and Atmospheric Administration Southwest Fisheries Science Center.

[g] National Hydrography Dataset Plus (U.S. Environmental Protection Agency) with a Strahler stream order of 3.

[h] California Department of Water Resources and Google Earth imagery.

[i] Produced by the authors using the River Assessment for Forecasting Temperature (RAFT) model (Pike et al. 2013).

Henderson et al. 2019). In addition to mean annual flow at Bend Bridge, we included flow variables that measured variation from each reach's mean flow and variation relative to the mean flow in each year. We refer to these covariates as "interannual reach flow" and "intra-annual reach flow," respectively, following the methods of Henderson et al. (2019). Interannual reach flow was calculated by standardizing flow to each reach's mean flow:

$$z_{\text{inter},d,y,k} = \frac{Q_{d,y,k} - \mu_k}{\sigma_k}, \tag{3}$$

whereas intra-annual flow was calculated by standardizing daily flow within each reach and year:

$$z_{\text{intra},d,y,k} = \frac{Q_{d,y,k} - \mu_{y,k}}{\sigma_{y,k}}, \tag{4}$$

where $z_{\text{inter},d,y,k}$ and $z_{\text{intra},d,y,k}$ are the inter- and intra-annual reach flows on day d in year y and reach k; $Q_{d,y,k}$ is discharge; μ_k and $\mu_{y,k}$ are the means of $Q_{d,y,k}$ for each reach and each reach and year, respectively; and σ_k and $\sigma_{y,k}$ are the SDs of $Q_{d,y,k}$ for each reach and each reach and year. Including intra-annual reach flow allowed us to examine whether large freshet events within a reach would increase survival relative to the mean flow for that year (Cavallo et al. 2013; Courter et al. 2016). We included intra-annual reach flow in models with mean annual flow at Bend Bridge because scaling intra-annual flow by both year and reach removes the effect of annual differences in intra-annual reach flow, thus eliminating correlation between these variables. We also included an interaction term between mean annual flow and intra-annual reach flow, which tests whether within-year deviations from the mean annual flow had a different effect in high- and low-flow years.

Before fitting mark–recapture models, we conducted pairwise comparisons of all covariates to evaluate collinearity. If the correlation coefficients between any two variables exceeded 0.70 (Dormann et al. 2012) or if the variance inflation factor exceeded 10 (Kutner et al. 2004), we retained only the covariate with a greater hypothesized effect on survival (Supplementary Material available in the online version of this article). All continuous variables were standardized to zero mean and unit SD so that changes in survival could be predicted by a 1-SD change in each covariate value.

Model selection.— We used Akaike's information criterion (AIC) to rank alternative models based on the best trade-off between improved fit and model complexity (Burnham and Anderson 2002). Models with lower AIC values are considered better-fitting models in the model set. Our model selection process consisted of first identifying the best-fitting model for detection probability, then assessing goodness of fit, and finally fitting alternative survival models using the best-fitting detection model. We evaluated goodness of fit by estimating the degree of overdispersion using two different parameters in program MARK: the median-$\hat{c}$ procedure and the bootstrap goodness-of-fit procedure. Goodness of fit was evaluated using a model that allowed both survival and detection to vary independently among reaches and years (i.e., a reach × year interaction). Estimates of $\hat{c}$ less than or equal to 4 indicate that variability in the data was greater than expected given the multinomial likelihood structure of the mark–recapture model. Values of $\hat{c}$ greater than 1 indicate overdispersion, with more variability in the data than expected given the multinomial structure of the mark–recapture model, while values much greater than 1 (e.g., $\hat{c} > 4$) indicate a fundamental lack of fit, whereby the model structure poorly describes variation in the data (Burnham and Anderson 2002). We estimated $\hat{c}$ to be 1.54, indicating that our model structure was appropriate but that our data were slightly overdispersed. We therefore used the quasi-AIC (QAIC$_c$), which adjusts the AIC value based on $\hat{c}$, to select the model that was most supported by the data and ranked with the lowest QAIC$_c$ score. In addition, $\hat{c}$ was used to inflate the SEs of parameter estimates in the model selected for inference.

The relative importance of covariates in the selected model (lowest QAIC$_c$ score) was evaluated graphically and by examining point estimates of β coefficients with 95% CIs. Covariates having β coefficients with large absolute values were interpreted to have a larger effect on survival. Covariates having β coefficients with 95% CIs that overlapped zero were interpreted as not being significantly different from zero (i.e., no detectable effect). Covariates that did not contribute significantly to explaining the data were still retained in the selected model because they were chosen a priori to be important for their potential effect on survival (Burnham et al. 2011).

To identify the most parsimonious detection model, we fitted a series of models with increasing complexity while holding the survival model structure fixed using the reach × year interaction model. Like survival, we modeled the effect of covariates on detection as linear on the logit scale (equation 1). The simplest model included only sampling occasion (i.e., receiver site) as a main effect on detection probability (Supplementary Material). Next, we added year as a categorical factor to the reach model. The third model added an interaction between year and receiver site because the number of receivers and/or receiver model used at each location varied among years. Finally, the mean reach-specific velocity for each individual was added to each of the three models above for a total of six models in the model set. We hypothesized that river velocity and the ambient noise associated with velocity impact the attenuation of acoustic signals in water, thereby affecting detection probability. For all models, detection probabilities were set to zero when receivers were not deployed below Paynes Creek (location 6) and at the Mill Creek confluence (location 8) in 2013, below Cypress (location 2) when fish were released downstream of this location in 2016, and below China Bend (location 15) in 2017. We found that the model with water velocity and a site × year interaction had the lowest QAIC_c, which was considerably lower than that of the second-best model, which included only a site × year interaction ($\Delta\mathrm{QAIC}_c = 2{,}069$; Supplementary Material). Therefore, the model including water velocity and the site × year interaction was used for all survival models.

Using an approach similar to that described above for the detection models, we fitted a set of eight survival models (Table 3) of increasing complexity and we used the QAIC_c model selection criterion to rank each model. Subsets of the more parameterized models were evaluated using the same model selection criteria. As a basis of comparison with more parameterized covariate models, the models with the fewest variables only estimated survival separately for each reach or for each reach and year. From there, we included a model to test the effect of reach length (i.e., travel distance) and travel time on survival, with an intercept offset for each year. This model tested whether reaches with longer travel times and reach lengths, which increase exposure to predators (Anderson et al. 2005), could better explain variation in survival among reaches and years. Third, we added the RAFT model's flow variables (e.g., flow and velocity) to models that included reach length and travel time to test whether river flows affected survival after accounting for effects of travel time and reach length. Fourth, we evaluated models that only included time-constant habitat covariates (e.g., wooded bank habitat, number of tributaries, etc.; see Table 2 for the full list) or time-varying covariates (e.g., temperature and depth) that excluded flow variables. Finally, the most complex models combined all covariates from the preceding models, fitting one full model with interannual reach flow and another with intra-annual reach flow.

RESULTS

Spatiotemporal Conditions

Water temperatures ranged from 8°C to 16°C throughout the study period and varied among years but always had an increasing trend from February to April, as measured at Bend Bridge (Figure 2). Drought years 2014 and 2015 had the warmest mean February–March whole-river temperatures (12.2°C and 13.6°C, respectively). Peak flows in the Sacramento River varied temporally between years in response to storm events: no pulses in 2013, a few weak pulses in 2014, a single large pulse in 2015, two moderate pulses in 2016, and many large pulses on top of extremely high sustained flows in 2017 (Figure 2).

Riparian channel features varied spatially across the study area, with a greater number of tributaries upstream and greater percentage of revetment, greater number of diversions, and a smaller width : depth ratio downstream (Figure 1). Bank type characteristics were distributed in distinct sections of the Sacramento River (Figure 3). The upper section (reaches 1–6) contained mostly wooded bank, with some bare bank and lesser amounts of revetment. The middle section (reaches 7–12) was predominantly bare bank, with some wooded bank and lesser amounts of revetment. The area with the highest proportion of bare bank was associated with off-channel habitat (Figure 1) in drought years ($r = 0.80$). The lower river section (reaches 13–17) was predominantly revetment, with some wooded bank and a lesser amount of bare bank.

Travel Time

The time it took fish to travel downstream varied by reach and across years with different flow, velocity, and temperature profiles (Figure 4). Fish slowed down through the upper and middle reaches of the river during the high-flow year, through the middle reaches during all years, and in the lower reaches during the most critically dry year (2013; Figure 5). Travel times were the longest in the wettest and driest years. In the wettest year (2017), median travel time in the upper Sacramento River (Figure 1) was 24 d, ranging up to 70 d, while in the critically dry year (2013), median travel time in the middle Sacramento River was 33 d, ranging up to 54 d (Table 4). The most consistent slow travel times occurred in the middle Sacramento River, within a 55-km stretch of the river between Woodson Bridge and Tisdale (reaches 9–13; Figures 1, 5). This part of the river coincides with the greatest extent of connected off-channel habitat that was visible during the wet year between Red Bluff and Colusa (Figure 1).

Reach-Specific Patterns in Survival

Reach-specific survival scaled by distance and time (per 10 km per day) was consistently high (98–100%) in the upper reaches (1–4) and lower reaches (13–17) of the Sacramento River (Figure 6A). Reach-specific survival was lowest (96%) at reach 7 and intermediate (97–98%) through reaches 8–12 between Red Bluff and Colusa.

Factors that Affect Survival

Survival models with flow and habitat covariates received more support than the models that included only reach or reach and year, indicating that we had identified features that were important for juvenile salmon survival. The top-ranked survival model based on QAIC_c was the full intra-

TABLE 3. Covariates included in each of the candidate mark–recapture survival models.

Covariate name	Reach	Distance–travel time	Interannual flow	Habitat	Intra-annual flow	Reach and year	Full interannual	Full intra-annual
Reach distance		x	x	x	x		x	x
Fish FL				x			x	x
Proportion of revetment				x			x	x
River sinuosity				x			x	x
Diversions per kilometer				x			x	x
Proportion of shaded riparian area				x			x	x
Tributaries per kilometer				x			x	x
Channel width : depth ratio				x			x	x
Mean slope of reach				x			x	x
Median travel time per reach		x	x	x	x		x	x
Reach	x					x		
Calendar year		x	x		x	x		
Reach × year interaction						x		
Flow standardized by reach			x				x	
Mean water temperature per reach							x	x
Mean water depth per reach							x	x
Mean water velocity per reach							x	x
Off-channel habitat per kilometer							x	x
Flow standardized by reach and year					x			x
Annual flow at Bend Bridge					x			x
Yearly reach flow × annual flow interaction								x

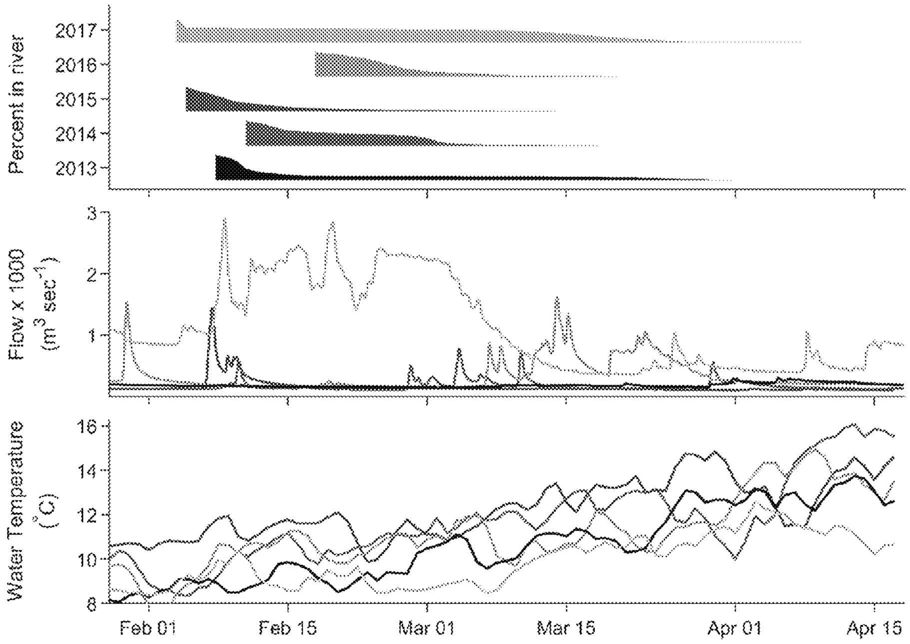

FIGURE 2. Percentage of acoustic-tagged winter-run Chinook Salmon juveniles in the Sacramento River from the date of release to the date on which the last fish was detected at Tower Bridge in the city of Sacramento for each year (upper panel). Flow (middle panel) and water temperature (lower panel) at Bend Bridge are also presented for each year (U.S. Geological Survey/U.S. Bureau of Reclamation hydrologic station [40.28849°, −122.186661°; rkm 489.4]; https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630).

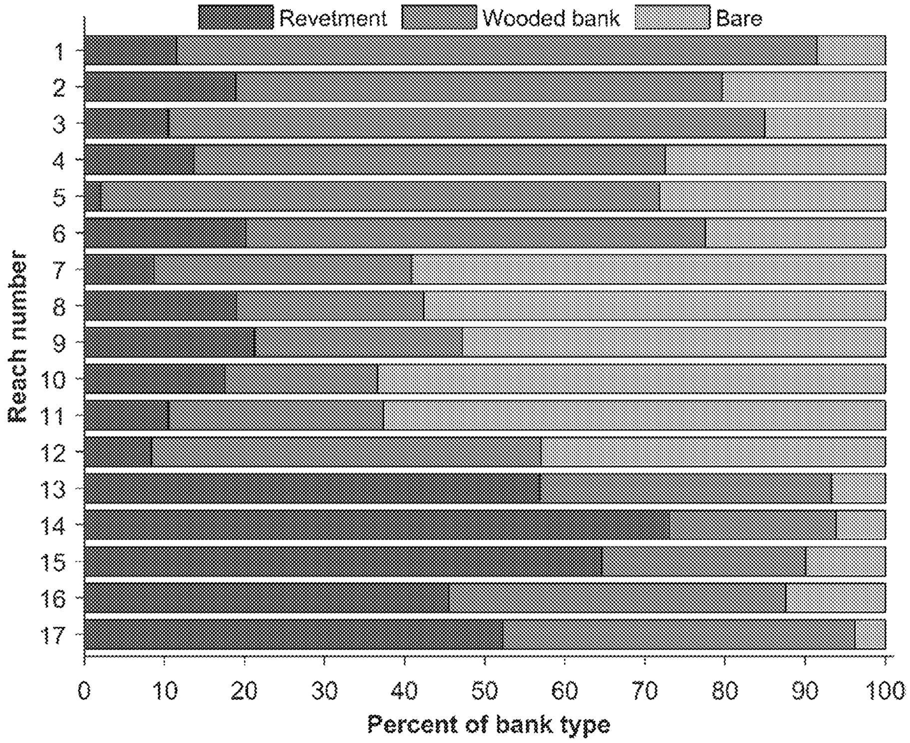

FIGURE 3. Percentages of revetment, wooded bank, and bare bank shoreline habitat types from upstream (reach 1) to downstream (reach 17) reaches of the Sacramento River. The area with the highest proportion of bare bank is associated with off-channel habitat (Figure 1) during drought years ($r = 0.80$).

annual reach flow and habitat model (Tables 3, 5), characterized by an interaction between mean annual flow and intra-annual reach flow and a combination of time-constant, reach-specific habitat features, reach water velocity, travel time, and fish length (Table 3). Among covariates with significant coefficients, as judged by 95% CIs that did not overlap zero, variation in annual flow had the strongest positive association with survival. These findings indicate that a 1-SD change in annual flow had a stronger effect on survival than a 1-SD change in any of the other covariates in the top-ranked model. However, the effect of annual flow was dampened by the negative effect of an intra-annual reach

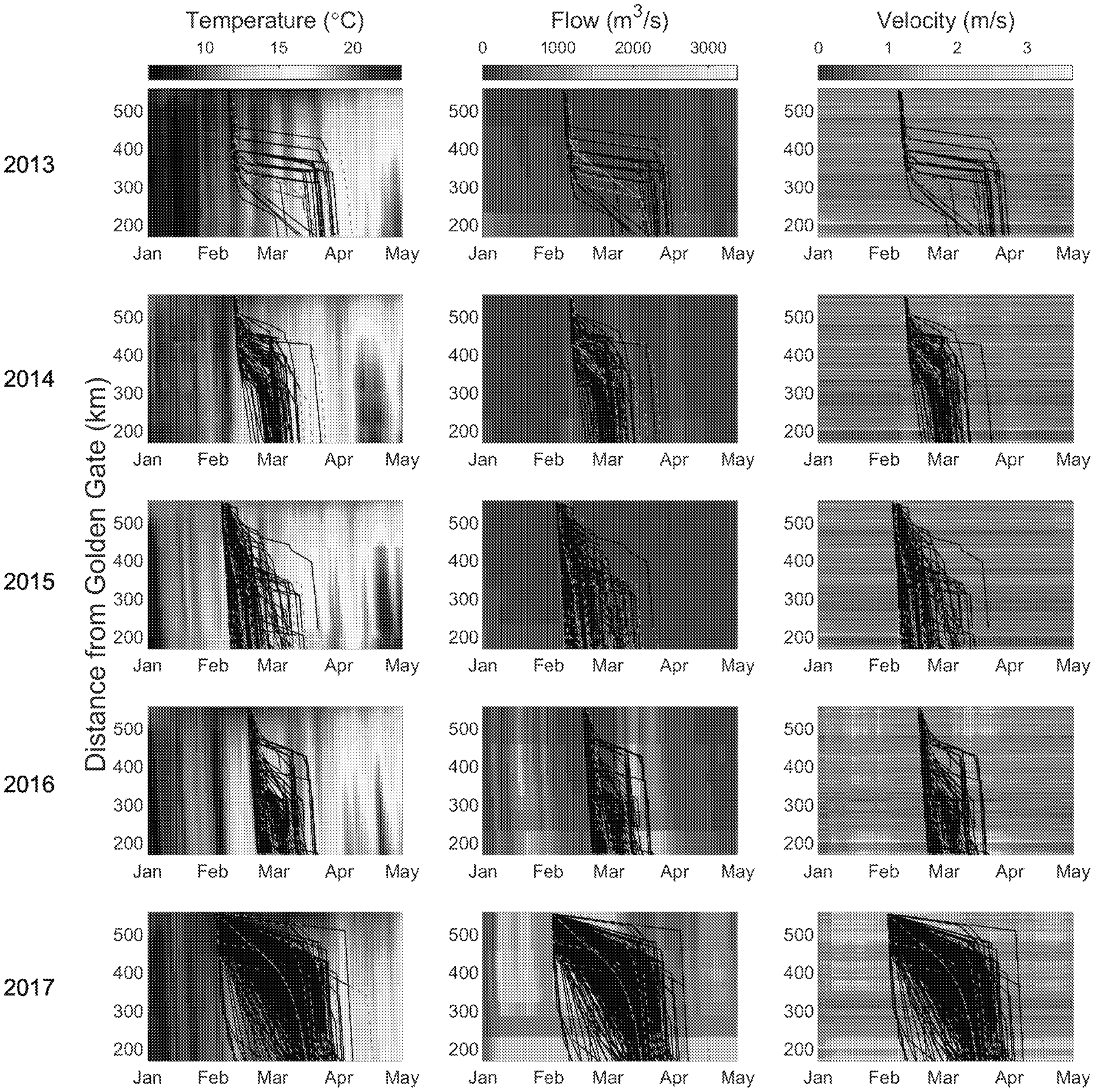

FIGURE 4. Downstream detections of juvenile winter-run Chinook Salmon (black lines) and interpolated tracks (gray dashed lines) in the Sacramento River from Redding to Sacramento, California. Detections overlay River Assessment for Forecasting Temperature (RAFT) model outputs for temperature (left column), flow (middle column), and velocity (right column) in water years 2013 (top row) to 2017 (bottom row).

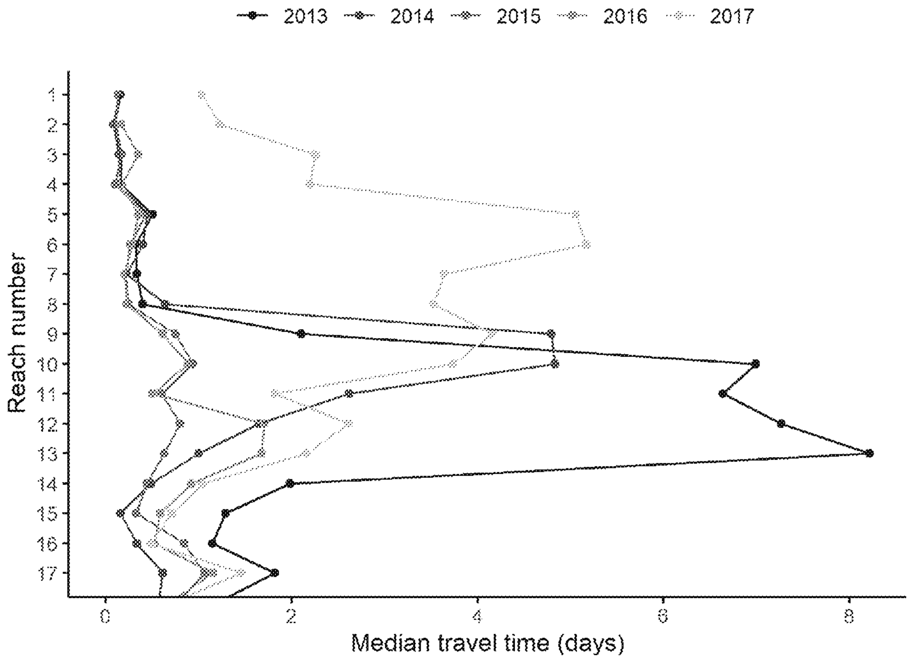

FIGURE 5. Travel time (d) by reach for juvenile winter-run Chinook Salmon migrating down the Sacramento River in each year. Each point represents the median number of days it took tagged fish to transit through a reach bounded upstream and downstream by acoustic receivers.

TABLE 4. Yearly variation in median travel time (d) of juvenile winter-run Chinook Salmon (Count) moving down the Sacramento River, with minimum (Min) and maximum (Max) values for the upper, middle, and lower sections (Figure 1) of the river.

Year	Section	Count	Median	Min	Max
2013	Upper	118	3	1	44
	Middle	23	33	4	54
	Lower	22	14	2	35
2014	Upper	288	3	1	36
	Middle	146	17	2	36
	Lower	135	3	2	13
2015	Upper	446	2	1	31
	Middle	310	5	1	36
	Lower	233	3	1	32
2016	Upper	531	2	1	28
	Middle	362	6	2	28
	Lower	285	5	1	28
2017	Upper	335	24	1	70
	Middle	293	18	2	44
	Lower	234	6	2	39

flow × annual flow interaction term. Other covariates with a significant positive effect on survival (i.e., 95% CIs that did not overlap zero) included percentages of revetment and wooded bank, fish length, and reach-specific intra-annual flow (Figure 7). Channel width : depth ratio, reach-specific velocity, depth, and reach length all had negative associations with survival, along with travel time, river temperature, and the intra-annual reach flow × annual flow interaction term. River sinuosity, diversion density, off-channel habitat, slope, and number of tributaries had negligible effects on survival, indicating that the covariates included in the selected model sufficiently explained differences in survival among years and reaches. Time-constant covariates, including river sinuosity, slope, and percent wooded bank, acted to increase estimates of survival in the upper reaches but decreased estimates of survival in the lower reaches relative to mean covariate values (Figure 6B). In contrast, the width : depth ratio decreased estimates of survival through the middle river (reaches 7 and 8) and increased estimates of survival relative to mean covariate values from reach 13 downstream, where the river becomes more channelized with revetment along the bank.

Mean annual flow, intra-annual reach flow, and their interaction had contrasting effects on predicted survival (Figure 8). Predicted survival per 10 km per day increased as a function of mean annual flow, with intra-annual reach flow and all other covariates set to mean values (Figure 8A). Due to the negative interaction between annual and intra-annual reach flow, the slope coefficient for intra-annual reach flow declined with annual flow such that reach effects were more positively associated with survival in low-flow years (Figure 8B). The combined effect of mean annual flow and intra-annual reach flow led to a positive relationship in low-flow years but a flat relationship in the high-flow year (Figure 8C). These findings

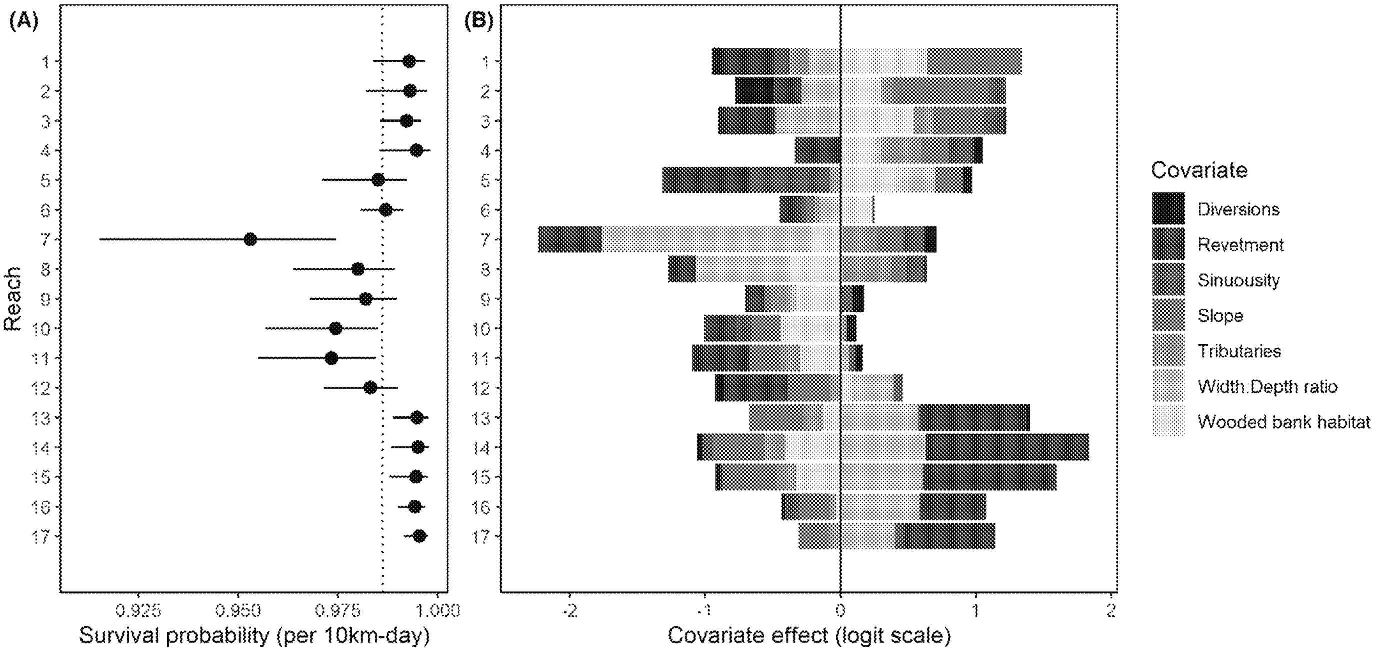

FIGURE 6. Effect of time-constant, reach-specific covariates on survival of juvenile winter-run Chinook Salmon: **(A)** predicted survival per 10 km per day (with 95% CIs) when all covariates are set to mean values except the reach-specific covariates shown in panel B (dashed line shows the mean survival over all reaches); and **(B)** the effect of each reach-specific covariate on the linear predictor (see equation 1). Covariate effects (represented as stacked bars) were calculated as the product of the standardized covariate and its corresponding slope coefficient (i.e., β). Habitat features associated with the riverbank also varied across the migration corridor (see Figure 3).

suggest that variation in daily reach-specific flows affect survival more in years when mean annual flow is low than in high-flow years.

DISCUSSION

The Sacramento River is the main source of California's water conveyance system and acts as a key migration corridor for anadromous fish moving from freshwater to ocean environments. Therefore, the management of reservoir releases directly affects the conditions encountered by juvenile salmon as they migrate to the ocean as smolts. Because of their small size, smolts are vulnerable to how these conditions affect exposure to predators during the downstream emigration phase of their life history (Sabal et al. 2021). Additionally, they may be vulnerable to delayed mortality in the ocean from associated migration duress (Michel 2018).

The decline of the winter run, as the most critically imperiled Chinook Salmon run, remains one of the most important issues confronting water management in the Sacramento River. In this study, we observed that mean annual flow over the time during which fish were in the river had the most positive effect on their survival out of all the modeled covariates. Moreover, we observed that higher flow at the reach scale had a more positive effect on survival in dry years with low flow than it did in wet years with high flow. Although the interaction between annual flow and intra-annual reach flow occurs with one high-flow year observed in 2017 (Figure 5), similar observations have been made in previous work on late-fall-run Chinook Salmon (Courter et al. 2016; Perry et al. 2018; Henderson et al. 2019). Anomalous wet years like 2017 are important to consider because California remains in a state of extended drought, and obtaining data for years like this is likely to be difficult given their importance for fish survival. It has long been known that freshwater flow is connected to variation in survival of juvenile salmon migrating to the sea (Kjelson and Brandes 1989; Newman and Rice 2002; Michel 2018; Notch et al. 2020); however, our findings suggest that although it may not be possible to create wet-year flow conditions like those in 2017, increasing flow through managed flow pulses can benefit salmon survival. Our results also improve current understanding of how annual changes in flow can affect survival rates and spatially varying changes in habitat features known to be important for rearing (Zeug et al. 2019; Zeug and Winemiller 2008) with time-varying features of the river (i.e., reach flow, temperature, and depth; Henderson et al. 2019). Considering these factors together in a novel framework that scales survival by the amount of time fish are spending in a given part of the river provides a clearer way to examine spatial variation in migration survival.

TABLE 5. Survival (ϕ) model selection based on quasi-Akaike's information criterion ($QAIC_c$) ranks with a $\hat{c}$ of 1.54. Models are shown with the number of parameters (npar), the calculated value of $QAIC_c$, the difference in $QAIC_c$ value between the given model and the top model ($\Delta QAIC_c$), and the deviance value (QDeviance).

Survival model	npar	$QAIC_c$	$\Delta QAIC_c$	QDeviance
Full intra-annual	108	13,320.53	0.00	13,103.37
Full interannual	106	13,415.67	95.15	13,202.56
Separate survival for reach and year	175	13,438.75	118.23	13,085.71
Intra-annual reach flow	100	13,488.73	168.20	13,287.73
Habitat	102	13,508.79	188.26	13,303.76
Interannual reach flow	98	13,544.11	223.58	13,347.15
Distance–travel time model	97	13,547.31	226.78	13,352.37
Reach	107	13,576.39	255.86	13,361.25

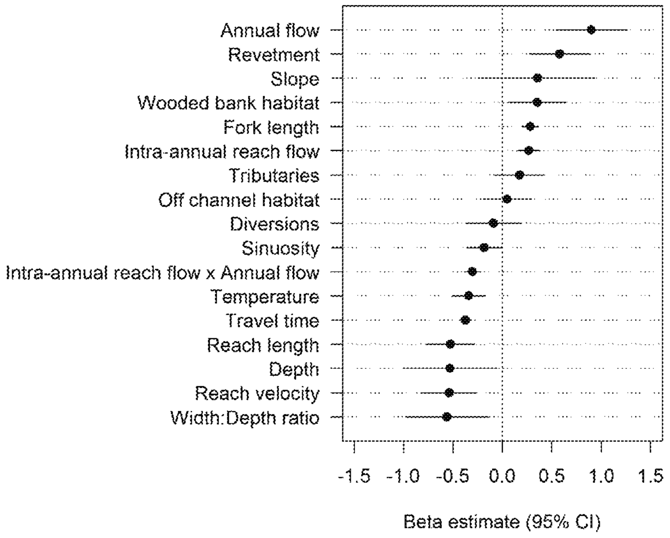

FIGURE 7. Parameter estimates (±95% CI) of slope coefficients (i.e., β estimates) for each covariate in the selected model. The CIs that overlap zero indicate no significant effect.

In some ways, our results differed from those of previous studies on the late-fall run (Perry et al. 2010; Michel et al. 2015; Henderson et al. 2019) and spring run (Cordoleani et al. 2018; Notch et al. 2020) of Chinook Salmon. We observed stopover behavior in all years, but the region of the river in which stopover behavior occurred appeared to depend on density-dependent habitat availability, with fish exhibiting stopover behavior higher in the river during the wettest year and lower in the river during the driest year (Figure 5). During dry years with lower flow, salmon

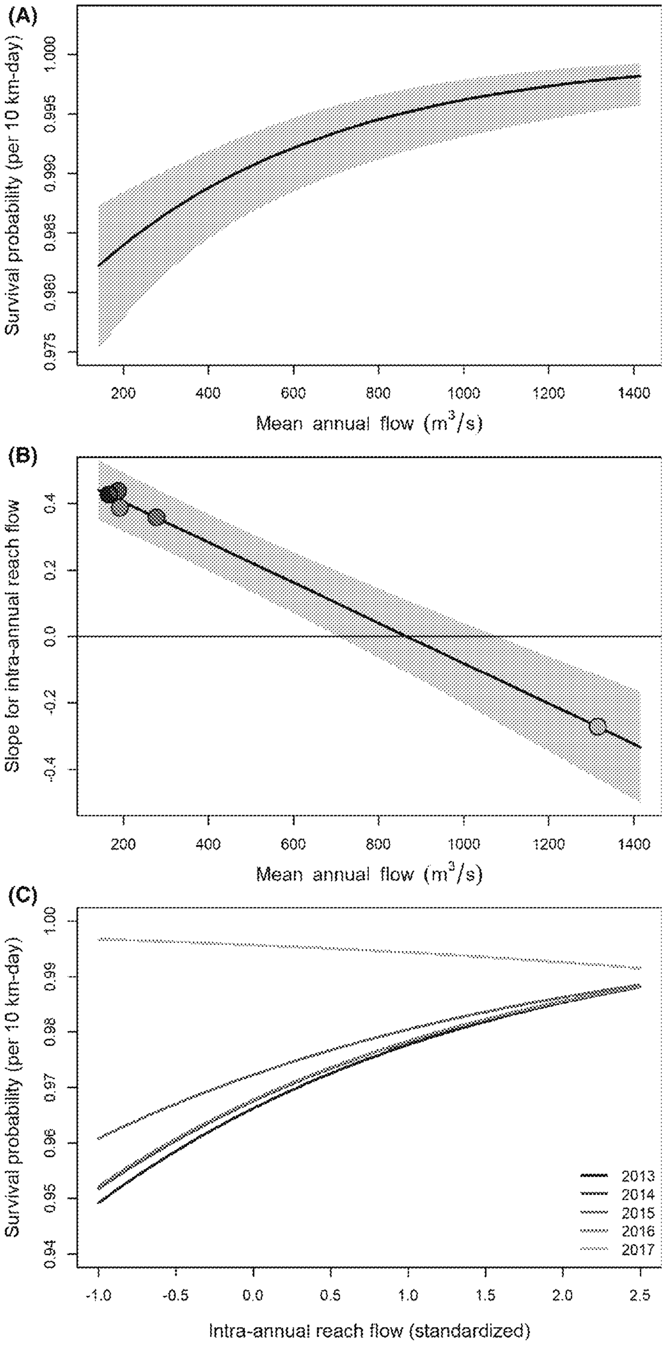

FIGURE 8. Effects of mean annual flow, interannual reach flow, and their interaction on predicted survival of juvenile winter-run Chinook Salmon: **(A)** predicted survival per 10 km per day as a function of mean annual flow, with intra-annual reach flow and the other covariates set to mean values, except for travel time (set to 1 d) and reach length (set to 10 km); **(B)** effect of the interaction between mean annual flow and intra-annual reach flow, showing the slope coefficient for intra-annual reach flow as a function of mean annual flow (symbols represent the slope for intra-annual reach flow for each value of mean annual flow; symbols are slightly jittered vertically to reduce overlap); and **(C)** combined effect of mean annual flow and interannual reach flow on predicted survival per 10 km per day. Shaded regions in panels A and B show the 95% CIs.

that delay migration tend to experience higher mortality (Sturrock et al. 2020). In 2013, a year that was characterized by low flows and a nearly flat hydrograph (Figure 2), the stopover behavior low in the river and the corresponding low survival suggest that fish may not initiate downstream migration without an appropriate migration cue, which usually arrives as a pulse in flow (del Rosario et al. 2013) or, ultimately, as warming temperatures (Figure 4). Salmon are known to avoid high temperatures by timing their migration to occur before or after peak river temperatures (Hodgson and Quinn 2002). Therefore, we might expect that fish migrating in response to high temperatures could suffer indirect effects, such as a reduction in aerobic scope (Eliason and Farrell 2016).

The trade-off between increased exposure to predators and access to good foraging habitat is indirectly supported with a positive association between annual flow and survival (Michel et al. 2015; Perry et al. 2018; Henderson et al. 2019; Zeug et al. 2020). High flows can benefit survival by increasing water turbidity, thus providing cover for juveniles to evade predators (Gregory and Levings 1998), and by offering access to a greater diversity of foraging and refuge habitat that allows fish to slow down higher in the watershed. A positive association of body size with survival is consistent with previous work on other runs (Cordoleani et al. 2018; Henderson et al. 2019; Notch et al. 2020), which suggests that a fish's size can reduce predation as individuals grow beyond the gape limitation of some predators (Nowlin et al. 2006). A caveat is that the increased tag burden of fish in the smaller size range could disproportionately affect the survival of acoustic-tagged fish (Brown et al. 2010; Liss et al. 2016). Although we did not detect a fish size effect for tag shedding or survival rates in the portion of tagged fish that were held and monitored for 60 d, tag burden will disproportionally affect the performance of smaller fish and may contribute to the observed higher survival for larger fish.

Some relationships between other covariates and survival ran counter to our working hypotheses and revealed interesting patterns upon further investigation. First, increased survival was associated with a higher proportion of revetment along the riverbank (Figure 7). However, the positive effect of revetment was only observed where it was predominant along the riverbank in the last five reaches (Figure 6B, reaches 13–17), which had similar habitat and morphology (e.g., deep, narrow, low-gradient channels; Supplementary Material) and downstream of reaches where fish were observed exhibiting slow travel. Fish surviving to these lower reaches are likely larger because of longer feeding durations or upstream size-selective mortality that removed smaller fish. Moreover, fish holding upstream that survived to these lower reaches are more likely to be actively out-migrating, which decreases travel time (Figure 5) and exposure to predators. Future work that compares the spatial survival of other runs that emigrate at other times may shed some light on the role of revetment, predation, and survival in this part of the river.

Second, while more rapid downstream movement may appear to result in better in-river survival for out-migrating smolts, the negative association between reach velocity and survival suggests that volitional downstream movement may be compromised. Inflection points that indicate a change to downstream migration behavior appear to correspond to sudden changes in the velocity profile of the river (Figure 4). As instream rearing is known to occur for winter-run fish in the main-stem Sacramento River (Freeman et al. 2001) and tributaries (Phillis et al. 2018), we may be observing a switch from resting and feeding to migration behavior in which vulnerability to mortality is higher, at least initially. During the wet year of 2017, when water velocities were high throughout the main channel, better access to low-velocity off-channel and ephemeral tributary habitat throughout the upper and middle Sacramento River may have been key for fish to improve foraging opportunities on prey (e.g., drift) that would otherwise have been advected in the main stem throughout the largest pulse flow periods.

Limitations of observational studies on hatchery-raised salmon in the field can make it difficult to infer how variables might affect wild fish, which initiate their smolt migration earlier in the fall. Natural-origin winter-run fish initiate their downstream migration beginning in July and into autumn, around the time when the first storms of the year arrive in California, following several months of summer conditions characterized by low flows and warm temperatures. These early storms create unique conditions, known colloquially as a "first flush," when accumulated debris and sediment are carried downstream, creating turbid conditions and cover that wild fish could use as refugia from predators. In contrast, our study fish were released during the peak of winter in a single synchronized event with the entire hatchery production of winter run to provide a swamping effect and improve survival. A study on Sockeye Salmon *O. nerka* using a combination of PIT and acoustic tags demonstrated that the estimated survival probability for smolts increased from 50% when migrating with 2,000 conspecifics to 95% when migrating with 350,000 conspecifics (Furey et al. 2016). Because density dependence spreads fish out as they migrate downriver through rearing habitat along channel margins, a predator swamping effect will attenuate at an unknown rate and will likely have different characteristics than natural-origin fish experience. In addition, if density-dependent habitat availability is indeed the primary mechanism that predicts where fish will slow down, natural-origin fish that are not confronted with as many conspecifics at a given time are more likely to exhibit slower travel times in the upper reaches of the river than that of our study fish. Future studies that release similar numbers of fish at different locations along the river may be able to control for a swamping effect and more closely approximate how natural-origin fish behave.

Management Implications

Flow management is often used as a primary tool for mitigating impacts to fish. When high flows are not available, maintaining functional flows through flow pulses offers managers another way to improve survival under low-flow conditions (Michel et al. 2021). Figure 8B describes how the slope of the intra-annual reach flow–survival relationship changes with mean annual flow. This relationship can be used by managers to determine, at a given level of annual flow, whether a flow pulse is likely to produce a measurable effect on survival. For example, when flow is less than about 700 m^3/s, given the confidence interval, pulse flows will have a high probability of having a positive effect on survival. The relationship also indicates what the magnitude of the effect may be. For example, when mean annual flow is 600 m^3/s, a pulse flow is going to have half the effect of a pulse event than when mean annual flow is 200 m^3/s. Of course, there are no observations between 300 and 1,300 m^3/s, and collecting these data in a targeted way is recommended to determine whether the relationship at higher flows is nonlinear.

As climate change induces more variability and a higher frequency of hot and dry conditions, facilitating migration with pulse flows is likely to become harder to achieve due to water scarcity and a lack of habitat diversity throughout the watershed (Lindley et al. 2007). This means that the resilience of declining salmon populations will increasingly depend on habitat restoration (Herbold et al. 2018). While habitat restoration can take months or years to achieve, depending on the scale of the activity, more information is needed to understand which characteristics of holding habitat cause fish to alter emigration. Some of the ways that winter-run fish interacted with spatial covariates appeared to change as they moved downstream, possibly because of selection, given that hatcheries release naïve juveniles into the upper river, or because of switching from holding to out-migration behavior. It is therefore important for resource managers to consider that how fish perceive the value of habitat variables can change in response to density-dependent effects and as the fish develop and mature, exhibiting behavioral and physiological plasticity as they undergo smoltification.

In this study, off-channel habitat was inaccessible during all years except 2017, which is likely why we were unable to detect an effect of access to off-channel habitat on survival. Natural-origin winter-run fish, which begin to rear and out-migrate during late fall and winter, when natural flows are more variable, may have better access to ephemeral off-channel habitat (Bellido-Leiva et al. 2021). We detected low survival and slow travel times in a middle section of the river with a large extent of potential off-channel habitat (Figure 1) where bare banks predominated (Figure 3), suggesting a location where juveniles may be responsive to targeted restoration efforts (around reaches 7–12), such as connecting off-channel habitat at lower flow thresholds.

The positive effect of wooded bank habitat on survival throughout the study area suggests that restoration activities that increase cover and bank complexity along the shoreline of the main-stem river could improve foraging and resting habitat (Zajanc et al. 2013). Indeed, vegetation has been shown to have the largest effect on smolt movement rates in the Sacramento River, with fish slowing down in areas having increased cover (Zajanc et al. 2013; McNair 2015). Wooded bank habitat on the Sacramento River has been lost over the past 50 years, primarily due to bank protection projects like the Sacramento Riverbank Protection Project. Since 1961, over 225 km (140 mi) of revetment (riprap) have been constructed on the riverbank, with only 7% of shaded riparian cover remaining in the lower Sacramento River (USFWS 2004). In our study, fish moved quickly through areas with heavy revetment and they exhibited slower movement in areas with wooded habitat. Moving slowly allows the fish time to rest and feed on their journey to sea.

In conclusion, out-migration survival of winter-run juveniles on the Sacramento River was best described by an intra-annual flow model with a mix of time-varying spatial covariates, reach-specific habitat features, and individual effects. Years with higher flow showed a strong association with increased survival, and years with lower flow showed a more positive flow–survival relationship at the reach scale. Wooded bank habitat had a positive association with survival, despite having been replaced by revetment along more than 90% of the riverbank in the Sacramento River. Evidence for instream holding behavior, which is known to be an important life history trait in juvenile winter-run fish, was indicated by slow travel times that appeared to respond to density-dependent habitat availability. Consistent slow travel times were observed in a section of the river between Red Bluff and Colusa, which coincided with the greatest extent of potential off-channel habitat that was connected during the high flows of 2017. Other habitat features did not have a consistent effect on survival across the migration corridor, as they displayed either a positive association with survival in the upper river and a negative association with survival in the lower part of the river or vice versa, indicating a dynamic relationship between the fish's physiological/behavioral developmental characteristics and their environment. With increased variability in drought and flood severity associated with climate change, it will become more important to disentangle the behavioral factors that affect out-migration timing (Munsch et al. 2019) and survival (Johnson et al. 2017), particularly as demands for freshwater put additional pressure on native fishes like Central Valley Chinook Salmon at the southern extent of their range.

ACKNOWLEDGMENTS

Funding for this study was provided by the State and Federal Contractors Water Agency, the Sites Authority, an Ecosystem Restoration Grant from the California Department of Fish and Wildlife, and the U.S. Bureau of Reclamation. J.L.H. was supported by a postdoctoral fellowship provided by the Delta Science Program to initiate the study. We are grateful to many field biologists at the National Oceanic and Atmospheric Administration's Southwest Fisheries Science Center for helping to collect the data upon which our analysis was based. Special thanks to Bob Null, Kevin Niemela, and John Rueth (U.S. Fish and Wildlife Service and Livingston Stone National Fish Hatchery) for tagging and logistical support. All experiments were performed upon approval by the Institutional Animal Care and Use Committee at the University of California at Santa Cruz. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government. There is no conflict of interest declared in this article.

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SUPPORTING INFORMATION

Additional supplemental material may be found online in the Supporting Information section at the end of the article.

From: Hassrick, Jason [Jason.Hassrick@icf.com]
Sent: 5/5/2022 8:47:45 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Spranza, John [john.spranza@hdrinc.com]
Subject: Re: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Ali,

I would be happy to.

Jason

JASON HASSRICK | **ICF** | jason.hassrick@icf.com | **+1.530.312.3275 mobile**
ICF Fish and Aquatic Science Team

From: Alicia Forsythe <aforsythe@sitesproject.org>
Date: Thursday, May 5, 2022 at 3:32 PM
To: Hassrick, Jason <Jason.Hassrick@icf.com>, John Spranza <John.Spranza@hdrinc.com>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Jason – I am just following up on previous emails from my vacation. See the email below from Doug. I think he might be miss interpreting your study results. Would you be willing to chat with him? I think we can make this very informal and I am comfortable with you just reaching out directly to him. I don't see the need for anyone from Sites to be on the phone as I want to give Doug a safe space to ask questions freely of you.

Let me know if you'd be willing to reach out to him. This, of course, is chargeable to the Sites Project.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Thursday, April 14, 2022 3:27 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Jerry Brown <jbrown@sitesproject.org>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Dear Jerry and Ali,

Thank you again for sending us the daily diversion tool, and to Jerry for coffee/tea the other morning. I wanted to follow up with two things for you:

First, I wanted to make sure that you were aware of this new peer reviewed scientific study which concludes that for juvenile winter-run Chinook salmon, migratory survival down the Sacramento River is reduced when flows are less than approximately 24,000 cfs (equivalent to 700 cubic meters per second). We've submitted this paper to CDFW (see below), and wanted to make sure that this was included in the JPA's administrative record for NEPA/CEQA since this was new information that was not available at the time of the public comment period on the EIS/EIR.

Second, we've been analyzing the potential changes in water diversions to storage using the daily diversion tool, and it appears that the proposed change to the bypass flow of 10,700 cfs from Oct to June results in an approximately 25% reduction in diversions to storage. It sounds like that is similar to what y'all are finding (our numbers are lower than what WRMWSD reported to their Board). In addition, as we have been exploring the model, we're not sure that the Delta outflow requirements in the model are actually working to limit water diversions to storage. It may be (probably is!) user error on our part, but if we're not able to get the model to work right in the next week or two we may want to check in to make sure the model is actually working correctly.

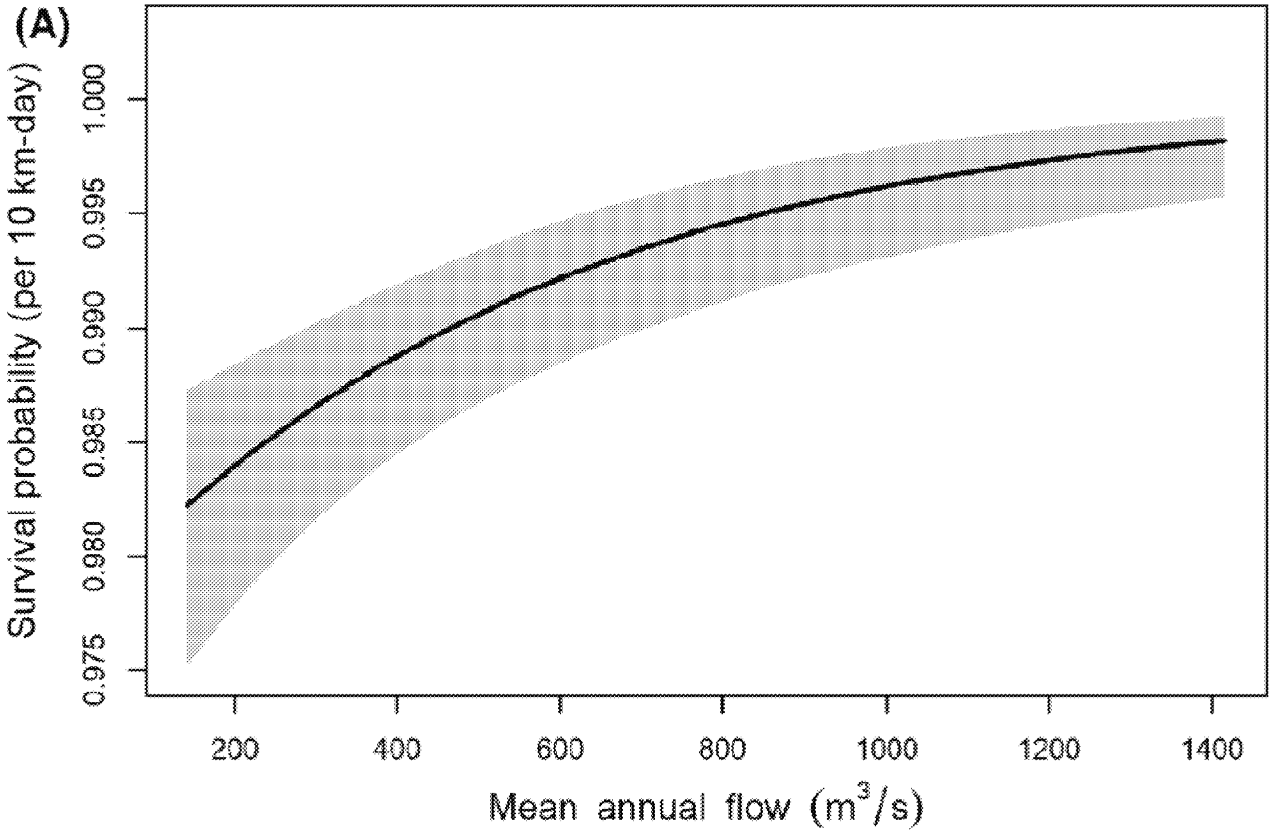
Thanks,
Doug

From: Obegi, Doug
Sent: Friday, March 25, 2022 10:52 AM
To: Kristal Davis-Fadtke <Kristal.Davis-Fadtke@wildlife.ca.gov>
Cc: jon@baykeeper.org
Subject: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Kristal,

I wanted to make sure you were aware of this new paper, which finds that for winter-run Chinook salmon, juvenile migratory survival down the Sacramento River is reduced when flows are less than around 24,000 cfs / 700 cubic meters per second:

"For example, when flow is less than about 700 m3/s, given the confidence interval, pulse flows will have a high probability of having a positive effect on survival. The relationship also indicates what the magnitude of the effect may be. For example, when mean annual flow is 600 m3/s, a pulse flow is going to have half the effect of a pulse event than when mean annual flow is 200 m3/s."



This paper indicates that at least for hatchery winter-run Chinook salmon, higher bypass flow thresholds for Sites Reservoir than 10,700 cfs are necessary to fully mitigate impacts and avoid further reductions in juvenile survival of this endangered species.

Best,
Doug

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Friday, March 25, 2022 9:23 AM
To: Obegi, Doug <dobegi@nrdc.org>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,

Attached is the published paper. Thanks for your interest.

Jason

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Tuesday, February 1, 2022 12:39 PM
To: Hassrick, Jason <Jason.Hassrick@icf.com>; arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

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Subject: RE: FW: Request for pre-publication copy of your recent manuscript

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From: Obegi, Doug <dobegi@nrdc.org>
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To: arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Sorry, no, I was interested in whether y'all had calculated what the survival rate down the length of the Sacramento River would be at different flow levels, based on the survival rate per 10 km reach shown in the flow:survival curve in Figure 8A. In other words, converting the flow:survival graph in Figure 8A into survival down the entire river rather than per 10 km segment.

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 12:09 PM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,
We have overall river survival by year, and flow varies by year. Is that what you are looking for? I will pull up that data for you.
Arnold

On Tue, Feb 1, 2022 at 11:36 AM Obegi, Doug <dobegi@nrdc.org> wrote:

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>
> ---
>
> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
> **Sent:** Tuesday, February 1, 2022 11:32 AM
> **To:** Obegi, Doug <dobegi@nrdc.org>
> **Cc:** miles.daniels@noaa.gov
> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>
> Great!
>
> On Tue, Feb 1, 2022 at 11:31 AM Obegi, Doug <dobegi@nrdc.org> wrote:
>
>> Yeah, it came through and I'm looking at it now.

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 11:32 AM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Were you able to download it? I got a system message saying it was too large.

On Tue, Feb 1, 2022 at 11:24 AM Obegi, Doug <dobegi@nrdc.org> wrote:

> Thanks Arnold! Look forward to reading the paper.
>
> Take care,
>
> Doug
>
> ---
>
> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
> **Sent:** Tuesday, February 1, 2022 10:57 AM
> **To:** Obegi, Doug <dobegi@nrdc.org>
> **Cc:** miles.daniels@noaa.gov
> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>
> Hello Doug,
>
> Please find attached the early online version of the paper. Let me know if you have any questions about it.
>
> Cheers,
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> Arnold
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> On Mon, Jan 31, 2022 at 1:49 PM Obegi, Doug <dobegi@nrdc.org> wrote:
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>> Congratulations to you both on this new paper published in CJFAM! Very cool. Any chance that one of you has a pre-publication version that you could share with me?
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>> **From:** Obegi, Doug
>> **Sent:** Monday, January 31, 2022 1:24 PM
>> **To:** jason.hassrick@icf.com
>> **Subject:** Request for pre-publication copy of your recent manuscript
>>
>> Hi Jason,
>>
>> I hope you're doing well these days. Congratulations on your new paper published in CJFAM! (https://afspubs.onlinelibrary.wiley.com/doi/abs/10.1002/nafm.10748)
>>
>> Do you have a pre-publication version of the manuscript that you would be willing to share with me, since the paper is currently not open access?

Thanks,

Doug

DOUG OBEGI

*Senior Attorney**

Water Program

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Please save paper.
Think before printing.

* *Admitted to practice in California*

--

Arnold J. Ammann
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From: Obegi, Doug [dobegi@nrdc.org]
Sent: 5/6/2022 9:09:24 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Jerry Brown [jbrown@sitesproject.org]
Subject: RE: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Thanks Ali – Jason did reach out and we're trying to set up a call for next week. FWIW I don't think it's necessary to exclude the Sites team from my call with Jason (it certainly won't change my questions or answers, and I don't think it's likely to change his), but appreciate the thought.

-d

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, May 6, 2022 8:47 AM
To: Jerry Brown <jbrown@sitesproject.org>; Obegi, Doug <dobegi@nrdc.org>
Subject: RE: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Doug – My apologies for taking so long to get back to you on the paper. The Sites Project Authority actually split the cost with ICF to make this paper open source as it has some key findings relative to our pulse flow protection measure. We wanted the agencies and others to be able to have easy access to it without copyright issues. The published version is attached and the on-line version is here: Factors Affecting Spatiotemporal Variation in Survival of Endangered Winter-Run Chinook Salmon Out-migrating from the Sacramento River - Hassrick - 2022 - North American Journal of Fisheries Management - Wiley Online Library.

Yesterday, I asked Jason to reach out to you to chat about the study. I've asked the Sites team to not participate in this as I want you to have a comfortable space to ask Jason questions to better understand what they looked at and the results. I expect you'll hear from Jason soon.

Again, my apologies for taking so long to get back to you on this paper. Hope you have a great weekend!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 |
aforsythe@sitesproject.org | www.SitesProject.org

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Thursday, April 14, 2022 4:36 PM
To: Obegi, Doug <dobegi@nrdc.org>; Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Re: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Doug – thanks for the message. Ali is out this week on vacation. Regarding the study, thank you for passing this along to us. I'm pretty sure the team is aware of the paper. Jason, the prime author, does work for ICF on the project. Ali will have more to say about it when she returns. Regarding the daily diversion tool, we'd be happy to get the right people together with your folks to work through any questions. Just let us know how we can help.

Jerry

From: Doug Obegi <dobegi@nrdc.org>
Date: Thursday, April 14, 2022 at 3:27 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>, Jerry Brown <jbrown@sitesproject.org>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Dear Jerry and Ali,

Thank you again for sending us the daily diversion tool, and to Jerry for coffee/tea the other morning. I wanted to follow up with two things for you:

First, I wanted to make sure that you were aware of this new peer reviewed scientific study which concludes that for juvenile winter-run Chinook salmon, migratory survival down the Sacramento River is reduced when flows are less than approximately 24,000 cfs (equivalent to 700 cubic meters per second). We've submitted this paper to CDFW (see below), and wanted to make sure that this was included in the JPA's administrative record for NEPA/CEQA since this was new information that was not available at the time of the public comment period on the EIS/EIR.

Second, we've been analyzing the potential changes in water diversions to storage using the daily diversion tool, and it appears that the proposed change to the bypass flow of 10,700 cfs from Oct to June results in an approximately 25% reduction in diversions to storage. It sounds like that is similar to what y'all are finding (our numbers are lower than what WRMWSD reported to their Board). In addition, as we have been exploring the model, we're not sure that the Delta outflow requirements in the model are actually working to limit water diversions to storage. It may be (probably is!) user error on our part, but if we're not able to get the model to work right in the next week or two we may want to check in to make sure the model is actually working correctly.

Thanks,
Doug

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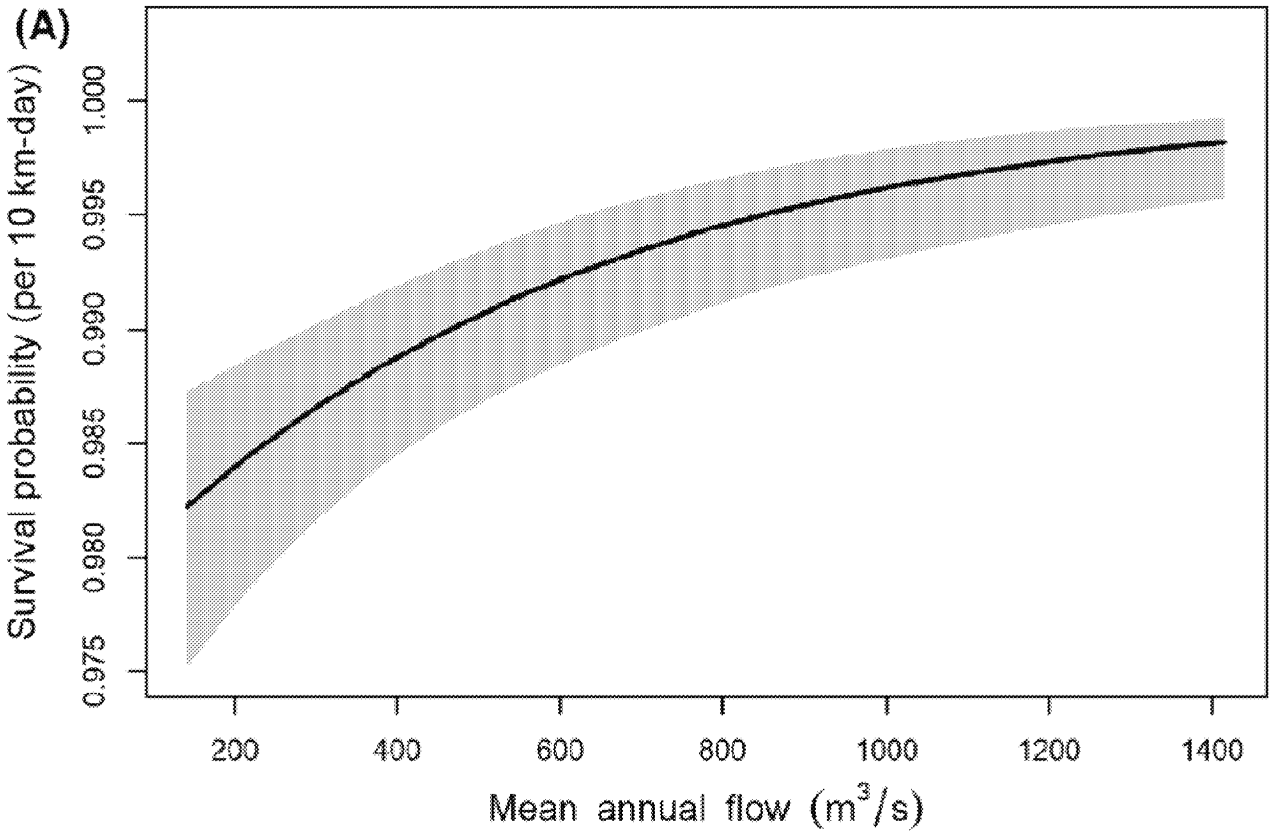

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--

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Table 1a-1 Mortality of Winter-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality

	Annual Mortality[4] (# of Fish/year)							
Analysis Period	**Pre-Spawn Mortality**	**Eggs Flow**	**Eggs - Temperature**	**Fry - Temperature**	**Fry - Habitat**	**Juvenile Temperature**	**Juvenile Habitat**	**Total**
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	9,090	466,365	69,062	3,143	95,476	1,488	47	644,672
Alternative 3A 041122 2035CT	8,938	446,798	10,259	44	98,906	22	33	564,999
Difference	-152	-19,567	-58,803	-3,100	3,430	-1,466	-15	-79,672
Percent Difference[3]	-2	-4	-85	-99	4	-99	-31	-12
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	9,028	481,409	1,743	0	108,903	0	11	601,094
Alternative 3A 041122 2035CT	9,022	446,098	1,745	0	110,187	0	4	567,057
Difference	-6	-35,310	1	0	1,285	0	-7	-34,037
Percent Difference	0	-7	0	0	1	0	-62	-6
Above Normal (12.2%)								
NOACTION 041122 2035CT	10,125	423,784	348,371	12,890	95,385	7,360	72	897,987
Alternative 3A 041122 2035CT	10,130	448,310	35,565	427	110,582	222	88	605,324
Difference	5	24,526	-312,805	-12,463	15,197	-7,138	16	-292,663
Percent Difference	0	6	-90	-97	16	-97	22	-33
Below Normal (18.3%)								
NOACTION 041122 2035CT	8,207	459,028	24,673	3,479	89,345	1,426	61	586,219
Alternative 3A 041122 2035CT	8,805	433,108	3,070	0	88,583	0	12	533,576
Difference	597	-25,920	-21,603	-3,479	-762	-1,426	-49	-52,642
Percent Difference	7	-6	-88	-100	-1	-100	-81	-9
Dry (22%)								
NOACTION 041122 2035CT	9,015	467,158	116,845	5,341	91,523	2,153	69	692,103
Alternative 3A 041122 2035CT	8,681	458,999	15,155	0	97,840	0	51	580,726
Difference	-334	-8,160	-101,689	-5,341	6,316	-2,153	-17	-111,378
Percent Difference	-4	-2	-87	-100	7	-100	-25	-16
Critical (14.6%)								
NOACTION 041122 2035CT	9,756	468,883	18,135	3	78,923	0	64	575,763
Alternative 3A 041122 2035CT	8,506	446,175	14,190	6	80,243	0	58	549,177
Difference	-1,250	-22,708	-3,945	3	1,320	0	-6	-26,586
Percent Difference	-13	-5	-22	113	2	0	-9	-5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1a-2 Mortality of Winter-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality

	Annual Mortality[4] (# of Fish/year)							
Analysis Period	**Pre-Spawn Mortality**	**Eggs Flow**	**Eggs - Temperature**	**Fry - Temperature**	**Fry - Habitat**	**Juvenile Temperature**	**Juvenile Habitat**	**Total**
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	9,090	466,365	69,062	3,143	95,476	1,488	47	644,672
Alternative 3B 041122 2035CT	9,013	445,925	15,558	557	98,831	444	40	570,368
Difference	-77	-20,440	-53,503	-2,587	3,354	-1,044	-7	-74,304
Percent Difference[3]	-1	-4	-77	-82	4	-70	-16	-12
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	9,028	481,409	1,743	0	108,903	0	11	601,094
Alternative 3B 041122 2035CT	9,356	450,068	1,725	0	108,459	0	7	569,615
Difference	328	-31,341	-18	0	-444	0	-4	-31,479
Percent Difference	4	-7	-1	0	0	0	-36	-5
Above Normal (12.2%)								
NOACTION 041122 2035CT	10,125	423,784	348,371	12,890	95,385	7,360	72	897,987
Alternative 3B 041122 2035CT	10,129	441,126	72,970	5,551	110,657	4,433	112	644,977
Difference	4	17,342	-275,401	-7,339	15,272	-2,927	40	-253,010
Percent Difference	0	4	-79	-57	16	-40	56	-28
Below Normal (18.3%)								
NOACTION 041122 2035CT	8,207	459,028	24,673	3,479	89,345	1,426	61	586,219
Alternative 3B 041122 2035CT	8,806	430,217	3,018	0	91,956	0	24	534,021
Difference	599	-28,811	-21,655	-3,479	2,611	-1,426	-37	-52,198
Percent Difference	7	-6	-88	-100	3	-100	-61	-9
Dry (22%)								
NOACTION 041122 2035CT	9,015	467,158	116,845	5,341	91,523	2,153	69	692,103
Alternative 3B 041122 2035CT	8,680	455,811	20,915	4	100,536	3	52	586,002
Difference	-335	-11,347	-95,930	-5,337	9,013	-2,150	-16	-106,102
Percent Difference	-4	-2	-82	-100	10	-100	-23	-15
Critical (14.6%)								
NOACTION 041122 2035CT	9,756	468,883	18,135	3	78,923	0	64	575,763
Alternative 3B 041122 2035CT	8,256	444,608	16,050	6	75,320	0	67	544,306
Difference	-1,500	-24,275	-2,085	3	-3,603	0	3	-31,457
Percent Difference	-15	-5	-11	116	-5	0	5	-5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-1 Mortality of Spring-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality								
	Annual Mortality[4] (# of Fish/year)							
Analysis Period	Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	1,711	5,196	56,864	2	2,576	3	0	66,352
Alternative 3A 041122 2035CT	495	4,705	32,245	0	2,547	5	0	39,997
Difference	-1,216	-492	-24,619	-1	-29	1	0	-26,356
Percent Difference[3]	-71	-9	-43	-76	-1	39	0	-40
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	512	6,772	5,227	0	2,212	0	0	14,722
Alternative 3A 041122 2035CT	443	5,066	4,431	0	2,244	0	0	12,185
Difference	-69	-1,706	-795	0	32	0	0	-2,537
Percent Difference	-13	-25	-15	0	1	0	0	-17
Above Normal (12.2%)								
NOACTION 041122 2035CT	10,683	6,285	168,206	0	2,089	0	0	187,262
Alternative 3A 041122 2035CT	452	3,567	137,957	4	2,331	0	0	144,310
Difference	-10,231	-2,718	-30,249	4	242	0	0	-42,951
Percent Difference	-96	-43	-18	0	12	0	0	-23
Below Normal (18.3%)								
NOACTION 041122 2035CT	210	2,718	65,450	10	2,820	0	0	71,207
Alternative 3A 041122 2035CT	403	2,540	14,908	0	2,812	0	0	20,663
Difference	193	-178	-50,542	-10	-8	0	0	-50,544
Percent Difference	92	-7	-77	-100	0	0	0	-71
Dry (22%)								
NOACTION 041122 2035CT	1,391	5,345	79,492	0	2,904	10	0	89,142
Alternative 3A 041122 2035CT	478	6,512	46,724	0	2,560	15	0	56,290
Difference	-912	1,167	-32,768	0	-344	5	0	-32,852
Percent Difference	-66	22	-41	0	-12	56	0	-37
Critical (14.6%)								
NOACTION 041122 2035CT	784	3,801	54,144	0	2,926	8	0	61,662
Alternative 3A 041122 2035CT	782	4,646	24,301	0	3,022	8	0	32,759
Difference	-2	845	-29,842	0	96	1	0	-28,903
Percent Difference	0	22	-55	0	3	8	0	-47

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1b-2 Mortality of Spring-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality								
				Annual Mortality[4] (# of Fish/year)				
Analysis Period	Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
			Long-term					
Full Simulation Period[1]								
NOACTION 041122 2035CT	1,711	5,196	56,864	2	2,576	3	0	66,352
Alternative 3B 041122 2035CT	519	4,938	37,983	1	2,560	4	0	46,006
Difference	-1,192	-258	-18,880	-1	-16	1	0	-20,346
Percent Difference[3]	-70	-5	-33	-38	-1	32	0	-31
			Water Year Types[2]					
Wet (32.9%)								
NOACTION 041122 2035CT	512	6,772	5,227	0	2,212	0	0	14,722
Alternative 3B 041122 2035CT	442	5,714	4,540	0	2,317	0	0	13,013
Difference	-70	-1,058	-687	0	105	0	0	-1,709
Percent Difference	-14	-16	-13	0	5	0	0	-12
Above Normal (12.2%)								
NOACTION 041122 2035CT	10,683	6,285	168,206	0	2,089	0	0	187,262
Alternative 3B 041122 2035CT	607	4,094	159,684	9	2,324	0	0	166,717
Difference	-10,076	-2,191	-8,522	9	235	0	0	-20,545
Percent Difference	-94	-35	-5	0	11	0	0	-11
Below Normal (18.3%)								
NOACTION 041122 2035CT	210	2,718	65,450	10	2,820	0	0	71,207
Alternative 3B 041122 2035CT	381	2,768	16,649	0	2,667	0	0	22,465
Difference	171	50	-48,800	-10	-153	0	0	-48,742
Percent Difference	81	2	-75	-100	-5	0	0	-68
Dry (22%)								
NOACTION 041122 2035CT	1,391	5,345	79,492	0	2,904	10	0	89,142
Alternative 3B 041122 2035CT	504	6,300	57,589	1	2,674	15	0	67,083
Difference	-886	955	-21,903	1	-230	5	0	-22,058
Percent Difference	-64	18	-28	0	-8	51	0	-25
Critical (14.6%)								
NOACTION 041122 2035CT	784	3,801	54,144	0	2,926	8	0	61,662
Alternative 3B 041122 2035CT	831	4,423	29,358	0	2,961	8	0	37,580
Difference	46	622	-24,786	0	35	0	0	-24,082
Percent Difference	6	16	-46	0	1	-3	0	-39

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-1 Mortality of Fall-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality

	Annual Mortality[4] (# of Fish/year)							
Analysis Period	Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	748,553	2,051,741	1,058,645	702	5,528,287	41,020	583,983	10,012,932
Alternative 3A 041122 2035CT	62,933	2,073,288	754,140	707	5,646,297	48,863	552,743	9,138,971
Difference	-685,620	21,547	-304,505	5	118,010	7,843	-31,241	-873,961
Percent Difference[3]	-92	1	-29	1	2	19	-5	-9
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	7,119	5,101,574	15,249	699	5,913,027	48,342	204,481	11,290,490
Alternative 3A 041122 2035CT	6,662	5,134,248	7,750	368	5,927,024	52,917	192,765	11,321,734
Difference	-457	32,675	-7,499	-330	13,996	4,574	-11,716	31,244
Percent Difference	-6	1	-49	-47	0	9	-6	0
Above Normal (12.2%)								
NOACTION 041122 2035CT	4,814,429	220,496	2,396,071	33	6,016,857	18,435	296,141	13,762,462
Alternative 3A 041122 2035CT	375,302	185,741	3,839,099	206	6,228,529	29,655	232,671	10,891,202
Difference	-4,439,128	-34,755	1,443,029	173	211,672	11,219	-63,471	-2,871,260
Percent Difference	-92	-16	60	525	4	61	-21	-21
Below Normal (18.3%)								
NOACTION 041122 2035CT	150,227	732,656	1,610,286	68	5,588,922	6,513	595,507	8,684,179
Alternative 3A 041122 2035CT	9,047	729,163	448,775	157	5,836,485	17,279	474,528	7,515,435
Difference	-141,179	-3,493	-1,161,511	89	247,563	10,766	-120,979	-1,168,744
Percent Difference	-94	0	-72	132	4	165	-20	-13
Dry (22%)								
NOACTION 041122 2035CT	980,284	425,788	1,328,534	1,346	5,161,528	23,897	944,774	8,866,150
Alternative 3A 041122 2035CT	24,295	499,425	1,011,644	1,542	5,192,825	25,675	969,708	7,725,113
Difference	-955,989	73,637	-316,890	195	31,297	1,777	24,935	-1,141,038
Percent Difference	-98	17	-24	15	1	7	3	-13
Critical (14.6%)								
NOACTION 041122 2035CT	106,507	498,232	1,420,283	982	4,811,255	108,421	1,074,169	8,019,849
Alternative 3A 041122 2035CT	106,613	485,443	372,328	1,240	5,068,981	126,810	1,048,393	7,209,808
Difference	105	-12,789	-1,047,955	258	257,726	18,389	-25,775	-810,041
Percent Difference	0	-3	-74	26	5	17	-2	-10

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1c-2 Mortality of Fall-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality

	Annual Mortality[4] (# of Fish/year)							
Analysis Period	**Pre-Spawn Mortality**	**Eggs Flow**	**Eggs - Temperature**	**Fry - Temperature**	**Fry - Habitat**	**Juvenile Temperature**	**Juvenile Habitat**	**Total**
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	748,553	2,051,741	1,058,645	702	5,528,287	41,020	583,983	10,012,932
Alternative 3B 041122 2035CT	102,792	2,059,130	884,391	675	5,637,749	49,907	541,702	9,276,345
Difference	-645,761	7,389	-174,254	-27	109,461	8,887	-42,282	-736,587
Percent Difference[3]	-86	0	-16	-4	2	22	-7	-7
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	7,119	5,101,574	15,249	699	5,913,027	48,342	204,481	11,290,490
Alternative 3B 041122 2035CT	6,322	5,102,402	16,748	354	5,964,296	53,779	181,294	11,325,195
Difference	-797	828	1,499	-344	51,269	5,437	-23,187	34,705
Percent Difference	-11	0	10	-49	1	11	-11	0
Above Normal (12.2%)								
NOACTION 041122 2035CT	4,814,429	220,496	2,396,071	33	6,016,857	18,435	296,141	13,762,462
Alternative 3B 041122 2035CT	730,314	185,786	4,206,201	207	6,207,390	29,264	260,787	11,619,948
Difference	-4,084,116	-34,710	1,810,131	174	190,533	10,829	-35,355	-2,142,514
Percent Difference	-85	-16	76	527	3	59	-12	-16
Below Normal (18.3%)								
NOACTION 041122 2035CT	150,227	732,656	1,610,286	68	5,588,922	6,513	595,507	8,684,179
Alternative 3B 041122 2035CT	7,808	726,337	521,678	103	5,784,721	14,764	493,505	7,548,915
Difference	-142,419	-6,319	-1,088,608	35	195,798	8,251	-102,003	-1,135,264
Percent Difference	-95	-1	-68	52	4	127	-17	-13
Dry (22%)								
NOACTION 041122 2035CT	980,284	425,788	1,328,534	1,346	5,161,528	23,897	944,774	8,866,150
Alternative 3B 041122 2035CT	44,298	487,106	1,211,714	1,514	5,245,810	28,844	918,435	7,937,722
Difference	-935,986	61,318	-116,820	167	84,283	4,947	-26,338	-928,429
Percent Difference	-95	14	-9	12	2	21	-3	-10
Critical (14.6%)								
NOACTION 041122 2035CT	106,507	498,232	1,420,283	982	4,811,255	108,421	1,074,169	8,019,849
Alternative 3B 041122 2035CT	107,970	484,691	584,452	1,167	4,927,449	130,479	1,035,041	7,271,249
Difference	1,462	-13,541	-835,831	185	116,194	22,058	-39,127	-748,600
Percent Difference	1	-3	-59	19	2	20	-4	-9

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-1 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality								
	Annual Mortality[4] (# of Fish/year)							
Analysis Period	Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	0	662,593	99,082	343	1,882,243	12,129	37,659	2,694,050
Alternative 3A 041122 2035CT	0	639,424	107,179	363	1,866,791	3,531	48,441	2,665,729
Difference	0	-23,169	8,096	19	-15,452	-8,598	10,782	-28,321
Percent Difference[3]	0	-3	8	6	-1	-71	29	-1
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	0	1,654,363	67,048	382	1,530,379	105	8,389	3,260,666
Alternative 3A 041122 2035CT	0	1,578,153	64,047	392	1,528,243	149	9,713	3,180,697
Difference	0	-76,209	-3,002	10	-2,136	44	1,323	-79,969
Percent Difference	0	-5	-4	3	0	42	16	-2
Above Normal (12.2%)								
NOACTION 041122 2035CT	0	832,343	81,039	145	1,723,863	144	16,398	2,653,930
Alternative 3A 041122 2035CT	0	851,989	100,175	343	1,714,198	178	25,280	2,692,162
Difference	0	19,646	19,135	198	-9,664	34	8,883	38,231
Percent Difference	0	2	24	137	-1	23	54	1
Below Normal (18.3%)								
NOACTION 041122 2035CT	0	37,600	62,005	61	2,098,727	735	31,767	2,230,895
Alternative 3A 041122 2035CT	0	41,017	87,115	240	2,158,000	690	35,782	2,322,843
Difference	0	3,417	25,109	179	59,272	-45	4,015	91,948
Percent Difference	0	9	40	295	3	-6	13	4
Dry (22%)								
NOACTION 041122 2035CT	0	38,852	185,948	347	2,163,152	2,536	54,946	2,445,782
Alternative 3A 041122 2035CT	0	36,136	202,640	306	2,122,155	2,705	86,590	2,450,532
Difference	0	-2,716	16,692	-41	-40,998	169	31,644	4,750
Percent Difference	0	-7	9	-12	-2	7	58	0
Critical (14.6%)								
NOACTION 041122 2035CT	0	34,797	99,235	737	2,087,554	75,808	99,124	2,397,255
Alternative 3A 041122 2035CT	0	38,515	90,784	548	1,983,194	18,168	109,622	2,240,831
Difference	0	3,718	-8,452	-189	-104,360	-57,640	10,498	-156,424
Percent Difference	0	11	-9	-26	-5	-76	11	-7

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 1d-2 Mortality of LateFall-Run Chinook Salmon by Life-stage and Source, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Mortality

	Annual Mortality[4] (# of Fish/year)							
Analysis Period	Pre-Spawn Mortality	Eggs Flow	Eggs - Temperature	Fry - Temperature	Fry - Habitat	Juvenile Temperature	Juvenile Habitat	Total
Long-term								
Full Simulation Period[1]								
NOACTION 041122 2035CT	0	662,593	99,082	343	1,882,243	12,129	37,659	2,694,050
Alternative 3B 041122 2035CT	0	626,205	106,943	371	1,885,278	4,359	45,704	2,668,859
Difference	0	-36,388	7,860	28	3,036	-7,771	8,045	-25,190
Percent Difference[3]	0	-5	8	8	0	-64	21	-1
Water Year Types[2]								
Wet (32.9%)								
NOACTION 041122 2035CT	0	1,654,363	67,048	382	1,530,379	105	8,389	3,260,666
Alternative 3B 041122 2035CT	0	1,538,112	64,386	408	1,534,093	153	10,180	3,147,333
Difference	0	-116,250	-2,663	26	3,715	48	1,791	-113,333
Percent Difference	0	-7	-4	7	0	46	21	-3
Above Normal (12.2%)								
NOACTION 041122 2035CT	0	832,343	81,039	145	1,723,863	144	16,398	2,653,930
Alternative 3B 041122 2035CT	0	852,728	99,998	339	1,730,177	171	20,414	2,703,826
Difference	0	20,385	18,958	195	6,314	27	4,017	49,896
Percent Difference	0	2	23	135	0	19	24	2
Below Normal (18.3%)								
NOACTION 041122 2035CT	0	37,600	62,005	61	2,098,727	735	31,767	2,230,895
Alternative 3B 041122 2035CT	0	40,905	81,777	230	2,164,960	695	37,950	2,326,517
Difference	0	3,305	19,771	170	66,232	-40	6,184	95,622
Percent Difference	0	9	32	280	3	-5	19	4
Dry (22%)								
NOACTION 041122 2035CT	0	38,852	185,948	347	2,163,152	2,536	54,946	2,445,782
Alternative 3B 041122 2035CT	0	38,068	207,317	327	2,158,469	3,076	71,006	2,478,263
Difference	0	-784	21,368	-20	-4,684	540	16,060	32,481
Percent Difference	0	-2	11	-6	0	21	29	1
Critical (14.6%)								
NOACTION 041122 2035CT	0	34,797	99,235	737	2,087,554	75,808	99,124	2,397,255
Alternative 3B 041122 2035CT	0	37,226	88,223	553	2,019,459	23,118	114,229	2,282,807
Difference	0	2,429	-11,013	-184	-68,095	-52,690	15,105	-114,448
Percent Difference	0	7	-11	-25	-3	-70	15	-5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

[4] Mortality values do not include base mortality

Table 2a-1 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	1,921,325
Alternative 3A 041122 2035CT	1,966,321
Difference	44,996
Percent Difference[3]	2.3
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	1,919,829
Alternative 3A 041122 2035CT	1,941,175
Difference	21,347
Percent Difference	1.1
Above Normal (12.2%)	
NOACTION 041122 2035CT	1,783,174
Alternative 3A 041122 2035CT	1,953,964
Difference	170,790
Percent Difference	9.6
Below Normal (18.3%)	
NOACTION 041122 2035CT	1,943,156
Alternative 3A 041122 2035CT	1,972,396
Difference	29,240
Percent Difference	1.5
Dry (22%)	
NOACTION 041122 2035CT	1,900,163
Alternative 3A 041122 2035CT	1,963,104
Difference	62,941
Percent Difference	3.3
Critical (14.6%)	
NOACTION 041122 2035CT	2,021,248
Alternative 3A 041122 2035CT	2,028,368
Difference	7,120
Percent Difference	0.4

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2a-2 Annual Potential Production for Winter-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	1,921,325
Alternative 3B 041122 2035CT	1,962,292
Difference	40,967
Percent Difference[3]	2.1
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	1,919,829
Alternative 3B 041122 2035CT	1,938,487
Difference	18,658
Percent Difference	1.0
Above Normal (12.2%)	
NOACTION 041122 2035CT	1,783,174
Alternative 3B 041122 2035CT	1,928,093
Difference	144,919
Percent Difference	8.1
Below Normal (18.3%)	
NOACTION 041122 2035CT	1,943,156
Alternative 3B 041122 2035CT	1,971,504
Difference	28,348
Percent Difference	1.5
Dry (22%)	
NOACTION 041122 2035CT	1,900,163
Alternative 3B 041122 2035CT	1,959,424
Difference	59,262
Percent Difference	3.1
Critical (14.6%)	
NOACTION 041122 2035CT	2,021,248
Alternative 3B 041122 2035CT	2,031,438
Difference	10,190
Percent Difference	0.5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-1 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	440,285
Alternative 3A 041122 2035CT	450,278
Difference	9,993
Percent Difference[3]	2.3
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	456,096
Alternative 3A 041122 2035CT	456,386
Difference	289
Percent Difference	0.1
Above Normal (12.2%)	
NOACTION 041122 2035CT	390,022
Alternative 3A 041122 2035CT	401,892
Difference	11,870
Percent Difference	3.0
Below Normal (18.3%)	
NOACTION 041122 2035CT	434,115
Alternative 3A 041122 2035CT	457,263
Difference	23,148
Percent Difference	5.3
Dry (22%)	
NOACTION 041122 2035CT	435,761
Alternative 3A 041122 2035CT	446,756
Difference	10,996
Percent Difference	2.5
Critical (14.6%)	
NOACTION 041122 2035CT	452,716
Alternative 3A 041122 2035CT	465,342
Difference	12,626
Percent Difference	2.8

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2b-2 Annual Potential Production for Spring-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	440,285
Alternative 3B 041122 2035CT	447,742
Difference	7,457
Percent Difference[3]	1.7
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	456,096
Alternative 3B 041122 2035CT	455,854
Difference	-242
Percent Difference	-0.1
Above Normal (12.2%)	
NOACTION 041122 2035CT	390,022
Alternative 3B 041122 2035CT	393,042
Difference	3,020
Percent Difference	0.8
Below Normal (18.3%)	
NOACTION 041122 2035CT	434,115
Alternative 3B 041122 2035CT	456,459
Difference	22,343
Percent Difference	5.1
Dry (22%)	
NOACTION 041122 2035CT	435,761
Alternative 3B 041122 2035CT	442,049
Difference	6,289
Percent Difference	1.4
Critical (14.6%)	
NOACTION 041122 2035CT	452,716
Alternative 3B 041122 2035CT	463,601
Difference	10,884
Percent Difference	2.4

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-1 Annual Potential Production for Fall-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	17,867,685
Alternative 3A 041122 2035CT	18,150,355
Difference	282,670
Percent Difference[3]	1.6
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	16,724,081
Alternative 3A 041122 2035CT	16,726,140
Difference	2,058
Percent Difference	0.0
Above Normal (12.2%)	
NOACTION 041122 2035CT	16,842,954
Alternative 3A 041122 2035CT	17,803,888
Difference	960,934
Percent Difference	5.7
Below Normal (18.3%)	
NOACTION 041122 2035CT	18,545,758
Alternative 3A 041122 2035CT	18,935,726
Difference	389,968
Percent Difference	2.1
Dry (22%)	
NOACTION 041122 2035CT	18,650,493
Alternative 3A 041122 2035CT	19,014,508
Difference	364,015
Percent Difference	2.0
Critical (14.6%)	
NOACTION 041122 2035CT	19,102,145
Alternative 3A 041122 2035CT	19,307,875
Difference	205,729
Percent Difference	1.1

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2c-2 Annual Potential Production for Fall-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	17,867,685
Alternative 3B 041122 2035CT	18,116,844
Difference	249,159
Percent Difference[3]	1.4
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	16,724,081
Alternative 3B 041122 2035CT	16,728,614
Difference	4,533
Percent Difference	0.0
Above Normal (12.2%)	
NOACTION 041122 2035CT	16,842,954
Alternative 3B 041122 2035CT	17,555,632
Difference	712,678
Percent Difference	4.2
Below Normal (18.3%)	
NOACTION 041122 2035CT	18,545,758
Alternative 3B 041122 2035CT	18,944,095
Difference	398,337
Percent Difference	2.1
Dry (22%)	
NOACTION 041122 2035CT	18,650,493
Alternative 3B 041122 2035CT	18,952,678
Difference	302,186
Percent Difference	1.6
Critical (14.6%)	
NOACTION 041122 2035CT	19,102,145
Alternative 3B 041122 2035CT	19,326,690
Difference	224,545
Percent Difference	1.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-1 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3A 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	2,883,330
Alternative 3A 041122 2035CT	2,900,770
Difference	17,440
Percent Difference[3]	0.6
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	2,690,042
Alternative 3A 041122 2035CT	2,719,943
Difference	29,900
Percent Difference	1.1
Above Normal (12.2%)	
NOACTION 041122 2035CT	2,902,637
Alternative 3A 041122 2035CT	2,901,909
Difference	-728
Percent Difference	0.0
Below Normal (18.3%)	
NOACTION 041122 2035CT	3,021,078
Alternative 3A 041122 2035CT	2,978,823
Difference	-42,256
Percent Difference	-1.4
Dry (22%)	
NOACTION 041122 2035CT	2,969,746
Alternative 3A 041122 2035CT	2,973,481
Difference	3,735
Percent Difference	0.1
Critical (14.6%)	
NOACTION 041122 2035CT	3,003,548
Alternative 3A 041122 2035CT	3,100,243
Difference	96,695
Percent Difference	3.2

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

Table 2d-2 Annual Potential Production for LateFall-Run Chinook Salmon, NOACTION 041122 2035CT vs. Alternative 3B 041122 2035CT

Long-term Average and Average by Water Year Type Annual Production

Analysis Period	Annual Potential Production (# of Fish/year)
Long-term	
Full Simulation Period[1]	
NOACTION 041122 2035CT	2,883,330
Alternative 3B 041122 2035CT	2,894,730
Difference	11,399
Percent Difference[3]	0.4
Water Year Types[2]	
Wet (32.9%)	
NOACTION 041122 2035CT	2,690,042
Alternative 3B 041122 2035CT	2,729,520
Difference	39,478
Percent Difference	1.5
Above Normal (12.2%)	
NOACTION 041122 2035CT	2,902,637
Alternative 3B 041122 2035CT	2,883,975
Difference	-18,661
Percent Difference	-0.6
Below Normal (18.3%)	
NOACTION 041122 2035CT	3,021,078
Alternative 3B 041122 2035CT	2,973,918
Difference	-47,161
Percent Difference	-1.6
Dry (22%)	
NOACTION 041122 2035CT	2,969,746
Alternative 3B 041122 2035CT	2,959,411
Difference	-10,335
Percent Difference	-0.3
Critical (14.6%)	
NOACTION 041122 2035CT	3,003,548
Alternative 3B 041122 2035CT	3,077,613
Difference	74,065
Percent Difference	2.5

[1] Based on the 80-year simulation period

[2] As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB D-1641, 1999). Water years may not correspond to the biological years in SALMOD.

[3] Relative difference of the annual average

JACOBS

Memorandum

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Sacramento, California 95833-2937
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www.jacobs.com

Project Name	Sites Reservoir Project	
Subject	Model Results to Support the 2022 Biological Assessment: No Action Alternative at 2035CT, Alternative 3A at 2035CT, and Alternative 3B at 2035CT – Anderson Model, Martin Model, and SALMOD	
Attention	Ali Forsythe/Sites Project Authority	Monique Briard/ICF
	Erin Heydinger/HDR	Mike Hendrick /ICF
From	Robert Leaf/JACOBS	Steve Micko/JACOBS
	Reed Thayer/JACOBS	Samaneh Saadat/JACOBS
Date	May 6, 2022	

1. Introduction

The Sites Reservoir Project team has developed model simulations to support quantitative analysis of Sites long-term operations as part of developing a Biological Assessment, for completion in 2022.

The results of these model simulations are provided for informational and review purposes. If there are any questions regarding the results of these simulations, please contact the modeling team.

2. Modeled Scenarios

Model results are provided for the alternatives tabulated below.

Model Name	**Label Name (as seen in spreadsheet)**	**Description**
No Action Alternative 041122 2035CT	NAA 041122 2035CT	Baseline simulation (Reclamation 2021 Benchmark at 2035CT and 15 cm of sea level rise)
Alternative 3A 041122 2035CT	ALT3A 041122 2035CT	1.5 MAF Reservoir with 345 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise
Alternative 3B 041122 2035CT	ALT 3B 041122 2035CT	1.5 MAF Reservoir with 230 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise

The Anderson and Martin models were used to simulate temperature-based mortality of early life stage winter run Chinook salmon. For detailed documentation, please review papers associated with the models (in the reference section).

The SALMOD model was used to simulate annual production potential for juvenile fall, late-fall, winter, and spring runs of Chinook salmon in the Sacramento River from Keswick Dam to the Red Bluff Diversion Dam.

3. Model Simulations for Modeled Scenarios

3.1 Anderson and Martin Models

A pdf report NODOS_BA2022_EggMortality_NAA_041122_2035CT_ALT3A_041122_2035CT_ALT3B_041122_2035CT.pdf, is provided. To better demonstrate differences between modeled alternatives, the x-axis range of exceedance plots is set to 20% to 0%.

3.2 SALMOD Models

Two pdf reports, SALMOD_Annual_Assessment_2035CTClim_NODOS_BA2022_Plots__rev04_20220422.pdf and NODOS_BA2022_SALMOD_Ann_Mortality_Production_Summary_All_Runs_2035CTClim.pdf, are provided.

4. References

Anderson, James. (2018). Using river temperature to optimize fish incubation metabolism and survival: a case for mechanistic models. 10.1101/257154.

Martin, B. T., A. Pike, S. N. John, N. Hamda, J. Roberts, S. T. Lindley, and E. M. Danner. 2017. Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 5/8/2022 11:21:39 AM
To: Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites Reservoir

If Ali does not want to do it, I would be happy to. I have the technical and academic background and lead HDR's Lake and Reservoir Practice Group. I am also very experienced in speaking at conferences.

I was actually looking at that conference and thinking about going one of the days.

Others from ICF that are very much on the technical side and in the weeks would be Anne Huber and Lesa Erecius from HDR

John Spranza

D 916.679.8858 M 818.640.2487

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Friday, May 6, 2022 2:55 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Spranza, John <john.spranza@hdrinc.com>
Subject: Re: Sites Reservoir

Not sure if you all are familiar with the Ca Lake Mgmt Society but they have reached out to us and are asking for a presentation on Sites at their fall "in person" conference in Oakland. Its would be ~100 lake managers from across the state. When I spoke with Stephen today it was apparent that they need a more technical person than me with knowledge of water quality considerations related to the various aspects of the operations of Sites (e.g. diversion sediment transport, reservoir wq, release effects).

Can one of you provide me with the name and contact info of the best person on our Sites project team to provide this type of presentation to this group for the Sites project?

COB Monday would be fine.

Thanks

From: Stephen McCord <sam@mccenv.com>
Date: Thursday, May 5, 2022 at 7:52 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: RE: Sites Reservoir

Hi, Jerry. I'll be driving for several hours tomorrow before 9am and after about 1:30pm. Let me know if/when you're available and I'll give you a call.
Basically, I'm on the conference planning committee and we're looking for speakers on the topic of new reservoirs. Sites seems like a great one. Pacheco in the San Jose area is another option. I have heard that you are can share both the promises and challenges of the Sites project, which seems best. Our conference will be in-person in Oakland, Oct. 13 (all day).

Stephen
Cell: 530-220-3165

From: Bruce Houdesheldt <bruceh@norcalwater.org>
Sent: Thursday, May 5, 2022 4:54 AM
To: Stephen McCord <sam@mccenv.com>
Cc: Jerry Brown (jbrown@sitesproject.org) <jbrown@sitesproject.org>
Subject: RE: Sites Reservoir

Stephen,

I have "cc" the Executive Director of Sites Reservoir, Jerry Brown, who would be the person to start with.

NCWA
Northern California Water Association

Bruce Houdesheldt
Director of Water Quality
Cell : 916-952-1287
Phone: 916-442-8333
Email: BruceH@norcalwater.org
455 Capitol Mall, Suite 703
Sacramento, CA 95814
www.norcalwater.org

From: Stephen McCord <sam@mccenv.com>
Sent: Tuesday, May 3, 2022 10:17 AM
To: Stephen McCord <sam@mccenv.com>
Subject: Sites Reservoir

Hello. I'm bcc'ing this to several people in hopes that you can connect me to the right person. I'm helping to organize the annual conference this fall for the CA Lake Mgt. Society. One topic that we're interesting in finding a speaker for is the subject Sites Reservoir. I've heard that it's a great idea worth state funding, and I've heard it'll be useless and an environmental disaster. Someone who has studied it and could provide a balanced presentation about it would be great.

Please connect me with anyone who you think could fit the bill.

Regards,
Stephen McCord

McCord Environmental, Inc.
759 Bianco Ct. | Davis, CA 95616
530-220-3165
www.mccenv.com

Meeting: **Sites Reservoir Committee, Environmental Planning and Permitting Workgroup**

Locations:

Maxwell Project Office, 122 Old Highway 99W, Maxwell, CA 95955
See below for alternate meeting locations.

Call in: **1-833-255-2803** Code: 512623326# Click here to join the meeting

Workgroup Chair:	Thad Bettner (GCID)
Workgroup Vice-Chair:	Heather Dyer (SBVMWD)
Staff Lead:	Ali Forsythe, Environmental Planning and Permitting Manager

AGENDA

Thursday, May 12, 2022; 1:00 pm – 1:45 pm

NO ACTION or DECISION WILL BE TAKEN

ROLL CALL & CALL TO ORDER:

- Introductions.
- Period for Public Comment.

1. Discussion and Information Items:

1.1 Review and comment on a contract with University of California, Santa Cruz for Winter-run Life Cycle Modeling Effort

2. Environmental Planning and Permitting Manager Report

- Key Planning and Permitting Activities Report

3. Upcoming Meetings:

Reservoir Committee
Friday, May 20, 2022 (9:00 am – 12:00 pm)

Authority Board
Wednesday, May 25, 2022 (1:30 – 4:00 pm)

Environmental Planning and Permitting Workgroup
Thursday, June 9, 2022 (1:00 – 2:30 pm)

Virtual Information will be provided before all meetings at Sitesproject.org.

ADJOURN

PERIOD OF PUBLIC COMMENT: Any person may speak about any subject of concern, provided it is within the jurisdiction of the Reservoir Committee and is not already on today's agenda. The total amount of time allotted for receiving such public communication shall be limited to a total of 10 minutes per issue and each individual or group will be limited to no more than 3 minutes each within the 10 minutes allocated per issue. **Note:** No action shall be taken on comments made under this comment period.

ADA COMPLIANCE: Upon request, agendas will be made available in alternative formats to accommodate persons with disabilities. In addition, any person with a disability who requires a modification or accommodation to participate or attend this meeting may request necessary accommodation. Please make your request to the Board Clerk, specifying your disability, the format in which you would like to receive this Agenda and any other accommodation required no later than 24 hours before the start of the meeting.

Alternate Meeting Locations:

Glenn-Colusa Irrigation District, 344 East Laurel St, Willows, CA 95988

San Bernardino Valley Municipal WD, 380 E. Vanderbilt Way, San Bernardino, CA 92408

Colusa County, 1215 Market St., Colusa CA 95932

Coachella Valley Water District, 51501 Tyler Street, Coachella CA 92236

Reclamation District 108, 975 Wilson Bend Rd., Grimes, CA 95950

Wheeler Ridge-Maricopa Water Storage District, 12109 Hwy 166, Bakersfield, CA 93313

Sites Reservoir Project - 3 Month Look Ahead

Primary	Assigned To	Governing Body
May 2022		
Consent Items		
Minutes	Yolanda Tirado	Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Authority Board & Reservoir Committee
1st Quarter 2022 Financial Report	Joe Trapasso	Authority Board & Reservoir Committee
Accept selection of Financial Audit Firm	Joe Trapasso	Authority Board & Reservoir Committee
UC Santa Cruz Modeling Support Contract	aforsythe@sitesproject.org, Joe Trapasso	Authority Board & Reservoir Committee
Phase 2, Amendment 2 Close Out Report - Authorize Final Carryover Funds	Joe Trapasso, Marcus Maltby	Authority Board & Reservoir Committee
Action Items		
Authorize Amendments to the Real Estate and Land Mgmt Policy	Kevin Spesert	Authority Board & Reservoir Committee
Discussion and Informational Items		
Review of AB 2639 (QUIRK) Bay/Delta water quality control plan/water right permits	Jerry Brown	Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Authority Board & Reservoir Committee
Closed Session		
Committees/Workgroups		
Payment of Claims	Joe Trapasso	Joint Budget & Finance Committee
1st Quarter 2022 Financial Report	Joe Trapasso	Joint Budget & Finance Committee
Financial Audit Firm	Joe Trapasso	Joint Budget & Finance Committee
Phase 2, Amendment 2 Closeout Report	Joe Trapasso, Marcus Maltby	Joint Budget & Finance Committee
UC Santa Cruz Modeling Support Contract	Joe Trapasso	Joint Budget & Finance Committee
Legislative and Outreach Update	Kevin Spesert	Legislative & Outreach Committee
Contract Strategy: draft qualitative analysis to identify shortlist of contract packages and delivery methods	Henry Luu	O&E Ad Hoc Sub-Workgroup
UC Santa Cruz Modeling Support Contract	Joe Trapasso	Environmental Planning & Permitting Workgroup
June 2022 (Joint Meeting)		
Consent Items		
Minutes	Sandra Yarbrough	Joint Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Joint Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Joint Authority Board & Reservoir Committee
Approve Land Appraiser On Call List	Kevin Spesert	Joint Authority Board & Reservoir Committee
Action Items		
Authorize adjustment to A3 budget for real estate actions	Kevin Spesert	Joint Authority Board & Reservoir Committee
Establish Weighting and Criteria for Selecting Project Contract Packages and Delivery Methods	Henry Luu, JP Robinette	Joint Authority Board & Reservoir Committee
Discussion and Informational Items		
Review Governance Approach in Preparation for start of Phase 3 and proceed with identifying immediate and near term next steps	Jerry Brown	Joint Authority Board & Reservoir Committee
Review Formation of Local Community Working Group	Kevin Spesert	Joint Authority Board & Reservoir Committee
Plan of Finance - Financing Action Plan Update	JP Robinette	Joint Authority Board & Reservoir Committee
Plan of Finance - Significant Terms to be included in Authority's Master Resolution	Cheyanne Harris, JP Robinette	Joint Authority Board & Reservoir Committee
Eagle Short Term Geotech Permit - Approach in Preparation for Approval to Submit in July	Ali Forsythe, John Spranza	Joint Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Joint Authority Board & Reservoir Committee
Closed Session		
Committees/Workgroups		
Payment of Claims	Joe Trapasso	Joint Budget & Finance Committee

Primary	Assigned To	Governing Body
Plan of Finance - Financing Action Plan Update	Cheyanne Harris, JP Robinette	Joint Budget & Finance Committee
Plan of Finance - Significant Terms to be included in Authority's Master Resolution	Cheyanne Harris, JP Robinette	Joint Budget & Finance Committee
Recommend weighting and evaluation criteria for establishing contract packages and delivery methods	Henry Luu	O&E Ad Hoc Sub-Workgroup
Recommendation of weighting and evaluation criteria for establishing contract packages and delivery methods	Henry Luu	Reservoir Operations & Engineering Workgroup
Final EIR/EIS - Overview of Changes to Project Description based on Comments Recieved	aforsythe@sitesproject.org, Laurie Warner Herson	Environmental Planning & Permitting Workgroup
Eagle Short Term and Nest Take Permit - Approach in Preparation for Approval to Submit in July	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
Biological Assessment - Aquatic Species Effects	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
State ITP for Operations - Aquatic Species Effects	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
July 2022		
Consent Items		Authority Board & Reservoir Committee
Minutes	Sandra Yarbrough	Authority Board & Reservoir Committee
Treasurer's Report	Joe Trapasso	Authority Board & Reservoir Committee
Payment of Claims	Joe Trapasso	Authority Board & Reservoir Committee
Action Items		Authority Board & Reservoir Committee
Geotech Priority 1A and 1B - Final Initial Study/Mitigated Neg Dec Release and Adopting the Project	Ali Forsythe, Laurie Warner Herson, Linda Fisher	Authority Board & Reservoir Committee
Placeholder - Facility partner MOU & A3 Budget Adjustments	JP Robinette	Authority Board & Reservoir Committee
Placeholder - Authorize "Offer Letter" to Reclamation	Jerry Brown	Authority Board & Reservoir Committee
Eagle Short Term and Nest Take Permit - Approval to Submit in July	Ali Forsythe, John Spranza	Authority Board & Reservoir Committee
Biological Assessment - Delegate authority for release of permit application	Ali Forsythe, John Spranza	Authority Board & Reservoir Committee
State ITP for Operations - Delegate authority for release of permit application	Ali Forsythe, John Spranza	Authority Board & Reservoir Committee
Placeholder: Approve Consulting Agreement with Mitigation Assistance Service Provider	aforsythe@sitesproject.org, Joe Trapasso, John Spranza	Authority Board & Reservoir Committee
Discussion and Informational Items		Authority Board & Reservoir Committee
Water Rights - Protests Status Update Briefing	aforsythe@sitesproject.org	Authority Board & Reservoir Committee
Placeholder - Authorize Real Estate Actions	Kevin Spesert	Authority Board & Reservoir Committee
Monthly Reporting (Monthly Status Report, Work Plan, Action Items)	All	Authority Board & Reservoir Committee
Committees/Workgroups		
Water Rights - Protests Status Update Briefing	aforsythe@sitesproject.org	Environmental Planning & Permitting Workgroup
Eagle Short Term and Nest Take Permit - Approval to Submit in July	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
Biological Assessment - Delegate authority for release of permit application	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
State ITP for Operations - Delegate authority for release of permit application	Ali Forsythe, John Spranza	Environmental Planning & Permitting Workgroup
Geotech Priority 1A and 1B - Final Initial Study/Mitigated Neg Dec Release	Ali Forsythe, Laurie Warner Herson, Linda Fisher	Environmental Planning & Permitting Workgroup
Placeholder: July Guiding Principles Workshop		
Guiding Principles Review and Kick-off for Contract Development	Cheyanne Harris, JP Robinette	Joint Authority Board & Reservoir Committee
Update on Financing Tracks based on results from June Two-Way Financing Check Ins	Cheyanne Harris, JP Robinette	Joint Authority Board & Reservoir Committee

From: JP Robinette [jrobinette@sitesproject.org]
Sent: 5/9/2022 9:39:29 AM
To: Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
CC: Luu, Henry [henry.luu@hdrinc.com]; Spranza, John [john.spranza@hdrinc.com]
Subject: Re: Sites: 404(b)(1) Compliance Memo - Input Needed ASAP

Hi Jelica,

Let's try to catch up tomorrow. Are you free at 8:30? If not, second preference would be 10am.

Thanks,
JP

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Thursday, May 5, 2022 3:40 PM
To: JP Robinette <jrobinette@sitesproject.org>
Cc: Luu, Henry <henry.luu@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>
Subject: RE: Sites: 404(b)(1) Compliance Memo - Input Needed ASAP

Hey JP
I'm free to chat next week or anytime before 4pm today. WE do have time to discuss as the meeting isn't till Monday May 16th. Looping in John here as he may have a simpler way to explain what we need from you and Henry (and Erin)

Jelica Arsenijevic
Environmental Project Manager

Due to COVID-19, I will be working from home. Please contact me via cell # listed below. Be safe out there!

FDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: JP Robinette <jrobinette@sitesproject.org>
Sent: Thursday, May 5, 2022 3:34 PM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Cc: Luu, Henry <henry.luu@hdrinc.com>
Subject: Re: Sites: 404(b)(1) Compliance Memo - Input Needed ASAP

Jelica, I am not following this request, and I thought I saw a meeting to discuss this coming up next week... is that right? If not, I could use a quick phone call. I am planning to take tomorrow off, so please let me know if this is urgent and we can chat.

JP

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Wednesday, May 4, 2022 2:36 PM
To: JP Robinette <jrobinette@sitesproject.org>; Luu, Henry <henry.luu@hdrinc.com>; Heydinger, Erin <erin.heydinger@hdrinc.com>
Cc: Spranza, John <john.spranza@hdrinc.com>; Markham, John <John.Markham@icf.com>; Vondergeest, Michael <Michael.Vondergeest@icf.com>; Smith, Kristin <Kristin.Smith@hdrinc.com>
Subject: Sites: 404(b)(1) Compliance Memo - Input Needed ASAP

JP, Henry, and Erin
We need your help with the 404(b)(1) memo. It was recently shared with you for your review/input, specifically honing in on section 2 of the document. Though the document is under review, we are concurrently continuing an effort in bolstering our rationale for why Alternative 2 is not the *Least Environmentally Damaging Practicable Alternative (LEDPA)*, and therefore being ruled out.

ICF was courteous to write up what we need from you (see highlighted text below). We are hoping to meet with the 3 of you and get valuable input from you to add to our rationale. We need the "detail" from you as this "detail" is what will convince the Corps that Alternative 2 should be ruled out.

I will work with Marcia to get a date on your calendar in the next week or two. ICF will lead the call and guide all of us through the innerworkings of the teams needs.

Erin, see attached email to link where the current draft lives on SharePoint.

As previously discussed, the ICF permitting team is preparing a technical memorandum for the USACE and SWRCB comparing the onsite alternatives against the Clean Water Act 404(b)(1) practicability screening criteria (esp. cost & logistics), including justification for screening out onsite Alternative 2 as information becomes available. Specifically, we are requesting additional information to build our argument around the following criteria:

- Cost metric 1: Construction or acquisition costs would result in a cost increase of no greater than 15 percent over the applicant-preferred alternative (onsite Alternative 3)
- Cost metric 3: Return investment of XX percent to Reclamation over XX years (added per engineering feedback)
- Logistics metric 3: Meet existing water supply requirements for participating members and programs as well as environmental water supply needs, including projected mitigation offsets for listed species during all water years (wet, above normal, below normal, dry, and critically dry)

Jelica Arsenijevic
Environmental Project Manager

Due to COVID-19, I will be working from home. Please contact me via cell # listed below. Be safe out there!

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/9/2022 12:37:17 PM
To: Joseph, Trevor [TJoseph@roseville.ca.us]; Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

Hi Trevor – Below

- The Authority is shifting its focus from Alternative 1 to Alternative 3 for its Final EIR/EIS. Alternative 3 maintains a reservoir size of 1.5 MAF, but it looks at a federal investment of up to 25% of project costs (Alternative 1 includes federal investment of up to 7%).
- The authority is currently preparing its Final EIR/EIS and responding to comments received on the draft document. The goal is to have this document completed in early 2023.
- The reference made to environmental flows depends on the way Reclamation uses its storage. As the project is currently envisioned, the State will receive 17% of the storage in Sites. With a Reclamation investment up to 25%, 17+25 = 42% of the project that could be used to the benefit of the environment. Reclamation is still determining how it would like to use its Sites water, but expect that it will be used to benefit anadromous fish to some degree.
- The project received an invitation to apply for a WIFIA loan of up to 49% of the project costs – estimated at $2.2B. An invitation to apply is similar to a pre-approval for a loan. The project was also awarded some additional potential funding by the State, both an inflation adjustment as well as an additional amount to fully fund the benefits. The additional funds awarded were $38.6M for a total of $875.4M
- The other big initiatives for the year include submitting the water right application to the State Board (which will occur this week), developing operating agreements with DWR and Reclamation, and submitting the Biological Assessment and CESA Operations Incidental Take Permit application for the project.

Hope these help. Happy to answer any questions.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Joseph, Trevor <TJoseph@roseville.ca.us>
Sent: Monday, May 9, 2022 7:18 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

Hi Ali and Erin

Can you give me a few bullets on the current status and next steps on SITES?

I assume the 1.5 MAF has not changed. I believe there is some potential federal interest and you are evaluating that now? My understanding the environmental document is complete and the project authority is working with NGOs and other interests to address comments? Did I hear correctly that 40% of flows may be for environmental benefit? Also did you obtain a WIFIA loan and secured additional Prop 1 funding? What would you say are the next steps?

If busy is there a source I can mine this info? I'm briefing our electeds tomorrow and want to give them the current status.

Thank so much.

trevor

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Monday, January 24, 2022 9:11 AM
To: Joseph, Trevor <TJoseph@roseville.ca.us>; Brett Ewart <BEwart@cityofsacramento.org>; Darin Reintjes <dreintjes@pcwa.net>; Benjamin Barker (bbarker@pcwa.net) <bbarker@pcwa.net>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Grinstead. Michael <GrinsteadM@saccounty.net>
Cc: Spranza, John <john.spranza@hdrinc.com>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

American River Team – Attached is the more detailed water right map for the American River area. There are 2 sheets in here as the American River watershed falls on the edge of the map. We would appreciate your feedback on:

1. Can we physically get water from the Sacramento River further into the American River watershed? We want to define a realistic place of use boundary, but we also don't want to overly restrict ourselves for the future.
2. Any points of rediversion we should add? I have a note from our call to add Woodland-Davis. But anything else? Recall we can not adding RiverArc at this time (but will add later and likely adjust the place of use boundary once RiverArc has a water right).

If a KMZ file would be more useful, please let me know and I can send that over.

Would be happy to chat about this on a call if that would be helpful to the group. Any feedback you have is much appreciated.

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-----Original Appointment-----
From: Joseph, Trevor <TJoseph@roseville.ca.us>
Sent: Monday, January 3, 2022 3:39 PM
To: Joseph, Trevor; Brett Ewart; Alicia Forsythe; Darin Reintjes; Benjamin Barker (bbarker@pcwa.net); Heydinger, Erin; Grinstead. Michael
Subject: American River Watershed and SITES - coordination meeting (save the date)
When: Tuesday, January 18, 2022 3:30 PM-4:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Microsoft Teams meeting

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From: Joseph, Trevor [TJoseph@roseville.ca.us]
Sent: 5/9/2022 12:44:48 PM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

Thank you

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Monday, May 9, 2022 12:37 PM
To: Joseph, Trevor <TJoseph@roseville.ca.us>; Heydinger, Erin <erin.heydinger@hdrinc.com>
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

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Cc: Spranza, John <john.spranza@hdrinc.com>; Angela Bezzone <bezzone@mbkengineers.com>
Subject: RE: American River Watershed and SITES - coordination meeting (save the date)

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Ali

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-----Original Appointment-----
From: Joseph, Trevor <TJoseph@roseville.ca.us>

Sent: Monday, January 3, 2022 3:39 PM
To: Joseph, Trevor; Brett Ewart; Alicia Forsythe; Darin Reintjes; Benjamin Barker (bbarker@pcwa.net); Heydinger, Erin; Grinstead. Michael
Subject: American River Watershed and SITES - coordination meeting (save the date)
When: Tuesday, January 18, 2022 3:30 PM-4:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Microsoft Teams meeting

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Click here to join the meeting

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From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 5/10/2022 9:41:51 AM
To: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]
CC: Moderan, Julien [Julien.Moderan@icf.com]; Hendrick, Mike [Mike.Hendrick@icf.com]
Subject: BA operations questions for Reclamation

Hi Ali and Erin,
We are putting together a list of questions to send over to Reclamation on the operations section 7 analysis in the BA. The team has come up the questions below and I wanted to run them by you two prior to sending them to make sure we didn't miss any or have any questions that maybe should be rephrased or not asked at this time.

- Specifics on how Reclamation would like the 53.5F analysis to be developed/organized. More specifically, for the EIR/S, USBR (Elissa Buttermore) requested that we analyze the frequency of exceeding 53.5F in Tier 1 and Tier 2 years between May 15 and Oct 31 in the Sac River below Clear Creek. Is USBR requesting similar analysis for the BA?
- Related to the EIR/EIS, we received a comment asking why we didn't analyze Tier 3 and 4 years. Will USBR want these years as part of the BA?
- What about maintenance, would that be covered?
- Are there components of the reconsultation that would need to be incorporated into this BA?
    - If so, which and why?
- Would Reclamation be open to an ESA conference on longfin smelt with NMFS?
- Are there any emerging concerns that we should consider in the BA operational analysis?
- Would Reclamation support Sites identifying a fisheries benefit by pushing flows into the Yolo in late summer/early fall?
- Would Reclamation like to provide an outline of the BA Aquatics section or review one we can provide?

Thanks,
John

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916.679.8858 M 818.640.2487
john.spranza@hdrinc.com

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Meeting: **Reservoir Committee Agenda Item 2.1** **May 20, 2022**

Subject: **Approve amendment to the Real Estate and Land Management Policy.**

Requested Action:

Approve an amendment to the Sites Project Authority Real Estate and Land Management Policy.

Detailed Description/Background:

The Sites Project Authority Real Estate & Land Management Policy was adopted by the Reservior Committee and Authority Board in May 2019. It provides the general policies for the Authority's Real Estate and Land Management program and includes provisions related to appraisal, acquisition, and land management activities.

The policy includes authorization to procure option agreements to acquire real property. Option agreements are an important tool for the Authority's overall acquisition program by providing the ability to secure the option to purchase parcels vital to the construction of the project ahead of the acquisition phase of the project.

At its April 27, 2022 meeting, the Land Management Committee recommend that the Reservior Committee and Authority Board adopt revised language to Section 3e of the policy as it relates to the "Authority to Acquire Options"as follows;

Existing Language

"The Executive Director is authorized to procure options for the purchase of any real property which the Authority determines to be required for project purposes at a price not more than the lesser of $25,000 or 5% of the appraised market value determined by a qualified appraiser.

Proposed Language

"The Executive Director is authorized to procure options for the purchase of any real property which the Authority determines to be required for project purposes. The terms and conditions of options procurements shall be established by the Authority Board of Directors."

The proposed change would create additional flexibility in establishing the price and terms of option agreements by allowing staff to negotiate agreements based on parameters established by the Authority Board/Reservior Committee.

Prior Action:

May 22, 2019 – Real Estate & Land Management Policy adoped by the Authority Board of Directors

Fiscal Impact/Funding Source:

None.

Staff Contact:

Kevin Spesert

Primary Service Provider:

None.

Attachments:

Revised Draft Real Estate & Land Management Policy.

Preliminary Evaluation of the Planning Aid Memorandum Technical Memorandum

To:	Alicia Forsythe, Sites Project Authority
CC:	John Spranza, Sites Integration Laurie Warner-Herson, Sites Integration
Date:	May 10, 2022
From:	ICF
Quality Review:	Mike Hendrick (ICF)
Authority Agent Review:	N/A
Subject:	Preliminary Evaluation of the Planning Aid Memorandum

1.0 Purpose

This memorandum presents a preliminary evaluation of the August 5, 2021, Planning Aid Memorandum (PAM) provided by the U.S. Fish and Wildlife Service (USFWS) to the ~~U.S.~~ Bureau of Reclamation (Reclamation) for the Sites Reservoir Project (Project). The purpose of the PAM was to provide Reclamation with the USFWS's comments and recommendations regarding the Project's potential effects on biological resources for consideration in project planning and preparation of a public revised draft environmental document. The PAM was prepared under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*). The Fish and Wildlife Coordination Act requires federal agencies proposing water resource development projects or involved in issuance of related permits or licenses to consult with the USFWS and provide equal consideration to the conservation, rehabilitation, and enhancement of fish and wildlife resources with other project purposes.

The PAM summarized early coordination between USFWS and Reclamation regarding potential ~~Project~~ effects of the proposed ~~Sites Reservoir~~ Project (Project). It provided a high-level description of the Project and USFWS's views of potential effects of the inundation of upland habitat (i.e., upland effects), increased diversions of Sacramento River water (i.e., in-river effects), and cumulative impacts associated with implementation of other projects. The PAM also summarized information and early analysis of effects provided to the USFWS by Reclamation and identified areas and concerns where the USFWS indicated that more information or analysis was needed.

The key concerns identified in the PAM are categorized as upland effects (Section 2.0), in-river effects (Section 3.0), and cumulative impacts (Section 4.0). Responses summarizing how each key concern was addressed are provided herein.~~; t~~The Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS) released in November 2021 contained much of the information to address these key concerns (Sites Project Authority and ~~U.S.~~ Bureau of Reclamation 2021). Subsequent analysis that ~~was~~ has been developed to date in preparation of responses to public comments on the RDEIR/SDEIS and for the development of related permitting processes was also used to address the key concerns.

It is important to note that the analysis of the comments on the RDEIR/SDEIS, the response to those comments, and the preparation of the Final EIR/EIS are ongoing. The Authority has recently changed the Project's diversion criteria and has worked with Reclamation since the issuance of the RDEIR/SDEIS to enhance the Project's anadromous species benefits, especially as reflected in the modeling framework. In addition, the Authority has moved from Alternative 1 as its Preferred Project for the purposes of the California Environmental Quality Act compliance to Alternative 3. Revised modeling is underway to reflect these adjustments and once modeling is completed, the Authority and Reclamation look forward to discussing the results and revisions to subsequent species analysis with the USFWS, National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife (CDFW). Therefore, the information and responses in this memorandum may change as these enhanced species protections and species benefits are incorporated into the Project.

2.0 Upland Effects

Key Concern: Provide greater specificity regarding potential mitigation lands or banks for each of the habitat types for which mitigation is proposed.

Response: Given the size of ~~Sites Reservoir~~the Project, the Sites Project Authority (Authority) will ~~have to~~ rely on several mitigation strategies including a mix of mitigation banks and other mitigation mechanisms. The Project's Mitigation and Monitoring Plan (Plan) ~~that~~ is under development and will be provided to the USFWS as part of ~~prior to the coordination Report and will accompany~~ the Project's Biological Assessment (anticipated summer 2022) and Final EIR/EIS (anticipated early 2023) ~~and the permitting documents~~ provides. The Plan includes ~~is~~ a comprehensive mitigation planning strategy, and implementation approach and general criteria for species and habitats based on anticipated ~~and permitted~~ Project impacts on regulated biological resources. As access is currently limited to less than 1% of the Project ~~area~~Area, a final analysis of impacts will be conducted once land access is obtained and following the final refinements of Project design and completion of on-the-ground, ~~and~~ protocol-level biological field surveys.

Commented [SJ1]: Reclamation Comment: Note that the mitigation plan will need to discuss more than conceptual, some specifications and general criteria

Commented [SJ2R1]: The plan is in the process of being revised and will incorporate this comment

Commented [DMD3]: Something is missing

Commented [SJ4]: Reclamation Comment: Add assurance for MP to be shared with service prior to coordination act report

Commented [SJ5R4]: Added text to address

Following completion of Project construction, temporary impacts will be mitigated through restoration and revegetation of areas disturbed by construction in accordance with an approved habitat restoration plan. Permanent impacts will be mitigated on site and at agency-approved (USFWS, ~~National Marine Fisheries Service (~~NMFS~~)~~, and/or ~~California Department of Fish and Wildlife (~~CDFW~~)~~) offsite locations. Onsite compensatory mitigation may include restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or preservation of aquatic or terrestrial biological resources that occur within the proposed Project area. Offsite compensatory mitigation for the proposed Project may include the purchase of agency-approved mitigation/conservation bank credits, the establishment of third party-responsible "turn-key" mitigation/conservation bank projects, preservation of biological resources through conservation easements with private landowners, payments to in-lieu fee programs, or the establishment of permittee-responsible offsite mitigation sites. The methods for assessing resources in the project footprint, best management practices to be applied, tools available for mitigating effects of the P~~p~~roject are discusses in chapters 9 – *Vegetation and Wetland Resources*, and 10 – *Wildlife Resources* of the RDEIR/SDEIS.

The Authority has conferred with USFWS about species habitat models and used this information to estimate mitigation obligations. The Authority expects to continue to work with USFWS and Reclamation as the Project moves forward and better information becomes available to define mitigation requirements.

Key Concern: Provide a better description of how increases in Incremental Level 4 refuge water will be provided and the expected benefit to migratory birds.

Commented [SJ6]: Reclamation Comment: Review the comment for coordination with the service

Commented [SJ7R6]: Added coordination text to first paragraph of response to address

Response: ~~Security/expansion of~~Providing Incremental Level 4 refuge water ~~supply~~ is an environmental benefit of the Project recognized by the California Water Commission in its authorization of State funding from the Water Storage Investment Program (WSIP). The Authority envisions that CDFW will take an active role in managing the ecosystem water and the Authority would work with CDFW to schedule and adjust releases of ecosystem water to address real-time conditions and needs. The Authority also recognizes that Incremental Level 4 refuge water ~~may~~ would be made available to federal refuges north and south of the Sacramento–San Joaquin Delta (Delta) and as such, expects that it would provide Incremental Level 4 water to appropriate destinations based on guidance from, and coordination with the CDFW, USFWS, and Reclamation. The Authority understands that Reclamation and CDFW have an existing methodology to allocate Incremental Level 4 refuge water to the National Wildlife Refuges, State Wildlife Areas, and privately managed wetlands included in Central Valley Project Improvement Act Refuge Water Supply Program. The Authority anticipates that CDFW and Reclamation would allocate~~d~~ the Incremental Level 4 refuge water that results from the Project in the same way they allocate all Incremental Level 4 refuge water.

Commented [DMD8]: this is one of our NEPA purposes, shouldn't this be: "... that L4 refuge water would be made available ..." or is there some other distinction we're making here?

Commented [EB9R8]: Revised as suggested

Table 1 below is from the Authority's *Water Storage Investment Program: Sites Reservoir Project Continuing Eligibility and Feasibility Determination* report (~~California Water Commission~~Authority 2021). It identifies the Project's Incremental Level 4 ~~r~~Refuge water supply benefits in terms of water supply increases to National Wildlife Refuges, State Wildlife Areas, and privately managed wetlands projected in 2030 and 2070 as estimated based on WSIP Unit Water Values. Incremental Level 4 represents the additional increment of water required for optimal wetland habitat development on the National Wildlife Refuges, State Wildlife Areas, and privately managed wetlands included in Central Valley Project Improvement Act Refuge Water Supply Program. The benefits to migratory birds of Incremental Level 4 refuge water supply were identified as part of the original foundational documents of the Central Valley Project Improvement Act and differ for each individual National Wildlife Refuge, State Wildlife Area, and privately managed wetland.

~~The Authority expects to work closely with the state and federal refuge managers to ensure this water is used effectively, including for migratory waterfowl use in winter and, as appropriate, its inclusion in the Central Valley Project Improvement Act Refuge Water Supply Program.~~

Table 1. **Sites Reservoir Project Incremental Level 4 Refuge Water Supply Increases (2030 and 2070) (TAF/year)**

Period	North-of-the-Delta	South-of-the-Delta [(b)]	Total
2030 Results			
Long-Term Average [(a)]	5	11	17
Wet	0	0	0
Above Normal	9	5	14
Below Normal	9	13	22
Dry	8	27	34
Critical	6	17	23
2070 Results			
Long-Term Average [(a)]	5	10	15
Wet	0	0	0
Above Normal	9	1	10
Below Normal	7	8	16
Dry	7	10	17
Critical	6	21	27

Source: CALSIM II.
Notes:
(a) Average weighted based on water-year frequency rates
(b) Includes both San Joaquin and Tulare Lake Refuge deliveries and based on San Joaquin Valley 60-20-20 Index Year Class.
TAF = thousand acre-feet

Key Concern: More thorough analysis is needed of geomorphic effects of flow reduction in the higher flow range on habitat (cut bank formation, cottonwood seed dispersion/regeneration processes, wood transport) and the sensitive species that use it (e.g., bank swallows, yellow-billed cuckoo).

Commented [SJ10]: Reclamation Comment: May have ROC implications and need to crosscheck this topic

Commented [EB11R10]: Noted

Response: The SRH-Meander model results presented in the RDEIR/SDEIS (Chapter 7 – *Fluvial Geomorphology*~~, Sites Project Authority and U.S. Bureau of Reclamation 2021~~) suggested that the tendency for meander is not significant among the Project alternatives and the No Action Alternative (NAA). The river meandering, bank erosion, and deposition modeling concluded that there were no significant differences in the channel alignments between existing conditions and the modeled alternatives. Thus, operational impacts on the geomorphic regime (including natural river geomorphic processes such as sediment transport and bank erosion) and existing river geomorphic characteristics (e.g., sinuosity, channel gradient, substrate composition, channel width and depth, and riparian vegetation) of the greater Sacramento River system are expected to be minimal, and consequently, impacts on sensitive species would be negligible or minimal as well. The Authority will review these results with USFWS and Reclamation to determine whether additional analysis is warranted, or additional considerations will be added to the monitoring and adaptive management plans or the Project description.

Key Concern: Additional review may be needed of the resource protection measures identified for habitats (e.g., riparian, upland, stream, and wetland) that could support special-status species including the listed valley elderberry longhorn beetle, red-legged frog, and several rare plants, which are potentially present within the impact area.

Commented [DMD12]: I think this comment is about the minimization and avoidance measures for certain spp/habitats. There may be buffers or other conservation measures in there that are not consistent with what the Service typically requires. We could ask them about this. It would be easier for implementation if our NEPA/CEQA commitments are consistent w/ what the BO will require.

Commented [EB13R12]: Added language to address

Response: As stated above, verification of species' presence and habitat suitability has been limited by lack of access to lands that would be affected by the Project. Potential wildlife resources in the study area were evaluated by reviewing existing information and identifying potentially suitable habitat with geographic information system modeling. Sources of information and modeling techniques are summarized in Chapter 10, *Wildlife Resources*, of the RDEIR/SDEIS~~ (Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. ~~During the development of Project environmental documents and prior to the Record of Decision, t~~The Authority will continue to work with Reclamation, USFWS, NMFS, CDFW, ~~Reclamation,~~ and other regulatory agencies to review these results and discuss ~~verify whether~~ the resource protection measures, including avoidance and minimization measures~~, identified address their concerns~~. These efforts have been ongoing for some time for aquatic species with more limited discussion on terrestrial species. The Authority with Reclamation would like to engage in more detailed discussion of these concerns with regard to terrestrial species.

3.0 In-River Effects

Key Concern: Provide a better demonstration of temperature benefit expected from opportunities to increase storage in Shasta R~~r~~eservoir.

Response: In coordination with Reclamation, text was developed to expand the discussion of fisheries benefits related to increased operational flexibility associated with Shasta R~~r~~eservoir. This text was developed after issuance of the PAM and was included in Chapter 2, *Project Description and Alternatives*, of the RDEIR/SDEIS. Additional water supply from Sites Reservoir would provide opportunities for improved management of salmonid habitat, particularly in the Sacramento River above Red Bluff Diversion Dam. By exchanging Sites Reservoir water for Central Valley Project (CVP) water, Reclamation has an additional tool to maintain and improve habitat for salmonid spawning, incubation, rearing, and migration. By delivering water to CVP contractors from Sites Reservoir, Reclamation may maintain supply in Shasta R~~r~~eservoir. Maintenance of supply can then be allocated in real-time management scenarios to uses that protect and enhance anadromous fish benefits, including protecting and enhancing the cold-water pool, which is essential for temperature control in the salmonid spawning reaches below Keswick Dam during Dry and Critically Dry Water Years. Increased storage may provide benefits beyond temperature such as ~~Maintenance of supply in Shasta reservoir may also provide~~ providing a resource for maintaining fall flows to sustain spawning redds that persist in the wetted margins of the Sacramento River. In years when storm events are weak and naturally-occurring pulse flows are minimal, this maintenance of supply could be used to manufacture a spring pulse flow to assist juvenile salmonids in completing their migration from the upper Sacramento River to the Delta and ultimately the Pacific Ocean. ~~Sites~~ The Authority ~~and its contractor will are~~is working with ~~USBR~~ Reclamation to ~~re-analyze various levels of USBR participation in the project to~~ assess and enhance fisheries benefits associated with ~~those levels of~~Reclamation's participation for the multiple objectives related to increased Shasta Reservoir storage.

The Project would also provide an additional capability to address expected changes in precipitation and runoff patterns anticipated to result from climate change (see ~~chapter~~ Chapter 28 of the RDEIR/SDEIS). While long-term averages in precipitation are not expected to change, more precipitation is expected to fall as rain, resulting in a decreased snowpack and changes in runoff patterns. These changes will likely present challenges for future water management, including that for environmental benefits. The ability of the Project to capture and store water that cannot be captured and stored by Reclamation and to exchange water with Shasta R~~r~~eservoir creates flexibility to provide environmental benefits to anadromous fish in the upper Sacramento River under climate change scenarios.

Key Concern: In general, whenever water diversions occur, there will be an associated loss of food organisms and sediment, incidental mortality of fish at the intake screen(s), and lower survival due to

Commented [DMD14]: This response includes exchanges, if we remove exchanges from the EIR/S's PD or S7 consult, then we may need to revisit/update this response.

Commented [MJ15R14]: Understood and noted. It will be edited as needed.

Commented [DMD16]: Same

Commented [MSC17R16]: How does this relate to the key concern of temperature? Or to other benefits of increased storage?

Is there an analysis of frequency of these exchanges and improved storage by WY type?
What results are expected to demonstrate this flexibility?
Is this related to all 3 objectives or just temperature benefits?
What seasons would these exchanges need to occur within to provide benefits?

Commented [MJ18R16]: Allocating Sites Reservoir water to CVP would allow for maintenance of cold-water supply in Shasta reservoir to be released, providing temperature benefits to salmonids.
Analysis of frequency of exchanges is pending.
Potential benefits of exchanges could be obtained in any season (eg. generating pulse flows when not naturally occurring) with maximum temperature benefits expected in Fall of critically dry years.

Commented [SJ19R16]: I have asked operations for this information and have been told that Reclamation has this information from Jacobs trend reporting spreadsheet which includes information on exchanges lower flows and related mechanisms (predation exposure, less inundated edge cover, less food production, less suspended sediment). Specific concerns expressed are as follows:

A. Flow criteria at Wilkins Slough (8,000 cfs [cubic feet per second] in April and May; 5,000 cfs in other months) is likely inadequate to protect downstream migrating salmon. Suggest consideration of Michel et al. (2021).

B. Need more thorough analysis of effects of habitat reduction on survival~~,~~. ~~weighted~~ Weighted usable area (WUA) curves do not disclose all effects associated with reduced flow.

C. Need m~~M~~ore complete analysis of effects of flow reductions on sturgeon migration.

Response:

A. Wilkins Slough: In response to the concerns expressed in the PAM and the comments on the RDEIR/SDEIS from CDFW and others, ~~During discussions with the State of California and others,~~ the Authority ~~has agreed to analyze~~ increased~~ing~~ the minimum bypass ~~base~~ flow requirement at Wilkins Slough during October to June ~~to May~~ to 10,700 cfs (303 m^3/s), which is consistent with the step function identified to in Michel et al. (2021) for increased Chinook salmon survival in the Sacramento River. In summary, Michel et al. (2021) looked at the challenge of implementing functional flows to optimize ecosystem improvements given the limited resources. The minimum bypass flow at Wilkins Slough during September remains at 5,000 cfs. The Project will not be diverting water from June 15 to the end of August. Revisions have been made to the Project diversion criteria. These revisions are reflected in Table 2.

Table 2. Comparison of RDEIR/SDEIS and Revised Diversion Criteria

Location (Listed from North to South)	**RDEIR/SDEIS with Mitigation Included**	**Revised and Expected in the Final EIR/EIS with Mitigation Included**
Bend Bridge Pulse Protection	Protection of all qualified precipitation-generated pulse events (i.e., peaks in river flow rather than scheduled operational events) from October to May based on the detection of fish presence and migration during the beginning of the flow event. For each event where fish presence and migration is detected, diversions from the Sacramento River would cease for 7 days.	Similar except the following: (1) a qualified precipitation-generated pulse event is determined based on forecasted flows and (2) pulse protection may cease earlier than 7 days if flows at Bend Bridge exceed 29,000 cfs and Project diversions subtracted from Bend Bridge flows continue to be at least 25,000 cfs
Minimum Bypass Flows in the Sacramento River at the RBPP	3,250 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design	No change
Minimum Bypass Flows in the Sacramento River at the Hamilton City Pump Station	4,000 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design	No change
Minimum Bypass Flows in the Sacramento River at Wilkins Slough	10,700 cfs in March through May; 5,000 cfs all other times	10,700 cfs October through June; 5,000 cfs September (not diverting from June 15 to end of August)
Fremont Weir Notch Protections	No more than 1% reduction in flow over weir when spill over the weir are less than 600 cfs. No more than a 10% reduction ~~when~~in flow over weir when spills over the weir are between 600 cfs and 6,000 cfs. No restriction when flows over the weir are greater than 6,000 cfs	No longer included. Revised minimum bypass flows in the Sacramento River at Wilkins Slough and Bend Bridge Pulse Protection provide protections for Fremont Weir Notch
Freeport, Net Delta Outflow Index, X2, and Delta Water Quality	Operations consistent with all applicable laws, regulations, biological opinions and incidental take permits, and court orders in place at the time that diversion occurs	No change

Note: This table mimics Table 2-5 in the RDEIR/SDEIS.

~~Operations of the Project will include this revised Wilkins Slough standard and the pulse flow requirements. The following criteria have been drafted to define a qualified pulse flow event:~~

1. ~~Outmigration pulse of anadromous fish is detected based on the Project's fish monitoring program.~~

2. ~~If the 3-day forecasted average of Sacramento River flow at Bend Bridge is projected to exceed 8,000 cfs and the 3-day forecasted average tributary flow upstream of Bend Bridge (Cow Creek, Cottonwood Creek, and Battle Creek) is projected to exceed 2,500 cfs, a pulse event is initiated and diversion restrictions would begin when flows in the Sacramento River at Bend Bridge exceed 8,000~~

~~cfs and flows in the tributaries upstream of Bend Bridge cumulatively exceed 2,500 cfs and the previous day was not already in a pulse event. If no forecast data are available for Sacramento River flow at Bend Bridge, a pulse event is initiated, and diversion restrictions would begin when the 3-day trailing average of Sacramento River flow at Bend Bridge exceeds 8,000 cfs and the 3-day trailing average of tributary flow upstream of Bend Bridge (Cow Creek, Cottonwood Creek, and Battle Creek) exceeds 2,500 cfs and the previous day was not already in a pulse event.~~

3. ~~A pulse event terminates 7 days after initiation or earlier if any of the following conditions occur: (1) the outmigration pulse of anadromous fish is no longer detected by the fish monitoring program; or (2) Sacramento River flow at Bend Bridge exceeds 25,000 cfs. If the Sacramento River flow at Bend Bridge exceeds 25,000 cfs during the 7-day pulse event, Project diversions may resume such that average daily diversions subtracted from Sacramento River flow at Bend Bridge continues to be at least 25,000 cfs.~~

4. ~~After completion of a pulse event, the following conditions must occur before another pulse event is triggered: (1) 3-day trailing average of Sacramento River flow at Bend Bridge was less than 7,500 cfs for 7 consecutive days; and (2) 3-day trailing average of tributary flow upstream of Bend Bridge (Cow Creek, Cottonwood Creek, and Battle Creek) was less than 2,500 cfs for 7 consecutive days. Diversions are otherwise unrestricted by the Bend Bridge pulse flow protection criteria.~~

The Authority ~~consulting team will be~~is working with Reclamation to revise the modeling and determination of ~~the~~ effects of the Project's revised ~~of this new~~ operations criteria ~~scenario~~ on fisheries resources ~~affected by the Project~~. The Authority is also in ~~and its consulting team are in~~ ongoing conversations with Reclamation, CDFW, NMFS, and USFWS to develop language to describe how these operational requirements will be implemented and develop the associated fish monitoring program ~~necessary~~. ~~For example, pulse flow criteria could be based on a 3-day trailing average as proposed in the RDEIR/SDEIS (Sites Project Authority and U.S. Bureau of Reclamation 2021) or based on a forecast from the California Nevada River Forecast Center. The operating language also needs to take into account the distance between the two diversion locations and Wilkins Slough and the travel time of flows~~.

Commented [MSC20]: Move to above? I find this language to somewhat address the few comments I made prior putting on my "non-BOR hat"

Commented [MJ21R20]: This statement about ongoing collaboration between the Authority/ICF and Reclamation, CDFW, NMFS and USFWS specifically relates to Pulse Flow Protection. Based on context, we think it is best kept here. Some level of ongoing and future coordination between the Authority and Reclamation is also already mentioned earlier in the exchanges benefits section ("Sites Authority and its contractor are working with Reclamation to assess and enhance fisheries benefits associated with Reclamation's participation for the multiple objectives related to increased Shasta Reservoir storage").

A. Upstream habitat: The Authority agrees diverting flow can have effects on habitat volume and available food that are likely more limiting, and not apparent in WUA calculations. The WUA is derived from the CALSIM runs and as such the WUA's are based on monthly averages that may not accurately reflect real time operations. The analysis in Chapter 11, *Aquatic Biological Resources*, of the RDEIR/SDEIS considers factors such as temperature, flow, and the effects of flow reductions on side channel and floodplain habitats to support its impact determination of less than significant with mitigation for salmonids ~~(Sites Project Authority and U.S. Bureau of Reclamation~~ ~~2021)~~.

   The Authority and its consulting team will be revising the CALSIM analysis with the revised diversion criteria and enhanced anadromous fish benefits ~~updated modeling inputs associated with RDEIR/SDEIS Alternative 3 and updated flow criteria~~ to reassess the effects on WUA in the

Final EIR/EIS. During ~~the spring and summer of~~ 2022, the Authority will work with Reclamation, USFWS, NMFS, and CDFW~~, and NMFS~~ to review the revised ~~CALSIM~~ modeling and related analyses to assess the adequacy of the analysis and work toward consensus on impact determinations and any measures needed to reduce impacts to less than significant levels (CEQA) and no adverse effects (NEPA).

~~A.~~B. Sturgeon: Shaffter (1997) reported spawning on white sturgeon in the Sacramento River at flows ~~on~~ of about 6,500 to 6,640 cfs (184 to 188 m³/s) after observing pulse of about 1,400 cfs (40 m³/s) over base flow conditions. This reference appears to be the source for the concern. The ~~Sites~~ Authority's decision to adopt a higher minimum bypass flow at Wilkins Slough ~~flow discussed above~~ and the ~~proposed~~ Project's pulse flow protection measure ~~incorporated in the proposed action will~~would ensure ~~Sites~~ the Project diversion do not cause flows to decline below those likely to influence sturgeon migration and spawning.

Key Concern: The relationship between pulses and fish movement is not a precise relationship. Longer and more frequent flows may be necessary to protect downstream-migrating juvenile salmon.

Response: ~~The pulse flow criteria described in the RDEIR/SDEIS (Sites Project Authority and U.S. Bureau of Reclamation 2021) were developed to facilitate modeling the effect of pulse flow protection on diversions to the Sites Reservoir.~~ The Project's ~~purpose of the~~ pulse protection measure is intended to ~~a~~ account for the importance of pulses in stimulating and providing for the redistribution of juvenile fish from~~or~~ their spawning grounds to downstream rearing areas and seaward migration (Poytress 2014, Steel 2020, Michel 2021, Hassrick 2022). The Authority recognizes that the precise relationship between flow pulses and fish movement is not known at this time. As such, the Authority intends to ~~How pulses are identified in real-time operations is a current topic of discussion between the Authority and the regulatory agencies. The Authority will continue this discussion as it develops the Final EIR/EIS and ROD. The Authority will continue to work with Reclamation, USFWS, CDFW, and NMFS to develop a suitable set of pulse flow protection criteria for the initial period of Project operations. And the Authority intends to~~ incorporate the pulse protection criteria, and strategies for evaluating the effectiveness of the criteria, into its adaptive management plan to address this~~e~~ uncertainty and continue to refine ~~to~~ the criteria ~~to ensure they provide the intended protections~~as the science and understanding of fish movement is better understood.

Key Concern: Need to address pulses as a mechanism to initiate/attract adult salmon and sturgeon up stream.

Response: ~~The proposed pulse flow criteria will ensure pulses are protected and propagate downstream to the Delta. The maximum rate of diversion for the Project is 3,900 cfs and many pulse flow criteria far exceed that level.~~ As presented in the RDEIR/SDEIS, the Project is not expected to impede the upstream migration of adult salmon or sturgeon ~~(Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. The proposed pulse flow criteria ensure pulses are protected and propagate downstream. In addition, the revised minimum bypass flow requirement at Wilkins Slough ~~Wilkins Slough flow requirement will~~ ensures that Project operations do not diminish flows below levels which may interrupt or delay the upstream migration of sturgeon. ~~The Authority~~

~~will review these results and those for~~ for, ~~new model runs that reflect revised operations criteria and Reclamation's increased Project involvement with the regulatory agencies and Reclamation to ensure concurrence with these findings.~~

Commented [DMD22]: Please also add the NEPA effects terms

Commented [MJ23]: Poytress 2014 missing from reference list, please check if the one I added (pulled from EIR/EIS Chap 11) is right.

Commented [MSC24]: These 3 citations are not mechanistic models – more correlations based on modeling.

Steel et al. 2020 provides a mechanistic model of survival on the Sac River -- >

Steel et al. 2020
Applying the mean free-path length model to juvenile Chinook salmon migrating in the Sacramento River, California
Environmental Biology of Fishes
103: 1603-1617

Commented [MJ25R24]: @Hassrick, JasonPlease review comment and respond accordingly. I can only access the abstract, not full paper. Conclusion seems to be: same survival rate but longer travel time between low and high flow conditions. No problem adding reference once full paper reviewed to check relevance.

Commented [MJ26R24]: Reviewed suggested article and added reference.

Commented [MJ27R24]: MG: We note Steel et al. 2020 is applicable to the Sacramento River from Knights Landing and the Delta; its greatest value, perhaps, is in providing a potential mechanistic explanation for the flow-survival thresholds found by Michel et al. (2021), which will then provide additional context to explain patterns noted by commenters.

Commented [MJ28]: @John to check with Ali

Commented [IJA29]: Upstream passage is not reliant on diversion rate, it is reliant of some quantity of flow. Perhaps provide that flow that is observed in the modeling rather than describe rate of diversion here. See next comment.

Say something like "The minimum flows passing the Project is required to be X in months when salon and sturgeon are initiating and attracted upstream."

...

Commented [MJ30R29]: From Appendix 11N: "The specific flow level at which passage difficulties for migrating adults first appear is not known for the Sacramento, Feather, or American Rivers. Therefore, threshold flows were selected based on the ...

Commented [MJ31R29]: Sophie Unger: Upstream migration of one or another salmon run or steelhead occurs in every month. We know of no clear evidence that pulse flows in mainstem rivers attract adult salmon or stimulate their migrations. Studies ...

Commented [IJA32]: May want to mention the detection of sturgeon and salmon in the river in 2014-2015 and 2021 drought conditions when initiation/attraction occurred on Sacramento River when flows were 4000-5000 through May. What are the CALSIM ...

Commented [MJ33R32]: Addressed in Appendix 11N, see above. Reference for presence of Sturgeons and Salmons in drought condition at flows ~4-5000cfs?

Commented [MJ34R32]: Sophie Unger: We can add this observation to the sentences proposed in the previous comment response, but we need a reference for the observation

Key Concern: Provide a better explanation of effects and benefits of fall pulse flows into Yolo Bypass for plankton production and discussion of consequences of reduced flow into the bypass due to reduction in flows attributable to diversions at TCCA and GCID diversions.

Commented [AF35]: We never address this part in our response.

Commented [MJ36R35]: Echoes some individual public comments. Sophie Unger is drafting some language to address this. Should be ready sometime today (May 10).

Commented [MJ37R35]: Second part now addressed thanks to Sophie's addition.

Response: An analysis of the expected timing and benefit of the Yolo Bypass flow measure to stimulate food production and convey forage species to the north Delta for the benefit of delta smelt (*Hypomesus transpacificus*) and other planktivorous fish is presented in Chapter 11 - *Aquatic Biological Resources*, of the RDEIR/SDEIS ~~(Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. The ~~Authority notes the~~ benefit of this measure has been acknowledged by CDFW in the review of the Project during the California Water Commission's WSIP approval process. ~~Nevertheless, the Authority expects to continue discussions with Reclamation, USFWS, and the regulatory agencies to refine criteria for implementing a food production release, and strategies for evaluating the effectiveness of the releases, which could be incorporated into the adaptive management plan.~~ An analysis of the consequences of reduced flow into the Yolo Bypass due to reduction in flows attributable to diversions at TCCA and GCID diversions is provided in the section, *Impact FISH-2: Operations Effects on Winter-Run Chinook Salmon, Floodplain Inundation and Access*, in Chapter 11 - *Aquatic Biological Resources*, of the RDEIR/SDEIS, as well as in Appendix 11M. The analysis concludes that Sites diversions result in minor reductions in Yolo Bypass acreages inundated during the winter and spring, but that when the net effect of all differences between the NAA and Alternatives 1, 2, and 3 are examined, the differences are small and the effect on fish populations is expected to be minor.

Key Concern: Address expected increase in loss of fish at South Delta export facilities associated with July ~~–~~through September increases in Delta exports.

Response: The effect of moving Sites Reservoir water across the Delta to the Delta export facilities on the location of X2, flows in Old and Middle River, and expected loss at the export facilities are addressed in Chapter 11 - *Aquatic Biological Resources*, and Appendix 5B3, *Delta Operations*, of the RDEIR/SDEIS ~~(Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. The results of these analyses suggest there would be little difference in south Delta ~~entrainment risk~~loss between the NAA and Alternatives 1, 2, and 3, primarily due to absence of juvenile ESA-listed fish in the Delta between July and September.

~~As indicated above, the Authority is revising its CALSIM analysis and subsequent modeling efforts to reflect a larger Reclamation involvement in the Project and the modified minimum bypass flow requirement at Wilkins Slough flow requirement of 10,700 cfs from October through June. The Authority's expectation is that these results should demonstrate improvements in fish survival relative to the existing analyses. The Authority will make these results available to Reclamation and the regulatory agencies to ensure the interpretation of the results and findings of effects are vetted by the agencies.~~

Commented [MSC38]: Suggest deleting this paragraph, the key concern was July – September and this refers to October – June.

Commented [MJ39R38]: Deleted

Formatted: Highlight

Key Concern: More thorough analysis may be needed of the effects of exchanges on spawning and rearing habitat in the American and Feather Rivers.

Response: The effects of Project operations on temperatures in the American and Feather Rivers are discussed in Chapter 11, *Aquatic Biological Resources*; Appendix 11B, *Upstream Fisheries Impact Assessment Quantitative Methods*; and Appendix 11D, *Fisheries Water Temperature Assessment*, of the RDEIR/SDEIS ~~(Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. The results indicate impacts from changes in temperatures are less than significant. The effects of Project operations on availability of spawning and rearing habitat in the American and Feather Rivers are also analyzed in Chapter 11 and Appendix 11K, *Weighted Usable Area Analysis*, of the RDEIR/SDEIS. The analysis suggests no significant differences between Alternatives 1, 2, and 3 and the NAA with respect to WUA. An analysis of the potential redd dewatering in the American and Feather Rivers was also conducted and discussed in Chapter 11. The results of that analysis suggested no significant differences among the alternatives~~.~~ ~~Data were not available to support a redd dewatering analysis on the Feather River; however, the Project operations are expected to have minimal to no effect on the low-flow channel.~~ and the NAA.

Commented [MSC40]: If data are not available to support analyses then is it appropriate to claim ops would be expected to be minimal to no effect?

Commented [IJA41R40]: But see 2 sentences earlier that says potential redd dewatering analysis was done? In review, it may be that the Feather R was not analyzed, so sentence should be consistent.

Commented [MJ42R41]: Sophie Unger: A simplified redd dewatering analysis was done for the Feather River that used 3-month patterns of flow reduction as a proxy for redd dewatering. The analysis and results are explained more fully in Appendix 11N.

Commented [MJ43R40]: Statement has been deleted.

These analyses will be revised to reflect the ~~new~~ revised diversion criteria and enhanced anadromous fish benefits in revised CALSIM and other model runs. Once the updated modeling is completed, ~~and~~ the Authority will be available to present and discuss those results with Reclamation, USFWS, NMFS, CDFW and the other regulatory agencies.

4.0 Cumulative Impacts with Other Projects

Key Concern: Reclamation should consider the benefits of these other projects, how they would interact with the ~~proposed p~~Project, and explain the sequence of construction/completion relative to the ~~proposed p~~Project.

Response: The Authority understands the interest in exploring how the Project may operate in conjunction with other ~~proposed~~ projects such as the revised Delta Conveyance Project and the Shasta Raise Project. However, these projects are presently not sufficiently developed to assess how they would be constructed and operated, and any analysis of cumulative effects would be speculative. The Authority thinks adding speculative results to the cumulative effects analysis could be misleading; ~~t~~Therefore, it does not plan to pursue such an analysis. For additional details, refer to Chapter 31, *Cumulative Impacts*, in the RDEIR/SDEIS ~~(Sites Project Authority and U.S. Bureau of Reclamation 2021)~~. Chapter 31 states "The cumulative analysis is primarily qualitative. The cumulative analysis qualitatively addresses projects listed in Table 31-1, such as Delta Conveyance Project. For many of the projects in Table 31-1 it would be speculative to define multiple parameters and assumptions within a numerical modeling effort."

5.0 References

~~California Water Commission. December 2021. Water Storage Investment Program: Sites Reservoir Project Continuing Eligibility and Feasibility Determination. Available: https://cwc.ca.gov/-/media/CWC-Website/Files/Documents/2021/12_December/December2021_Item_10_SitesFeasibility_Final.pdf~~

Hassrick, J.L., A.J. Ammann, R.W. Perry, S.N. John, and M.E. Daniels, 2022. Factors affecting spatiotemporal variation in survival of endangered winter-run Chinook salmon out-migrating from the Sacramento River. N. Am. J. of Fish. Man. https://doi.org/10.1002/NAFM.10748

Michel, C.J., J. Notch, F. Cordoleani, A. Ammann, E. Danner. 2021. Nonlinear survival of imperiled fish informs managed flows in a highly modified river. *Freshwater Ecology.* Available: https://doi.org/10.1002/ecs2.3498

Poytress, W. R., J. J. Gruber, F. D. Carrillo, and S. D. Voss. 2014. *Compendium Report of Red Bluff Diversion Dam Rotary Screw Trap Juvenile Anadromous Fish Production Indices for Years 2002–2012.* Prepared for California Department of Fish and Wildlife Ecosystem Restoration Program and the U.S. Bureau of Reclamation. July. U.S. Fish and Wildlife Service, Red Bluff, CA.

Schaffter, R. G. 1997. White Sturgeon spawning migrations and location of spawning habitat in the Sacramento River, California. Calif Fish Game 83(1):1-20.

Sites Project Authority. December 2021. Water Storage Investment Program: Sites Reservoir Project Continuing Eligibility and Feasibility Determination. Available: https://cwc.ca.gov/-/media/CWC-Website/Files/Documents/2021/12_December/December2021_Item_10_SitesFeasibility_Final.pdf

Sites Project Authority and ~~U.S.~~ Bureau of Reclamation. 2021. Sites Reservoir Project Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS). November. Available: https://sitesproject.org/revised-draft-environmental-impact-report-supplemental-draft-environmental-impact-statement/

Steel, A.E., Anderson, J.J., Mulvey, B., & Smith, D.L. (2020). Applying the mean free-path length model to juvenile Chinook salmon migrating in the Sacramento River, California. Environmental Biology of Fishes, 103, 1603-1617. https://doi.org/10.1007/s10641-020-01046-8

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CC: Lecky, Jim [Jim.Lecky@icf.com]; Tannourji, Danielle [Danielle.Tannourji@icf.com]; Smith, Kristin [Kristin.Smith@hdrinc.com]
Subject: Sites/Reclamation Weekly BA Coordination Meeting - Operations Consultation Questions

Good Morning,

As discussed in our weekly meeting, the Sites BA team has put together the following questions on the operations section 7 consultation for your consideration. Please let me know if you have any questions on them. Thanks.
John

- Specifics on how Reclamation would like the 53.5F analysis to be developed/organized. More specifically, for the EIR/S, USBR (Elissa Buttermore) requested that we analyze the frequency of exceeding 53.5F in Tier 1 and Tier 2 years between May 15 and Oct 31 in the Sac River below Clear Creek. Is USBR requesting similar analysis for the BA?
- Related to the EIR/EIS, we received a comment asking why we didn't analyze Tier 3 and 4 years. Will USBR want these years as part of the BA?
- What about maintenance, would that be covered?
- Are there components of the reconsultation that would need to be incorporated into this BA?
  - If so, which and why?
- Would Reclamation be open to an ESA conference on longfin smelt with NMFS?
- Are there any emerging concerns that we should consider in the BA operational analysis?
- Would Reclamation support Sites identifying a fisheries benefit by pushing flows into the Yolo in late summer/early fall?
- Would Reclamation like to provide an outline of the BA Aquatics section or review one we can provide?

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

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Meeting: **Sites Reservoir Committee (RC), Coordination Workgroup**

Locations: Maxwell Project Office, 122 Old Highway 99W, Maxwell, CA 95955
See below for alternate meeting locations.

Call in: **1-916-538-7066** Code: **372 979 656#** Click here to join the meeting

Workgroup Chair: Thad Bettner (RC Chair/Glenn-Colusa Irrigation District)
Workgroup Vice-Chair: Valerie Pryor (RC Vice-Chair/Zone 7 Water Agency)
Staff Lead: Jerry Brown, Executive Director

AGENDA

Thursday, May 12, 2022; 9:00 – 10:00 am

NO ACTION or DECISION WILL BE TAKEN

ROLL CALL & CALL TO ORDER:

- Introductions.
- Period for Public Comment.

1. Discussion and Information Items:

1.1 Board Meeting Agenda Planning

1.2 General Coordination Among Committees and Workgroups

1.3 New Participant Interest Update

1.4 Feedback from ACWA Pop Up Gathering

2. Upcoming Meetings:

Reservoir Committee
Friday, May 20, 2022 (9:00 am – 12:00 pm)

Authority Board
Wednesday, May 25, 2022 (1:30 – 4:00 pm)

Coordination Workgroup
Wednesday, June 9, 2022 (9:00 – 10:00 am)

Virtual Information will be provided before all meetings at Sitesproject.org.

ADJOURN

PERIOD OF PUBLIC COMMENT: Any person may speak about any subject of concern, provided it is within the jurisdiction of the Reservoir Committee and is not already on today's agenda. The total amount of time allotted for receiving such public communication shall be limited to a total of 10 minutes per issue and each individual or group will be limited to no more than 3 minutes each within the 10 minutes allocated per issue. **Note:** No action shall be taken on comments made under this comment period.

ADA COMPLIANCE: Upon request, agendas will be made available in alternative formats to accommodate persons with disabilities. In addition, any person with a disability who requires a modification or accommodation to participate or attend this meeting may request necessary accommodation. Please make your request to the Board Clerk, specifying your disability, the format in which you would like to receive this Agenda and any other accommodation required no later than 24 hours before the start of the meeting.

Alternate Meeting Locations:

Coachella Valley Water District, 51501 Tyler Street, Coachella, CA 92236

Colusa County, 1215 Market Street, Colusa, CA 95932

Davis Water District, 1717 5th Street, Davis, CA 95616

Glenn-Colusa Irrigation District, 344 East Laurel Street, Willows, CA 95988

San Bernardino Valley Municipal WD, 380 E. Vanderbilt Way, San Bernardino, CA 92408

Wheeler Ridge-Maricopa Water Storage District, 12109 Hwy 166, Bakersfield, CA 93313

Zone 7 Water Agency, 100 North Canyons Parkway, Livermore, CA 94551

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/11/2022 11:14:19 AM
To: Thad Bettner (tbettner@gcid.net) [tbettner@gcid.net]; Lewis Bair [LBair@RD108.org]
CC: Heydinger, Erin [erin.heydinger@hdrinc.com]
Subject: Sites Project - NMFS WRLCM Scope
Attachments: UCSC_Sites_BA_SOW_22MAR2022_SitesComments_REV 2.docx

Hi Thad and Lewis – It was great to chat with you last week on the NMFS Winter-run Life Cycle Model concerns. I took a second look at the draft scope (attached) and added a little bit to it (in track changes and highlighted in yellow). I noted the following concerns from our discussion last week (these are generalized):

1. Document Key Assumptions – As part of the model documentation appendix for the BA (see subtask 6, Part A on page 5), we've added a requirement for key model assumptions and the sensitivity of those assumptions in driving results. I would expect that we would also talk through these as part of the results presentations earlier in that subtask.

2. Discuss Results with Sites – This is in there in Subtask 6 on page 5. There is no limitation on who Sites includes in this discussion and we'd be happy to include you both.

3. Not Release Results Until Sites Approves – I've added a few sentences in under Subtask 6 on this. This may eventually fit better in the contract rather than here in the scope, but wanted to make sure I've captured this somewhere and the contracting folks can figure out the best spot for this.

The attached scope is a draft. UC Santa Cruz is providing a revised scope on/around May 16. We will work with UC Santa Cruz to incorporate in these changes once we see their proposal next week.

Would appreciate any thoughts you have on the attached and suggested changes.

I plan to reach out to Bruce DiGennaro today.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

Lifecycle Modeling for the Sites Reservoir Project Biological Assessment

Scope of Work

prepared by UC Santa Cruz for the Sites Project Authority

March XX, 2022

1. BACKGROUND

The Sites Project Authority (SPA) is undergoing a study to evaluate the effect of operating a new off-river water storage reservoir northwest of Sacramento, California that diverts water directly from the Sacramento River. This project, called the Sites Reservoir Project (Project), would provide an additional water storage facility to secure water resources for California residents while trying to minimize take to endangered aquatic species. The Project may ~~not only includes major physical alteration to the Sacramento River system network but will also~~ change the hydrodynamics of the Sacramento River system ~~that will~~and could affect habitat for several aquatic species, including threatened and endangered salmonids.

The Sacramento River winter-run Chinook (SRWRC) salmon (*Oncorhynchus tshawytscha*) is a federally endangered species (Federal Register 1994) that relies on the Sacramento River system for all freshwater lifestages. Historically, SRWRC adults returned from the ocean in the winter and navigated up the Sacramento River to spawn in the cool spring-fed tributaries of Mount Shasta the following summer. The construction of Shasta Dam in 1938 blocked access to their historical spawning grounds, forcing SRWRC to spawn in the mainstem Sacramento River below Keswick Dam where water temperature is artificially regulated by Shasta Dam releases to provide cool water for spawning. After spawning, eggs emerge as fry where they can either rear as juveniles in the upper river or move downstream to the Yolo Bypass, lower river, Delta, or bay to continue growth before outmigrating to the ocean as smolts the following winter/spring. Because SRWRC exist throughout the Sacramento River in several lifestages, the Project may affect the habitat for multiple SRWRC freshwater lifestages. As mandated by the Endangered Species Act, major construction requires that the operating agency conducts a Biological Assessment to quantify the impacts on threatened and endangered species and their habitat. In 2011, the findings from the Consolidated Salmonid Cases argued that lifecycle models are a necessary tool to quantify the effect of habitat modification and water operations on the overall population dynamics of salmonid species, including SRWRC.

The winter-run Chinook salmon lifecycle model (WRLCM) was initially developed in 2014 (Hendrix et al) to evaluate the effect of water operations on the population dynamics of SRWRC. The WRLCM has since been used to successfully evaluate the effect of alternative water management actions and large-scale modifications to the Sacramento River system in the Biological Opinion for the California WaterFix Project in Central Valley, California (Hendrix et al. 2017) and to evaluate the effect of alternative management actions without physical modifications in the Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project (Hendrix et al. 2019). Through these implementations of the model, the WRLCM was used to predict how proposed actions affect population metrics including cohort replacement rate, escapement, and smolt production. The implementation of the WRLCM to evaluate water operations is a significant advancement over lifestage-specific models because it can integrate the effect of water operations across the entire lifecycle and multiple environmental conditions. Therefore, the WRLCM is a valuable tool ~~one of the most appropriate tools~~ to evaluate possible ~~the~~ effects of proposed Project operations on the population dynamics of SRWRC.

2. DESCRIPTION OF WORK

This Scope of Work includes an application of the WRLCM to evaluate the effects of proposed Project operations on SRWRC population dynamics to inform SPA's Biological Assessment. SPA has planned a 3-phased approach to evaluating proposed Project operations on SRWRC population dynamics. Each phase consists of running three proposed Project operations: two action alternatives and one baseline (no project). The third and last phase will consist of proposed Project operations that are informed by the results of the first two phases. Therefore, our Scope of Work is categorized into three tasks. Task 1 includes all work associated with the first batch of three scenarios. Task 2 includes all work associated with the second batch of three scenarios. Task 3 includes all work associated with the last batch of three scenarios, following SPA's review of the results from the first two tasks.

Our proposed work supports both University of California (UC) Santa Cruz staff and staff from a subconsultant, QEDA Consulting, LLC (QEDA). Together, UC Santa Cruz and QEDA staff comprise the lead model developers for both the WRLCM and the submodels upon which the WRLCM depends. Submodels include habitat capacity models and the enhanced Particle Tracking Model (ePTM), which can be used to estimate outmigration survival through the Delta. UC Santa Cruz and QEDA staff have an on-going collaboration that fosters continued model improvement and seamless transitions between submodels.

This Scope of Work is generated with the expectation that we use most up-to-date versions of our models to evaluate proposed Project operations, including the ePTMvII to evaluate Delta smolt survival, and the WRLCM v.1.5 to evaluate SRWRC population dynamics. We also assume there are no changes in geometry from DSM2 v.8.0.6 or the CalSimII version that was provided by SPA as an example on March 2, 2022. If there are any reasons that necessitate using different versions of these models or changes to system geometry, UC Santa Cruz will discuss these changes with SPA and make any necessary changes to the timeline and/or budget.

Table 1 below describes the expected timeline for each Task and Subtask proposed in this Scope of Work. Based on Table 1, we expect each task will take 2-3 months to complete. Although it is possible to analyze separate tasks in parallel, we require at least 1 month between starting the analyses on separate tasks to stagger when submodels are run for a given task.

Table 1. Description of subtasks and timelines for Tasks 1, 2, and 3.

Sub-Task	**Timeline**		
	Task 1: **3 scenarios**	**Task 2:** **3 scenarios**	**Task 3:** **3 scenarios**

1: Project Management	all weeks	all weeks	all weeks
2: Database Management	2 weeks	2 weeks	2 weeks
3-4: Generate Estimates for Habitat Capacity (Subtask 3) and Delta Smolt Survival (Subtask 4)[1]	5 weeks	4 weeks	4 weeks
5: Generate WRLCM results	2 weeks	2 weeks	2 weeks
6: Communicating WRLCM results	2 weeks	2 weeks	2 weeks
TOTAL DURATION	**11 weeks**	**10 weeks**	**10 weeks**

[1] Subtasks 3 and 4 are combined in the timeline because some components can be executed in parallel.

TASK 1: Evaluating effects of initial 3 proposed Project operations on SRWRC population dynamics

Subtask 1: Project Management

Project management includes the UC Santa Cruz Principal Investigator and support for administrative staff. The UC Santa Cruz Principal Investigator will serve as the point of contact between UC Santa Cruz and SPA, ensure project progress and deliverables, and attend meetings with SPA. Administrative staff for UC Santa Cruz's Fisheries Collaborative Program will provide several resources including contract support and human resources.

Subtask 2: Database Management

UC Santa Cruz staff will maintain a SQL database to house data received from SPA for each proposed action. This database will store results from CalSim II and the HEC5Q model to simulate temperature in the Sacramento River. Database Management also includes translation between SPA's CalSimII geometry and the CalSim3 geometry used in the development of the WRLCM and its submodels. The generation of this database will allow for repeatability of WRLCM results.

Subtask 3: Generate Habitat Capacity Estimates

Habitat capacity models estimate the number of individuals that saturate a given habitat area with specific environmental conditions. Within the WRLCM, habitat capacity estimates inform the density dependent movement function to determine if fry remain in a given geographic area (i.e., upper river, lower river, Yolo Bypass, Delta, or bay) or move downstream. Finescale estimates of habitat capacity (i.e., by DSM2 node) are also directly incorporated into the ePTMvII to inform the distribution of fry and subsequent location of the origin of smolts in the Delta. Therefore, habitat capacity models are important submodels that directly inform both the WRLCM and the ePTMvII. UC Santa Cruz staff includes the lead model developers for both habitat capacity models. UC Santa Cruz staff will generate estimates of habitat capacity for all geographic areas of the WRLCM (upper river, lower river, Yolo Bypass, Delta, and bay), and for all DSM2 nodes in the Delta according to methods described in Hendrix et al (2019). This subtask also includes translation between SPA's DSM2 v.8.0.6 geometry and the DSM2 v.8.2 geometry used in the development of the WRLCM and its submodels.

Subtask 4: Generate Delta Smolt Survival Estimates

The ePTMvII is a mechanistic model that combines hydrodynamics and fish behavior to simulate Delta survival and routing for outmigrating smolts. Therefore, the ePTMvII submodel estimates the important vital rate of Delta smolt survival for the WRLCM. An earlier version of the ePTM (ePTM vI) was used in the Biological Opinion for the California WaterFix Project in Central Valley, California (Hendrix et al. 2017) to estimate smolt survival and has recently undergone substantial improvement to better represent outmigration survival in the Delta. Lead developers of the ePTMvII work at both UC Santa Cruz and QEDA and thus staff from both groups will work on this Subtask. This Subtask is split into Part A and Part B to reflect the work done by each group. This subtask also includes translation between SPA's DSM2 v.8.0.6 geometry and the DSM2 v.8.2 geometry used in the development of the WRLCM and its submodels.

Part A (QEDA Consulting):

Dr. Doug Jackson is the lead programmer at QEDA and serves as a core member of the ePTMvII development team lead by UC Santa Cruz. The ePTMvII is a complex model that is computationally expensive because it layers fish behavior on top of finescale hydrodynamic data from DMS2 Hydro. Dr. Jackson has extensive knowledge of both the ePTMvII and computer programming and as a result has developed a way to expedite running the ePTMvII using the Amazon Web Services (AWS) Cloud Platform. While this requires an additional cost, it significantly reduces computation time and allows for faster generation of ePTMvII results.

Part B (UC Santa Cruz):
Dr. Vamsi Sridharan is an Assistant Project Scientist at UC Santa Cruz and has been the team lead for ePTMvII development since the first pilot application in 2015 (Sridharan and Byrne 2015). Once the ePTMvII runs are completed by QEDA, Dr. Sridharan will translate the ePTMvII results to the monthly scale required by the WRLCM. Dr. Sridharan will achieve this by post-processing the results of the ePTMvII runs into a tabulated set of 1000 replicate river and floodplain rearing smolts. He will also incorporate the Delta habitat capacity calculations to renormalize the ePTMvII predicted through-Delta survivals to estimate 1000 replicate habitat-capacity weighted through-Delta survivals of Delta-rearing smolts. These replicates allow uncertainty to be propagated along with survival estimates within the WRLCM.

Subtask 5: Generate WRLCM results

The WRLCM is a spatially and temporally explicit stage-structured simulation model that has been used in previous Biological Opinions (Hendrix et al, 2017, 2019) to evaluate the effect of Central Valley Project and State Water Projects on SRWRC population dynamics. Dr. Noble Hendrix is a Quantitative Ecologist at QEDA and is the lead model developer for the WRLCM (Hendrix et al. 2014, 2017, 2019), which was previously used to evaluate proposed projects under Cal Water Fix (Hendrix et al 2017) and the ROC LTO (Hendrix et al 2019). Therefore, QEDA will take the lead on generating typical WRLCM results for evaluating population dynamics. Results will include relative differences between baseline and alternative scenarios in population metrics such as the cohort replacement rate, escapement, Delta smolt survival, and smolt production. Relative comparisons are necessary to avoid confusion between modeled fish with historically observed numbers of fish. QEDA will work with the SPA and UC Santa Cruz staff to coordinate the development of these outputs in a manner that is appropriate given the WRLCM assumptions and limitations.

Subtask 6: Communicating WRLCM results
Both UC Santa Cruz and QEDA will be involved with communicating WRLCM results to SPA. This Subtask is split into Part A and Part B to reflect the work done by each group.

As the effort is expected to be an iterative process with follow on modeling runs, both UC Santa Cruz and QEDA are not to release the results of this effort to anyone other than SPA until authorized in writing by SPA. The only exception to this would be the release of results, if necessary, under a Public Records Act request. In the instance of a Public Records Act request, UC Santa Cruz shall notify SPA as soon as possible of such a request and of the information being released in response to the request.

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Part A (QEDA Consulting):

QEDA will contribute to at least two presentations to discuss WRLCM results with SPA. The first presentation will occur after the completion of Task 1 (Subtasks 1 through 5) to discuss model results. Before this meeting, QEDA will disseminate the following figures:

- Summary of WRLCM population metrics, including differences in cohort replacement rate, escapement, Delta smolt survival, and smolt production under the baseline and compared to each of the alternatives.
- Summary of Delta smolt survival by month (generated in Subtask 4)
- Summary of habitat capacity by month (generated in Subtask 3)

Following discussion with SPA, QEDA will revise figures as needed and will attend an additional meeting with SPA to discuss the final suite of figures and associated text.

QEDA will also contribute to a WRLCM model description, including a description of key model assumptions, that can be available for use as an Appendix to the Project BA. This model description will include the details of model calibration and will be similar to those included as Appendices to previous Biological Opinions (Hendrix et al. 2017, Hendrix et al. 2019). The model description will include:

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- Description of the WRLCM model structure and parameter values used in the evaluation of the Project
- Description of the ePTMvII version and its assumptions used in the WRLCM to evaluate the Project scenarios
- Description of WRLCM components that reflect modifications to the existing system (e.g., effect of Fremont Weir notch on probability of entry into the Yolo Bypass)
- Description of key model assumptions and the sensitivity of those assumptions in driving results

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QEDA will also review sections of the Project BA pertaining to interpretation of the WRLCM. This review will allow QEDA staff the opportunity to ensure that SPA's interpretation of model results are consistent with the capabilities and limitations of the WRLCM.

Part B (UC Santa Cruz):

UC Santa Cruz staff will contribute to final figures summarizing WRLCM and will participate in all presentations to SPA. UC Santa Cruz staff will also review sections of the Project BA pertaining to interpretation of the WRLCM. This review will allow UC Santa Cruz staff the opportunity to ensure that SPA interpretation of model results are consistent with the capabilities and limitations of the WRLCM.

TASK 2: Evaluating effects of a second batch of 3 proposed Project operations on SRWRC population dynamics

Subtask 1: Project Management

Subtask 1 is identical for all Tasks. See Task 1, Subtask 1 for details.

Subtask 2: Database Management

Subtask 2 is identical for all Tasks. See Task 1, Subtask 2 for details.

Subtask 3: Generate Habitat Capacity Estimates

Subtask 3 is identical for all Tasks. See Task 1, Subtask 3 for details.

Subtask 4: Generate Delta Smolt Survival Estimates

Subtask 4 is identical for all Tasks. See Task 1, Subtask 4 for details.

Subtask 5: Generate WRLCM

Subtask 5 is identical for all Tasks. See Task 1, Subtask 5 for details.

Subtask 6: Communicating WRLCM results

Both UC Santa Cruz and QEDA will hold one meeting (virtual) with SPA consultant's team to discuss results from all proposed actions including those developed in Task 2. Finally, QEDA will incorporate the WRLCM outputs from the scenarios developed under Task 2 into the final suite of figures.

TASK 3: Evaluating effects of a third batch of 3 proposed Project operations on SRWRC population dynamics

Subtask 1: Project Management

Subtask 1 is identical for all Tasks. See Task 1, Subtask 1 for details.

Subtask 2: Database Management

Subtask 2 is identical for all Tasks. See Task 1, Subtask 2 for details.

Subtask 3: Generate Habitat Capacity Estimates

Subtask 3 is identical for all Tasks. See Task 1, Subtask 3 for details.

Subtask 4: Generate Delta Smolt Survival Estimates

Subtask 4 is identical for all Tasks. See Task 1, Subtask 4 for details.

Subtask 5: Generate WRLCM

Subtask 5 is identical for all Tasks. See Task 1, Subtask 5 for details.

Subtask 6: Communicating WRLCM results

Both UC Santa Cruz and QEDA will hold one meeting (virtual) with SPA consultant's team to discuss results from all proposed actions including those developed in Task 3. Finally, QEDA will incorporate the WRLCM outputs from the scenarios developed under Task 3 into the final suite of figures.

3. DELIVERABLES AND SCHEDULE

Table 2 below provides descriptions of the project deliverables and approximations of estimated completion dates.

Table 2. Description and estimated completion date for project deliverables. The Estimated Completion Date for all deliverables is the number of weeks after UCSC receives SPA model outputs for a given task. Initially, UCSC expects to receive SPA model outputs for Task 1 by 5/2/2022, for Task 2 by 7/1/2022 and for Task 3 by 10/1/2022. If there is any delay in receiving model inputs from SPA or to the contract start date, the estimated completion dates will be shifted by the same number of days as the delay.

Commented [AMO1]: Check with Sites team re: anticipated timeline for each batch.

Commented [HE2R1]: We can submit batch 1 as soon as the contract is signed. We expect batch 2 to be ready in ~May. In the RFP, I have requested batch 3 begin once batch 2 has been delivered.

Deliverable Number	Deliverable Description	Estimated Completion Date
UCSC-01-01	Provide Final WRLCM modeling schedule once Task 1 scenarios are delivered	*+ 1 wk (5/9/2022)*
UCSC-01-02	Provide summary of WRLCM population metrics (e.g. CRR and escapement), Delta smolt survival by month, and habitat capacity by month for Task 1 scenarios	*+ 9 wk (7/5/2022)*
UCSC-01-03	Provide Final figures summarizing WRLCM results for Task 1 scenarios	*+ 11w (7/19/2022)*
UCSC-01-04	Provide WRLCM model description (e.g. description of model structure and assumptions)	*+ 13w (8/2/2022)*
UCSC-01-05	Provide written and verbal comments on interpretation of WRLCM results in Draft Project BA sections for Task 1 scenarios	*+ 13 wk*
UCSC-02-01	Provide Final WRLCM modeling schedule once Task 2 scenarios are delivered	*+ 1 wk*
UCSC-02-02	Provide summary of WRLCM population metrics (e.g. CRR and escapement), Delta smolt survival by month, and habitat capacity by month for Task 2 scenarios	*+ 8 wk*
UCSC-02-03	Provide Final figures summarizing WRLCM results for Task 2 scenarios	*+ 10 wk*
UCSC-02-04	Provide written and verbal comments on interpretation of WRLCM results in Draft Project BA sections for Task 2 scenarios	*+ 12 wk*
UCSC-03-01	Provide Final WRLCM modeling schedule once Task 3 scenarios are delivered	*+ 1 wk*
UCSC-03-02	Provide summary of WRLCM population metrics (e.g. CRR and escapement), Delta smolt survival by month, and habitat capacity by month for Task 3 scenarios	*+ 8 wk*
UCSC-03-03	Provide Final figures summarizing WRLCM results for Task 3 scenarios	*+ 10 wk*
UCSC-03-04	Provide updates to WRLCM model description (e.g. description of model structure and assumptions) based on Task 3 scenarios, if applicable	*+ 12 wk*
UCSC-03-05	Provide written and verbal comments on interpretation of WRLCM results in Draft Project BA sections for Task 3 scenarios	*+ 12 wk*
UCSC-04-00	Submit any remaining deliverables to close contract	*12/31/2022*

4. BUDGET

The total project budget for this agreement is $XXX,XXX (Table 3). The budget includes salaries and benefits for UC Santa Cruz staff, and costs through QEDA's subaward, which includes both staffing and Amazon Web Services. We assume there will be no travel, and all meetings will be hosted virtually. Please refer to additional documents for more detailed budget information.

Commented [HE3]: RFP requests proposal not to exceed $200k

Table 3. Estimated project costs.

Description	Total Cost
UCSC Staff Salaries	$XX,XXX
UCSC Staff Benefits	$XX,XXX
Indirect Costs	$XX,XXX
QEDA Consulting LLC (subaward)	$XX,XXX
PROJECT TOTAL	**$XXX,XXX**

5. TERM OF CONTRACT, FUNDING, AND INVOICING

The term of this agreement shall be May 1, 2022 or upon execution, whichever is later, through December 31, 2022. The total amount of this contract is $XXX,XXX. Invoices will be submitted to SPA bimonthly to pay for the work conducted by UCSC and sub-contractor QEDA Consulting, LLC.

Commented [AMO4]: Check with Sites re: anticipated start date

Commented [AMO5]: we may want to stretch this out farther, given past issues, to avoid the need for a NCTE? Check with Sites and their timeline

Commented [EH6R5]: Let's discuss this afternoon.

6. REFERECES

Federal Register. 1994. Endangered and Threatened Species; Status of Sacramento River Winter-run Chinook Salmon; Final Rule. Federal Register, Volume 59.

Hendrix, N., Criss, A., Danner, E., Greene, C.M., Imaki, H., Pike, A., and Lindley, S.T. 2014. Life cycle modeling framework for Sacramento River Winter run Chinook salmon. NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-530 U.S. 1-27.

Hendrix, N., Jennings, E., Criss, A., Danner, E., Sridharan, V., and Lindley, S.T. 2017. Model Description for the Sacramento River Winter-run Chinook Salmon Life Cycle Model. Prepared for the 2017 Biological Opinion for the California WaterFix Project in Central Valley, California.

Hendrix, N., Osterback, A.-M.K., Jennings, E., Danner, E., Sridharan, V., and Lindley, S.T. 2019. Model Description for the Sacramento River Winter-run Chinook Salmon Life Cycle

Model. Prepared for the 2019 Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project.

Sridharan V., and Byrne B. 2015. Enhanced Particle Tracking Model (ePTM): status of model development and pilot application during WY 2015. Sacramento (CA): National Marine Fisheries Service, National Oceanographic and Atmospheric Administration. Report Submitted to the independent review committee of the Delta Science Panel on the Long Term Operations and Biological Opinions. 90 p.

Maxwell Water Intertie Status Update

To:	Daniel Cardona, Lisa Butler (USDA)
From:	Jerry Brown, Kevin Spesert
CC:	JP Robinette, Ali Forsythe, Cheyanne Harris
Date:	November 1, 2021
Subject:	Maxwell Water Intertie Status Update April 2021 – October 2021

Summary

This report covers the time period from April 2021 through October 2021.

During this period, the Sites Project Authority (Authority) continued to make progress to advance the Maxwell Water Intertie (MWI) Project. Work activities included ongoing environmental planning and permitting activities, preliminary engineering and design activities, local agency/landowner engagement, and program management. The Authority will work in the coming year with USDA Rural Development to make necessary adjustments to the current conditions for the loan including establishing loan closing in mid- 2023 and extending the construction start date to 2024 to reflect the most current updated schedule.

Background

The Authority consists of 9 voting members representing 11 public agencies and 2 non-voting members within the Sacramento Valley watershed. The 2 non-voting members consist of the Bureau of Reclamation (Reclamation) and the California Department of Water Resources (CDWR). Reclamation, CDWR, and 5 of the Authority members also serve on the Sites Project Reservoir Committee.

The Sites Project Reservoir Committee consists of 23 voting members who are investing to obtain direct water supply and storage benefits from the proposed Sites Reservoir. They represent the agencies that will finance and construct the project facilities. The Reservoir Committee is comprised of agencies across California including the Sacramento Valley, Bay Area, San Joaquin Valley, and Southern California.

The Authority is advancing the MWI Project to increase the efficiency and reliability of water management in the western Sacramento Valley, increase the region's drought resiliency, and strengthen the region's rural economy. The MWI Project proposes to interconnect the Tehama-Colusa Canal and the Glenn-Colusa Irrigation District's Main Canal and utilize their capacity to divert stormwater flows from the Sacramento River for use by the Sites Reservoir Project[1] (Sites). The ability of the MWI to move water between the existing canals would greatly benefit Colusa and Glenn County agriculture. When built and operated in coordination with Sites, the MWI can provide significantly more water supply benefits for agriculture and rural communities throughout the Sacramento and San Joaquin Valleys, flood risk reduction for Colusa County, and add much needed reliability, resiliency and flexibility back to the statewide water management system. The MWI has independent utility from the Sites Project and will achieve the following:

- Improve the transfer of water between the regions' 2 major canal systems to increase water supply resiliency and reliability for participating water agencies in the Sacramento Valley, providing a direct benefit to agriculture and benefit the economies of adjacent rural communities
- Provide releases through the Colusa Basin Drain to the Sacramento-San Joaquin Delta for potential export to participating water agencies in the San Joaquin Valley for agricultural use and benefit the economies of adjacent rural communities

Participating Agencies Subscription

All of the existing agencies in the project continued their participation during the reporting period. Funding by each participant is proportional to their requested annualized water supply benefit which is currently measured in acre-feet per year and at the present time the project is at approximately full subscription.

Funding and Financing

- **Local Project Participants**: Since 2015, local project participants have invested $43.8 million to advance Sites. In September 2021, the local project participants reaffirmed their investment in Sites by approving the Third Amendment to the 2019 Reservoir Project Agreement (Amendment 3 Project Agreement) and the associated work plan (Amendment 3 Work Plan). By approving the Amendment 3 Project Agreement, the local project participants have committed to fund work activities for up to the next 36 months. In addition to the Amendment 3 Project Agreement, the Authority worked with local project participants to develop a 2021 Draft Plan of Finance to evaluate the mechanisms for near-term and long-term financing. In conjunction with this effort, the Authority also developed the Sites Reservoir Benefits and Obligations Guiding Principles and Preliminary Terms (Guiding Principles) to allocate benefits, costs, financing and ownership obligations. Both the 2021 Draft Plan of Finance and 2021 Draft Guiding Principles were endorsed by the Reservoir Committee and Authority Board in October

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[1] The Sites Reservoir Project is a proposed off-stream water storage reservoir being developed, in accordance with the beneficiary pays principle, as a local, state, and federal partnership to primarily provide water supply reliability and environmental flows to benefit rural communities and farms, cities, and ecosystems. The proposed maximum storage capacity of Sites Reservoir is 1,500,000 acre-feet.

2021. Over the coming months, the existing Local Project Participants will be working with their respective home agencies to execute the Amendment 3 Project Agreement. The Authority has initiated discussions with several entities that are looking to secure new water supplies by participating in the project.

- **State of California (Proposition 1):** The State continues to provide funding for development activities through an Early Funding Agreement (EFA) administered by the California Water Commission (CWC) under Proposition 1 Water Storage Investment Program (WSIP), which was executed in 2019. The EFA has a ceiling of $40.8 million. In January 2021, CWC awarded a 2.5% inflation adjustment to all of the WSIP projects increasing the overall award. To date, $20.5 million has been received through the EFA, with an additional $15.4 million planned through the end of 2024 in the approved next work plan. In November 2021, the Authority will be submitting the Final WSIP Feasibility Report and 75% Non-Public Cost Share Materials to CWC staff to satisfy the Proposition 1 eligibility requirements. These documents will inform the CWC's determination of feasibility which is anticipated to be discussed at their meeting on December 15, 2021. At this meeting, the CWC will determine whether the Project is feasible to continue eligibility for the full $836 million WSIP final award.

- **Bureau of Reclamation (WIIN Act):** In addition to the $24 million from previous appropriations, Congress appropriated $80 million in October 2021 for the Sites Project. The Authority and Reclamation entered into a Financial Assistance Agreement in August 2020 to allocate $6.0 million to fund the 2021 work plan activities, including completion of the Federal Feasibility Study, environmental permitting and planning, and geotechnical evaluations. The Authority and Reclamation are coordinating to execute an amendment and new Financial Assistance Agreement to fund activities beyond 2021. The Authority will continue to seek additional WIIN Act appropriations in the coming fiscal years.

- **Federal Feasibility Study:** The Authority's efforts with Reclamation to advance the Federal Feasibility Study culminated in Reclamation's release of the Final Feasibility Report and a Secretary of Interior determination of feasibility in December 2020, a key milestone for maintaining eligibility under the WIIN Act.

- **WIFIA Loan:** In July 2021, the Authority submitted a letter of interest (LOI) for a WIFIA loan. The Authority expects to receive notice of whether it will be invited to apply for a WIFIA Loan in November 2021.

Work Plan Through 2021

The Authority's work plan through the end of 2021 consists of $33.6 million of local, state, and federal funding to complete the deliverables to satisfy the State of California's eligibility through Proposition 1 while improving the Project's operational, cost, and permitting certainty. A critical path schedule is being maintained as part of the approved work plan and a status update on the milestones mentioned in the previous status report are as follows:

Milestone	**Anticipated Completion Date (as reported in March 2021 Status Report)**	**Status (as of October 2021)**
Revised Public Draft Environmental Impact Report (RDEIR) and Supplemental Draft Environmental Impact Statement (SDEIS)	August 2021	In Progress – Release anticipated on Nov 12, 2021
Amendment 3 Project Agreement and Work Plan	September 2021	Completed
Project Plan of Finance	September 2021	Completed
Authority's Final State WSIP Feasibility Report	December 2021	In Progress – anticipated finalization in Nov 2021
Reclamation's Biological Assessment submitted to the U.S. Fish and Wildlife Service and National Marine Fisheries Service	December 2021	In Progress – anticipated submission in February 2022
Final Programmatic Agreement under the National Historic Preservation Act ready for signature	December 2021	In Progress – anticipated submission in February 2022
Clean Water Act 404/401 Permit Applications	December 2021	In Progress – anticipated submission in February 2022
Water Right Application	December 2021	In Progress – anticipated submission in February 2022
Anticipated start of construction	2024	2024
Submit a Letter of Interest for WIFIA loan	2021	Completed – submitted in July 2021

Reservoir Operations

The Authority is continuing reservoir operations modeling and analysis to further define and refine operations, water diversions, and potential yields in support of the environmental planning and permitting, engineering feasibility, and financing activities.

Environmental Planning & Permitting

The Authority, as the state lead agency, and Reclamation, as the federal lead agency, continue to perform additional environmental analysis to support the development of the RDEIR/SDEIS. During the reporting period, the Authority coordinated with Reclamation to prepare the chapters, figures, and appendices. The Authority also facilitated technical working groups with non-governmental organizations (NGOs), focused on key RDEIR/SDEIS topics. The Authority anticipates publishing the RDEIR/SDEIS on November 12, 2021.

The Authority has ongoing discussions with the California Department of Fish and Wildlife (CDFW) to discuss Sites, the permit application process, and supporting information for the permit applications. The Authority is currently developing the initial parameters for the water right application which is expected to be submitted in February 2022.

Engineering and Technical

The Authority is continuing to refine and optimize the Sites' design and facilities based on updated ranges of reservoir operations. Ongoing engineering analysis and studies are supporting completion of environmental documentation and permitting activities. During the reporting period, the Authority supported Reclamation with ongoing geotechnical investigations to improve the cost estimation accuracy while working to reduce construction cost related risk. Additional engineering analysis is to support the feasibility as a locally sponsored storage project in compliance with the WIIN Act and in compliance with the State of California's Proposition 1 requirements. The Authority approved the Feasibility Project Cost Estimate in June 2021. The engineering facilities are approximately at a 10% design level.

Communications and Local Agency Coordination

The Authority continues to conduct outreach efforts with landowners, local community members, state and federal elected officials, government agencies, non-governmental organizations, and regional coalitions to advance Sites. The Authority hosted 9 public workshops from February to October 2021 focused on "three big questions" related to financing and satisfying the Proposition 1 requirement for 75% non-public cost share: "What do we get?", "What does it cost us?", and "How do we pay for it?".

Work Plan Beyond 2021

In September 2021, the Authority approved the Amendment 3 Work Plan which will fund work activities for up to the next 36 months through the end of 2024. The Amendment 3 Work Plan totaling $120 million includes local, state, and federal funding sources to complete the planning phase of the Sites Reservoir Project. The Amendment 3 work plan includes the following milestones:

- Reclamation's Biological Assessment submitted to the U.S. Fish and Wildlife Service and National Marine Fisheries Service in February 2022
- Final Programmatic Agreement under the National Historical Preservation Act ready for signature in February 2022
- Water Right Application submitted in February 2022
- Final EIR/EIS completed in June 2022
- Authority works with USDA Rural Development to adjust current loan conditions in 2022
- Authority issues Notice of Determination/ Reclamation executes Record of Decision in late 2022
- Receive Water Right Order and Permit in 2023
- Execute Administration of Public Benefits Agreements with State agencies in 2023
- Execute Benefits and Obligations Contract with Local Project Participants in 2023
- Complete necessary requirements to initiate bank financing in 2023
- Close on USDA Loan in 2023
- Complete Land Acquisition Master Plan in 2023
- Advance Engineering to 30% design level (65% design level for selected features in support of permits)
- Anticipated start of construction in 2024 based on current schedule and permitting activities

Based on the current project schedule, the Authority anticipates initiating a loan agreement in mid-2023 with the acquisition of the critical permits and water right. The physical construction work is projected to start in 2024 and is approximately 6 years total duration, ending with operational completion in 2030. The timing for construction of the MWI has not yet been determined and will be evaluated in the next work period as the engineering design progresses. The Authority will work in the coming months with USDA Rural Development to make necessary adjustments to the current conditions for the loan including establishing loan closing in mid-2023 and extending the construction start date to 2024 to reflect the most current updated schedule.

Maxwell Water Intertie Status Update

To:	Lisa Butler, Patty Gerald, Anita Lopez (USDA)
From:	JP Robinette; Derek Gardels, Cheyanne Harris
CC:	Jerry Brown, Kevin Spesert, Ali Forsythe
Date:	April 29, 2022
Subject:	Maxwell Water Intertie Status Update November 2021 – April 2022

Summary

This report covers the time period from November 2021 through April 2022.

During this period, the Sites Project Authority (Authority) continued to make progress to advance the Maxwell Water Intertie (MWI) Project. Work activities included ongoing environmental planning and permitting activities, preliminary engineering and design activities, local agency/landowner engagement, and program management. The Authority was invited by EPA to apply for a WIFIA loan of up to 49% of eligible project cost. The Authority will work in the coming months with USDA Rural Development to make necessary adjustments to extend the date by which the USDA loan needs to be executed to sometime in 2024 and extending the construction start date to 2024 to reflect the most current updated schedule.

Background

The Authority consists of 9 voting members representing 11 public agencies and 2 non-voting members within the Sacramento Valley watershed. The 2 non-voting members consist of the Bureau of Reclamation (Reclamation) and the California Department of Water Resources (CDWR). Reclamation, CDWR, and 5 of the Authority members also serve on the Sites Project Reservoir Committee.

The Sites Project Reservoir Committee consists of 22 (previously 23 members) voting members who are investing to obtain direct water supply and storage benefits from the proposed Sites Reservoir. They represent the agencies that will finance and construct the project facilities. The Reservoir Committee is comprised of agencies across California including the Sacramento Valley, Bay Area, San Joaquin Valley, and Southern California.

The Authority is advancing the MWI Project alongside the Sites Project to increase the efficiency and reliability of water management in the western Sacramento Valley, increase the region's drought resiliency, and strengthen the region's rural economy. The MWI Project proposes to interconnect the Tehama-Colusa Canal and the Glenn-Colusa Irrigation District's Main Canal and utilize their capacity to divert stormwater flows from the Sacramento River for use by the Sites Reservoir Project[1] (Project). The ability of the MWI to move water between the existing canals would greatly benefit Colusa and Glenn County agriculture. When built and operated in coordination with the Sites Project, the MWI can provide significantly more water supply benefits for agriculture and rural communities throughout the Sacramento and San Joaquin Valleys, flood risk reduction for Colusa County, and add much needed reliability, resiliency and flexibility back to the statewide water management system. The MWI has independent utility from the Sites Project and will achieve the following:

- Improve the transfer of water between the regions' 2 major canal systems to increase water supply resiliency and reliability for participating water agencies in the Sacramento Valley, providing a direct benefit to agriculture and benefit the economies of adjacent rural communities
- Provide releases through the Colusa Basin Drain to the Sacramento-San Joaquin Delta for potential export to participating water agencies in the San Joaquin Valley for agricultural use and benefit the economies of adjacent rural communities

Participating Agencies Subscription

Funding by each participant is proportional to their requested annualized water supply benefit which is currently measured in acre-feet per year and at the present time the project is at approximately full subscription, and has a waiting list of interested new participants.

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[1] The Sites Reservoir Project is a proposed off-stream water storage reservoir being developed, in accordance with the beneficiary pays principle, as a local, state, and federal partnership to primarily provide water supply reliability and environmental flows to benefit rural communities and farms, cities, and ecosystems. The proposed maximum storage capacity of Sites Reservoir is 1,500,000 acre-feet.

Funding and Financing

- **Local Project Participants**: Since 2015, local project participants have invested $43.8 million to advance Sites. In September 2021, the local project participants reaffirmed their investment in Sites by approving the Third Amendment to the 2019 Reservoir Project Agreement (Amendment 3 Project Agreement) and the associated work plan (Amendment 3 Work Plan). By approving the Amendment 3 Project Agreement, the local project participants have committed to fund work activities through the end of 2024. In addition to the Amendment 3 Project Agreement, the Authority worked with local project participants to develop a 2021 Draft Plan of Finance to evaluate the mechanisms for near-term and long-term financing. In conjunction with this effort, the Authority also developed the Sites Reservoir Benefits and Obligations Guiding Principles and Preliminary Terms (Guiding Principles) to allocate benefits, costs, financing and ownership obligations. Both the 2021 Draft Plan of Finance and 2021 Draft Guiding Principles were endorsed by the Reservoir Committee and Authority Board in October 2021. Over the past five months, the existing Local Project Participants have worked with their respective home agencies to execute the Amendment 3 Project Agreement. The Authority has initiated discussions with several entities that are looking to secure new water supplies by participating in the project.

- **State of California (Proposition 1):** The State continues to provide funding for development activities through an Early Funding Agreement (EFA) administered by the California Water Commission (CWC) under Proposition 1 Water Storage Investment Program (WSIP), which was executed in 2019. The EFA has a ceiling of $40.8 million. Over the past year, CWC has awarded two inflation adjustment to all of the WSIP projects. In March 2022, the CWC made an additional adjustment to the Sites Project increasing the overall award to $875 million. To date, $26.6 million has been received through the EFA, with an additional $14.2 million planned through the end of 2024 in the approved next work plan. In November 2021, the Authority submitted the Final WSIP Feasibility Report and 75% Non-Public Cost Share Materials to CWC staff to satisfy the Proposition 1 eligibility requirements. These documents informed the CWC's determination of feasibility in December 2021 deeming the project eligible for the full WSIP final award.

- **Bureau of Reclamation (WIIN Act):** In addition to the $24 million from previous appropriations, Congress appropriated $80 million in October 2021 for the Sites Project. The Authority and Reclamation has entered into multiple Financial Assistance Agreements to support environmental permitting and planning, and geotechnical evaluations. The Authority and Reclamation are coordinating to execute a new Financial Assistance Agreement to fund activities beyond 2022. The Authority will continue to seek additional WIIN Act appropriations in the coming fiscal years.

- **Federal Feasibility Study:** The Authority's efforts with Reclamation to advance the Federal Feasibility Study culminated in Reclamation's release of the Final Feasibility Report and a Secretary of Interior determination of feasibility in December 2020, a key milestone for maintaining eligibility under the WIIN Act.

- **WIFIA Loan:** In July 2021, the Authority submitted a letter of interest (LOI) for a WIFIA loan. In March 2022, the Authority received an invitation to apply for a WIFIA Loan for 49% of project costs (expected to be up to $2.2 billion). The Authority anticipates submitting its WIFIA Loan application in March 2023 and executing the loan agreement in mid 2024.

Work Plan Through 2021

The Authority's work plan through the end of 2021 consisted of $33.6 million of local, state, and federal funding to complete the deliverables to satisfy the State of California's eligibility through Proposition 1 while improving the Project's operational, cost, and permitting certainty. A status update on the milestones mentioned in the previous status report is as follows:

- Revised Public Draft Environmental Impact Report and Supplemental Draft Environmental Impact Statement released on November 12, 2021. Public review/comment period concluded on January 28, 2022.
- Authority's Final State WSIP Feasibility Report completed in November 2021. State Feasibility determination occurred in December 2021.
- The total project cost estimate was updated to 2021 dollars of $3.93 billion.

Reservoir Operations

The Authority is continuing reservoir operations modeling and analysis to further define and refine operations, water diversions, and potential yields in support of the environmental planning and permitting, engineering feasibility, and financing activities.

Environmental Planning & Permitting

The Authority, as the state lead agency, and Reclamation, as the federal lead agency, completed the development of the Revised Draft Environmental Impact Report / Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS) during this reporting period. The RDEIR/SDEIS was released for public review and comment on November 12, 2021. The Authority and Reclamation hosted public meetings on the RDEIR/SDEIS in December 2021 and the public comment period concluded in January 2022. The public comment period closed on January 28, 2022.

The Authority has ongoing discussions with the California Department of Fish and Wildlife (CDFW) to discuss the Sites Project, the permit application process, and supporting information for the permit applications. The Authority submitted the Construction Incidental Take Permit in January 2022. Ongoing work on the Operations Incidental Take Permit application has focused on the approach and analysis methodology. The Authority expects to submit the Water Right application in May 2022.

Engineering and Technical

The Authority is continuing to refine and optimize the Project's, including the MWI's, design and facilities based on updated ranges of reservoir operations. Ongoing engineering analysis and studies are supporting completion of environmental documentation and permitting activities. The Authority is also planning to undertake additional geotechnical investigations from 2022 to 2024. Current activities include additional geotechnical investigations in Colusa County between the existing Tehama Colusa Canal and the Glenn Colusa Main Canal to assist with determining the location of the Terminal Regulating Reservoir associated with. Additional geotechnical investigations to inform 30 percent design efforts are also being planned and the Authority is currently evaluating these efforts and determining the appropriate CEQA analysis and necessary permits and approvals.

Communications and Local Agency Coordination

The Authority continues to conduct outreach efforts with landowners, local community members, state and federal elected officials, government agencies, non-governmental organizations, and regional coalitions to advance Sites. The Authority hosted 9 public workshops in 2021 focused on "three big questions" related to financing and satisfying the Proposition 1 requirement for 75% non-public cost share: "What do we get?", "What does it cost us?", and "How do we pay for it?".

Work Plan Through 2024

The Authority's work plan through the end of 2024 consists of $120 million of local, state, and federal funding to complete the planning phase of the Sites Reservoir Project. A critical path schedule is being maintained as part of the approved work plan and a status update on the milestones is as follows:

Milestone	Anticipated Completion Date (as reported in November 2021 Status Report)	Anticipated Completion Date (as of April 2022)
Reclamation's Biological Assessment submitted to the U.S. Fish and Wildlife Service and National Marine Fisheries Service	February 2022	June 2022
Final Programmatic Agreement (Section 106) under the National Historical Preservation Act ready for signature	February 2022	August 2022
Water Right Application	February 2022	May 2022
Final EIR/EIS completed	June 2022	January 2023
Work with USDA Rural Development to extend USDA Loan Letter of Conditions	n/a	September 2022
Receive Water Right Order and Permit	2023	December 2023
Execute Administration of Public Benefits Agreements with State agencies	2023	July 2023
Complete necessary requirements to initiate bank financing	2023	Mar 2024
Close on WIFIA and USDA Loan	2023	Mid 2024
Advance Engineering to 30% design level (65% design level for selected features in support of permits)	n/a	January 2024
Anticipated start of construction based on current schedule and permitting activities	2024	Late 2024

Based on the current project schedule, the Authority anticipates initiating a loan agreement in mid 2024 with the acquisition of the critical permits, water right, and investor commitment. The physical construction work is projected to start in late 2024 and is approximately 6 years total duration, ending with operational completion in 2030. The timing for construction of the MWI has not yet been determined and will be evaluated as the engineering design progresses. The Authority will work in the coming months with USDA Rural Development to make necessary adjustments to extend the date by which the USDA loan needs to be executed to sometime in in 2024 and extending the construction start date to 2024 to reflect the most current updated schedule.

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 5/11/2022 4:45:32 PM
To: louis.sahagun@latimes.com
CC: Kevin Spesert [kspesert@sitesproject.org]; Marcia Kivett [MKivett@sitesproject.org]
Subject: Follow-up Items
Attachments: 20220510_Autority to State Board_Reg Water Right Application Submittal_Final signed[1].pdf; CDFW_RDEIR-SDEIS Comments.pdf; Listed Species That Could Be Affected and Key Permits.docx; RDEIR-SDEIS Number of Cultural SItes - Sites Valley.docx; Sites-Participation.pdf; Summary of Construction Costs Indicating New Conveyance.pdf

Hi Louis – Great to spend time with you yesterday. I hope you got the material you needed about the project for your article in your travels today. Don't hesitate to call if you have any other questions or information needs.

Jerry

Please find attached the materials you requested during our site tour yesterday.

1. Water Right submittal cover letter – the water right application along with the $600k+/- non-refundable fee was submitted to the State Water Resources Control Board today.
2. CDFW RDEIR/SDEIS comments – chapter 5 comments are where CDFW discusses a diversion criteria of 10.7 kcfs at Wilkins Slough which is what we are using for all of our permits and approvals, including the water right materials.
3. Listing of listed species that may be affected by the project – its important to be aware that we're being conservative in terms of what's possibly out there and the extent of presence. We'll know better once we have access for on-site surveys.
4. Synopsis for cultural village and burial sites in the inundation area – Chapter 22 of the RDEIR/SDEIS has more information. This write-up includes summary level of burial and village sites only. The two tribes we're working with very closely (monthly meetings) on these aspects are the Yoche DeHe Wintu and the Colusa Indian Community Council.
5. Breakdown of Participation capacity shares in the project – by annual water supplies (average annual AF per year) and storage space (AF). The numbers don't exactly total 1.5MAF because of the assumption about the amount of "deadpool" in the reservoir. Please note we are in the process of discussing increased federal participation with Reclamation given the prior feasibility determination of 25% investment and the funding availability under WIIN and the Bipartisan Infrastructure Legislation.
6. Summary of Construction Costs – I flagged the items that could generally be considered "new conveyance". There is a cost to use of existing conveyance facilities which is being negotiated. We include these costs in the roll up of unit cost of the project (ie $/AF) which is currently in the ballpark of $700/af, FOB released from the reservoir.

State And Federally Listed Species Affected By The Project

Species	Federal Status	State Status
Invertebrates		
Conservancy fairy shrimp	E	
Vernal pool fairy shrimp	T	
Vernal pool tadpole shrimp	E	
Valley elderberry longhorn beetle	T	
Reptiles and Amphibians		
California red-legged frog	T	
Giant garter snake	T	T
Birds		
Tricolored blackbird		T
Swainson's hawk		T
Bald eagle		E, FP
Golden eagle		FP
Fish		
Winter run Chinook salmon	E	T
Spring run Chinook salmon	E	T
Steelhead	T	
Green sturgeon	T	
Delta Smelt	T	E
Long fin smelt	FC	T
Key: E = Endangered, T= Threatened, FC = Candidate for Federal listing, FP = California Fully Protected Species		

Key Permits Required for the Project

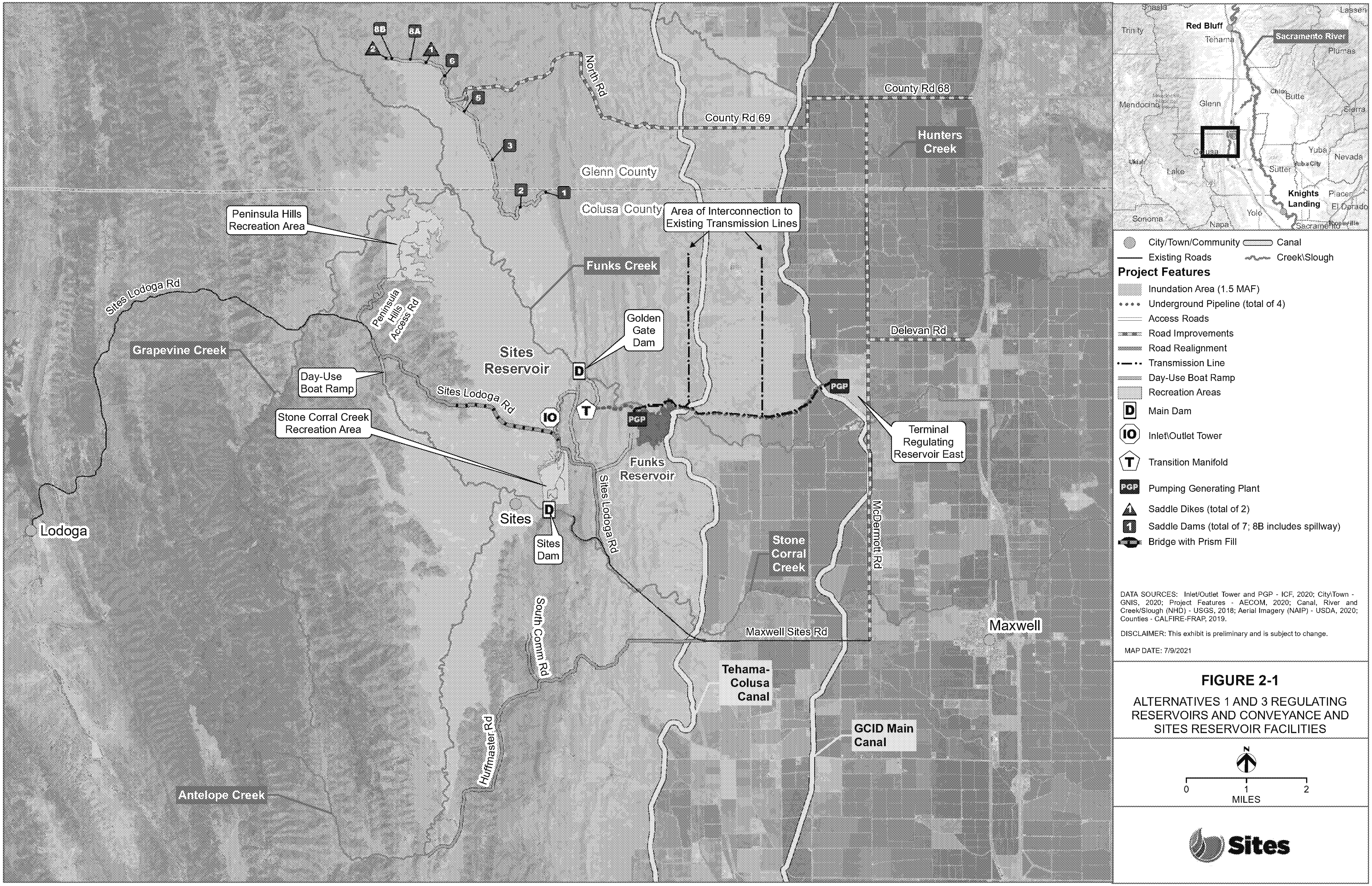
(Note, this list is not all inclusive. A complete list of permits required for the Project is included in Chapter 4 of the RDEIR/SDEIS here: Environmental Review - Sites Reservoir (sitesproject.org)).

US Army Corps of Engineers, Sacramento District	Clean Water Act Section 404 permit	Permit related to the discharge of dredged or fill material into waters of the United States.
U.S. Fish and Wildlife Service and National Marine Fisheries Service	Section 7 Endangered Species Act Consultation	Consultation related to determining that any discretionary action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitat. Incidental Take Statement/Incidental Take Permit for any take of listed species.
U.S. Fish and Wildlife Service	Incidental Eagle Take Permit; Nest Take Permit	Permit for the take of bald and/or golden eagle and their nests.
The Advisory Council on Historic Preservation; California Office of Historic Preservation	Section 106 consultation	Consultation related to considering the effects of a federal undertaking on historic and cultural resources.
California Department of Fish and Wildlife	California Endangered Species Act Incidental Take Permit	Permit for take of state-listed endangered or threatened species or species proposed for state listing
	Lake and Streambed Alteration Agreement	Related to any substantial diversion or obstruction of the natural flow of, or substantial change or use of any material from the bed, channel, or bank of, any river, stream, or lake; crossing of streams, rivers, or lakes (also for reservoirs, which interrupt streams)
State Water Resources Control Board	Water Rights Permit	Related to the diversion and utilization of water from existing streamflow
Central Valley Regional Water Quality Control Board	Section 401 Water Quality Certification	State certification that the federal permit for discharge of dredged or fill material to waters of the United States does not violate state water quality standards.

Number of Cultural (Burial and Village Sites) In the Sites Valley

The Archaeological Research Program at California State University, Chico conducted archaeological studies of a good portion of the current Project Area from 2001 to 2003. For the purpose of these previous archaeological studies, village sites were defined as areas having evidence of at least one of the following (but not necessarily all of the following): dietary remains reflecting multiple seasons, ground and flaked stone, midden soils, housepits, and human burials. Based on these studies, 11 Native American village sites have been recorded within the reservoir inundation area.

No isolated Native American human remains were found in these archaeological studies. However, two existing cemeteries and a single grave marker are located within the reservoir inundation area. There may be unmarked human remains outside but near the existing cemeteries or remains found in other areas of the inundation area. We are planning for the relocation of all human remains to outside of the inundation area. Relocation of these individuals would be completed consistent with State and Federal law and conducted in close coordination with family/next of kin and local Tribes for any Native American remains.



DATA SOURCES: Inlet/Outlet Tower and PGP - ICF, 2020; City\Town - GNIS, 2020; Project Features - AECOM, 2020; Canal, River and Creek/Slough (NHD) - USGS, 2018; Aerial Imagery (NAIP) - USDA, 2020; Counties - CALFIRE-FRAP, 2019.

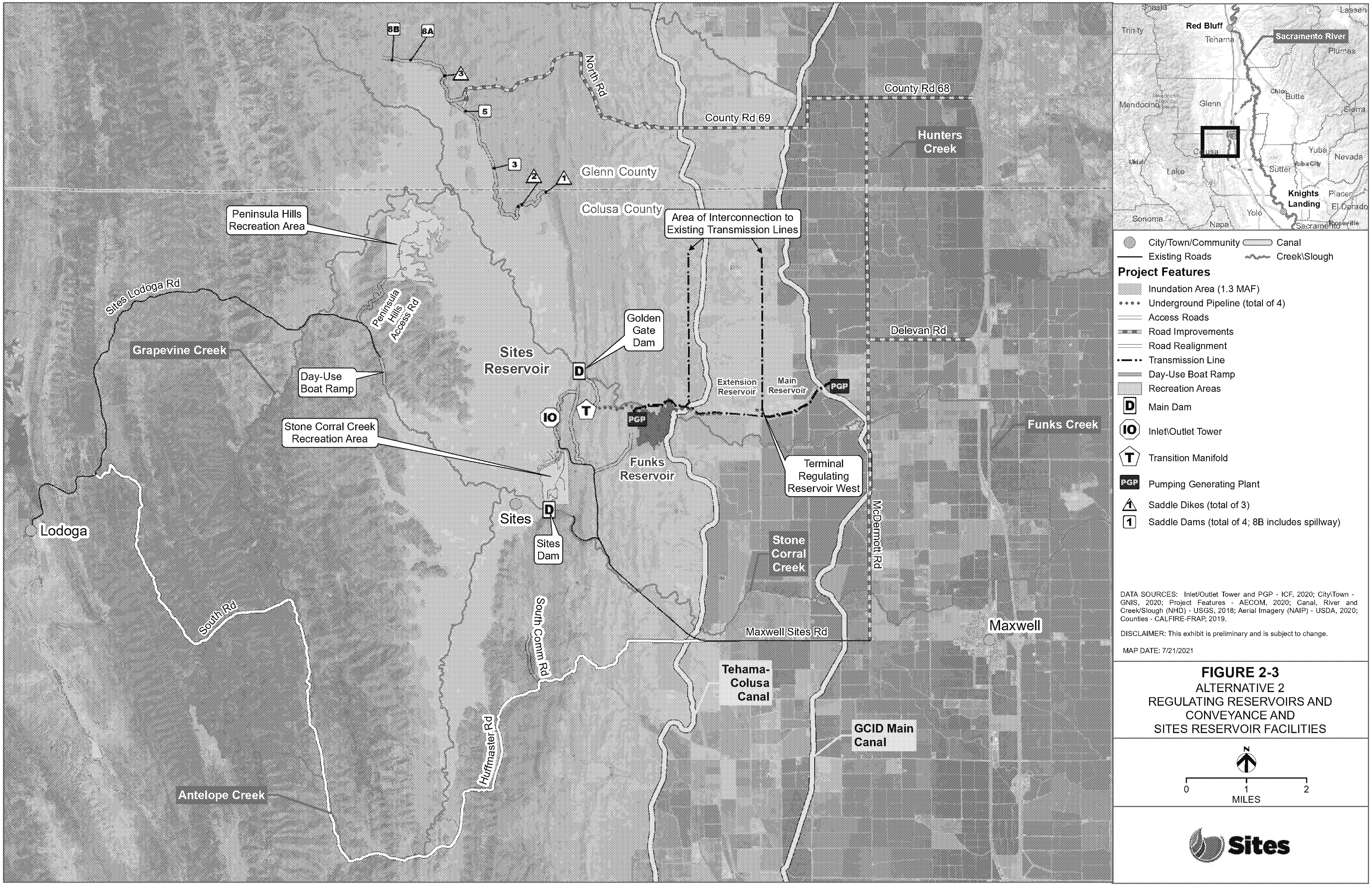
DISCLAIMER: This exhibit is preliminary and is subject to change.

MAP DATE: 7/9/2021

FIGURE 2-1

ALTERNATIVES 1 AND 3 REGULATING RESERVOIRS AND CONVEYANCE AND SITES RESERVOIR FACILITIES

PATH: \\PDCCITRDSGIS1\PROJECTS_1\SITES_PA\00528_20\FIGURES\DOC\EIREIS\1_DEIR\01_ADEIR\CHAPTER2\FIG2-1_ALT1_3_REGRESERVOIRS_CONV.MXD - USER: 24991 - DATE: 7/9/2021



DATA SOURCES: Inlet/Outlet Tower and PGP - ICF, 2020; City\Town - GNIS, 2020; Project Features - AECOM, 2020; Canal, River and Creek/Slough (NHD) - USGS, 2018; Aerial Imagery (NAIP) - USDA, 2020; Counties - CALFIRE-FRAP, 2019.

DISCLAIMER: This exhibit is preliminary and is subject to change.

MAP DATE: 7/21/2021

FIGURE 2-3
ALTERNATIVE 2
REGULATING RESERVOIRS AND
CONVEYANCE AND
SITES RESERVOIR FACILITIES

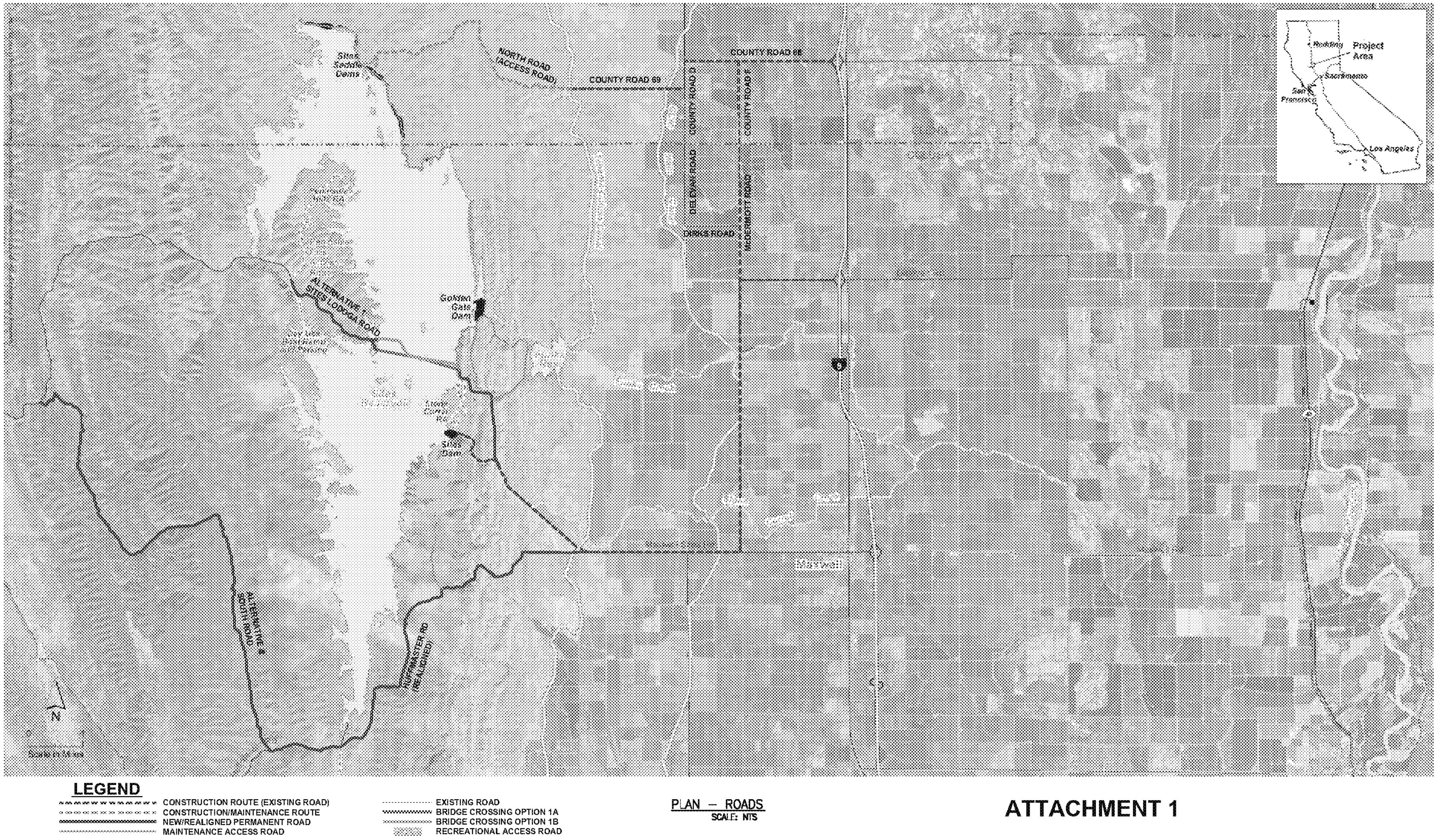
PATH: \\PDCCITRDSGIS1\PROJECTS_1\SITES_PA\00528_20\FIGURES\DOC\EIREIS\1_DEIR\01_ADEIR\CHAPTER2\FIG2-3_ALT2_REGRESERVOIRS_CONV.MXD - USER: 24991 - DATE: 7/21/2021

2.5.1.7 New and Existing Roadways

Approximately 46 miles of new paved and unpaved roads would provide construction and maintenance access to the facilities, as well as public access to the recreation areas. Table 2-4 identifies these roads and their purposes (i.e., construction access, local access, and maintenance access). Figure 2-35 shows the locations of all local access, construction access, and maintenance access roads that would be needed. The general objectives and maintenance responsibilities for these road types are discussed below, and more detailed information for construction access, local access, and maintenance access roads presented in the corresponding subsections. The road improvements and roadway designs are being coordinated with the Counties of Colusa and Glenn.

Construction access roads would be designed to provide the roadway improvements necessary to the movement of construction equipment and transport of materials. Roadways that would be used for construction access and local access would be designed to achieve the objectives for both uses and prioritize needs for local traffic use and safety. Roads used solely for construction access would be designed with two 12-foot-wide gravel lanes and up to 2-foot-wide shoulders. These roads would be used for maintenance access after completion of construction. Permanent facility access roads constructed from gravel and asphalt would facilitate operation and maintenance. These access roads would require new construction or the relocation of existing public county roads. Temporary gravel roads would also be built during construction. The maintenance of roads used for both construction and local access would be the Authority's construction contractor's responsibility during construction and the responsibility of the departments for the Counties of Colusa or Glenn having jurisdiction over those roads after construction.

Local access roads that would be improved or relocated for construction purposes would provide reliable infrastructure for the traveling public, accommodate transportation needs, and be consistent with state and local design standards. These improved roads would enable construction vehicles to safely travel and pass one another. After construction of the reservoir was completed, these roads would be maintained to support the operation of the Sites Reservoir. Some of these roads would also be available for public use. Local access roads would generally



Source: AECOM 2020
Drawing No. STS–305–C–2601

Figure 2-35
Local Access, Construction Access, and Maintenance Access Roads

have two 12-foot-wide lanes with paved shoulders, and their postconstruction maintenance would be the responsibility of the departments for the Counties of Colusa or Glenn having jurisdiction over them.

Maintenance access roads would be constructed or improved in accordance with the equipment and personnel required for operations and maintenance of specific facilities. As discussed above, roads installed for construction access would be repurposed for maintenance following construction. Repurposed maintenance roads would have one 15-foot-wide minimum gravel lane with no shoulders.

Table 2-4. Sites Project Roads and Purposes Common to Alternatives 1, 2, and 3

Roads	Road Purpose		Approx. Current Length (miles)	Approx. Improved Length (miles)	Improvement Types
	Colusa County[2]	Glenn County[2]			
Road 68	--	Local, Construction	3	3	Shoulder improvements/ intersection widening, two structure improvements
Road D	--	Local, Construction	0.5	0.5	Shoulder improvements/ intersection widening, two structure improvements
Road 69	--	Local, Construction	2	2	Shoulder improvements/ intersection widening, three structure improvements
North Road	--	Construction, Maintenance	0	5	New gravel road
Delevan Road	Local, Construction		2	2	Shoulder improvements/ widening
McDermott Road	Local, Construction	Local, Construction	8	4	Shoulder improvements/ widening/paving, five structure improvements
Saddle Dam Road – North (5–9) (provide access to northern portions of Sites Reservoir and the saddle dams)	--	Construction, Maintenance	1	2	New gravel road
Saddle Dam Road – South (1–5)	Maintenance	Maintenance	0	3	New road
Huffmaster Road realigned	Local	--	12	7	Gravel road for residents

Roads	Road Purpose		Approx. Current Length (miles)	Approx. Improved Length (miles)	Improvement Types
	Colusa County[2]	Glenn County[2]			
Sites Lodoga Temporary Detour Road (Shoo-Fly)	Local, Construction	--	1	1	New, temporary gravel road
Day-Use Boat Ramp (westside)	Local	--	0	0.3	New paved road
Peninsula Hills Recreation Area (provide access from Sites Lodoga Road to the Peninsula Hills Recreation Area)	Local	--	0	4	New gravel road
Access Road A (Funks PGP/Golden Gate Dam)	Maintenance	--	0	1	New road
Access Road B (Funks PGP/Golden Gate Dam)	Maintenance	--	0	0.4	New road
Access Road C1 (Funks PGP)	Maintenance	--	0.4	0.4	Existing road
Access Road C2 (Funks PGP/Golden Gate Dam)	Maintenance	--	0.6	0.6	Existing jeep road
Stone Corral Creek Recreation Area/Sites Dam	Local	--	0	2.5	New road
Comm Road South	Local	--	0	1	New road

Table Notes:
Local access includes local road for public use and recreational access.
Any improvement type identified as a new road has an approximate current length of 0.

The roadway alignments discussed below are based on service needs and existing planning-level-based mapping to establish a corridor width along roadways. Corridor widths would vary depending on the level of topographical relief—greater relief requires greater flexibility throughout the design process to allow the engineers to move the road within the corridor.

Construction traffic will be routed around the community of Maxwell as part of the Project and per the traffic management plan. Operation of recreational areas at Sites Reservoir would result in an influx of seasonal recreation use and associated traffic. Additional transportation improvements in Maxwell may be necessary, specifically along Oak Street in Maxwell to support the seasonal recreation trips. The Authority will work with the County of Colusa to identify and implement improvements within Maxwell such as lighted pedestrian crossings, stop signs, and other traffic calming features. The disturbance area for roads would include the footprints of the roads and stream crossings, the staging areas for materials and equipment, and the area needed to construct the facilities and access roads. Traffic not construction related and traveling through certain parts of the construction zone (e.g., Sites Lodoga Road) would be diverted around construction disturbance areas in accordance with a TMP.

Initial construction activities would involve establishing staging areas, surveying and marking roadways, clearing, and grading. Road construction would entail making road cuts and fills; hauling away excess cut materials; constructing culverts; laying aggregate road base and asphalt; erecting fences, guardrails, and signs; installing roadway striping and reflectors; restoring temporary disturbance areas; and cleaning up the work sites.

Construction Access

Construction access for Sites Reservoir and supporting facilities would occur on public roads from I-5 to the reservoir site on the north and at Sites Lodoga Road on the east. These roads currently cross small creeks and irrigation canals, and the crossings are generally reinforced through concrete box culverts. There are three primary construction access routes for consideration that would most likely be defined for use by the Authority's construction contractor.

The first construction access route would be on 5.5 miles of existing 24-foot-wide paved road from I-5 west along Road 68, south on Road D, and west on Road 69 to just west of the TC Canal. The road would then revert to a single lane, 12-foot-wide gravel road (North Road), which would be temporary and continue for approximately 5 miles along existing ranch roads and trails to the north end of the Sites Reservoir at the saddle dams. From this location, the Authority's construction contractor would establish their own onsite access roads within the limits of the reservoir.

The second construction access route would be on 7.2 miles of existing paved road from I-5 west along Delevan Road, north along McDermott Road, and west on Road 69 to just west of the TC Canal. Approximately 1.5 miles of McDermott Road between Dirks Road and West Glenn Road consists of gravel; therefore, it is assumed paving would be needed to accommodate the volume of heavy construction traffic.

The third construction access route would be on 12 miles of existing paved road from I-5 along Delevan Road, south along McDermott Road to Maxwell Sites Road, and then west to the existing gravel access road to Funks Reservoir. The first mile of this gravel road would be the initial segment of the Sites Lodoga Road realignment. This gravel road would also provide access to the Funks PGP and Golden Gate Dam. Maxwell Sites Road would provide access to Sites Dam. Construction equipment/materials would not be permitted to pass through the community of Maxwell on the Maxwell Sites Road; therefore, the construction access roads would circumvent Maxwell.

The existing roads are nonstandard in geometry and have inadequate roadbed structural sections to accommodate the large, heavy vehicles that would be used to transport construction equipment and materials. These roads consist of Road 68, Road D, Road 69, Delevan Road, and McDermott

Road. They are narrow and typically include two paved 11-foot- or 12-foot-wide lanes and 1- to 3-foot-wide earthen shoulders. The pavement conditions of Road 68, Road D, and Road 69 pavement conditions were identified as “at risk”, “poor”, and “very poor”, respectively, upon visual inspection by Project engineers. A segment of McDermott Road in Colusa County is gravel. Road 69 transitions to a single-lane, gravel road west of the TC Canal. The following improvements would need to be implemented on these roadways:

- Roadbed and intersection widening to allow for safe mobility of construction traffic that would be comingled with local vehicular and agricultural equipment traffic
- Roadbed reconstruction to enable use by large, heavy vehicles transporting construction equipment and materials
- Horizonal and vertical curve corrections
- Drainage feature improvements to allow for proper drainage

Reconstruction of the aforementioned roads would include the addition of new 2-foot-wide paved shoulders to each lane, as well as potential modifications to existing creek and irrigation canal crossings (as described below). The new shoulders would be within the public right-of-way, as would any temporary work areas needed to reconstruct the roads. All existing roadway improvements would be designed to avoid or minimize impacts on existing utility infrastructure and public right-of-way. Once the roads are constructed, all county roads would be maintained by the Counties of Glenn or Colusa, while specific access and maintenance roads (e.g., North Road, South Comm Road) would be maintained by the Authority.

The following roads have existing creek and irrigation canal crossings. It is assumed that these crossings would need to be widened, strengthened, or replaced, depending on their structural condition and load rating capacity.

- Road 68 – two crossings
- Road D – two crossings
- Road 69 – three crossings (two on paved roads crossing the TC Canal and GCID Main Canal, and one on a gravel road)
- McDermott Road – five crossings

Local Access

In addition to the local roads described above that would be improved for construction purposes and then remain local access roads, a number of other public local roads would be relocated or developed to accommodate reservoir facilities. These roads include Sites Lodoga Road, Huffmaster Road, Comm Road South, and recreation area roads. There would also be one temporary detour during construction, the Sites Lodoga Temporary Detour Road (Shoo-Fly). Permanent changes to Sites Lodoga Road and Huffmaster Road are discussed in Sections 2.6 and 2.7.

- **Comm Road South** – Access to existing communication facilities would consist of a gravel road that would start near the northern end of Huffmaster Road and proceed north to the communications tower.
- **Recreation Area Roads** – New recreation area roads would provide access from Sites Lodoga Road to the Peninsula Hills Recreation Area, day-use boat ramp, and Stone Corral Creek Recreation Area. The access road to Peninsula Hills Recreation Area on the west side of Sites Reservoir would be paved. The access road to the day-use boat ramp, which would also be on the west side of the reservoir, would be paved. The access road to the Stone Corral Creek Recreation Area on the east side of the reservoir would be a combination of paved and gravel.
- **Sites Lodoga Temporary Detour Road (Shoo-Fly)** – A temporary detour road would be constructed to expedite construction and maintain traffic movement through the reservoir site during the construction of Sites Dam and the bridge across the reservoir (Alternatives 1 and 3 only). This road would convey local traffic for a period of approximately 1 year and would be aligned around the Sites Dam site. There would be overlap with a section of the Sites Lodoga realignment from Maxwell Sites Road to near the easterly bridge at the top of the ridge. The temporary detour road would then split off to the south and traverse hilly terrain before Comm Road South rejoined Sites Lodoga Road near its intersection with Peterson Road.

Maintenance Access

New and existing maintenance access roads would provide access to the main dams, saddle dams and dikes, I/O Works, and Funks PGP. Except for the existing road to Funks Reservoir, the maintenance access roads would be single-lane, 15-foot-wide gravel roads with no shoulder. Comm Road South would be a local access and maintenance access road.

North Road would begin at the end of the unpaved Road 69, continue 5 miles to the reservoir's edge, and connect with several new maintenance access roads that would provide access to the saddle dams and dikes. Access Road A1 would be a new gravel road along the crest of the Golden Gate Dam with minor cuts and fills. Access Roads B1 and B2 would be new gravel roads connecting to the I/O Works and Golden Gate Dam with minor cuts/fills. Access Road C1 is would be a two-lane, 30-foot-wide, paved road to access Funks Reservoir and the existing road to the reservoir would be maintained. Access Road C2 would be improved from an existing jeep trail at the east base of the Golden Gate Dam to a gravel road that would extend off Access Road C1.

ALTERNATIVES 1 & 3

2.6.3 New and Existing Roadways

Sites Lodoga Road is an east-west, two-lane major collector road that extends through the community of Maxwell, which is adjacent to I-5, and provides an important emergency and evacuation route in a limited roadway network to and from the rural communities of Lodoga and Stonyford. Sites Lodoga Road becomes Maxwell Sites Road east of the community of Sites, which is in the inundation area. The Sites Reservoir would eliminate east-west access to I-5 (east of the reservoir) from Stonyford and Lodoga (west of the reservoir) because it would inundate the current alignment of Sites Lodoga Road. Because Sites Dam and the inundation area would eliminate access on Sites Lodoga Road, an alternative method for access west of the reservoir would be needed. Under Alternatives 1 and 3, this access is provided by realigning a segment of Sites Lodoga Road and constructing a bridge over the reservoir. The relocated segment of Sites Lodoga Road would include 5-foot-wide shoulders adjacent to the two 12-foot-wide lanes to accommodate bicycles and would connect to the new bridge.

The realigned Sites Lodoga Road would be placed across the reservoir and extend 7,800 feet; it would necessitate the construction of four fill prisms that would be up to 150 feet tall and would support two shorter bridge segments approximately 3,450 and 4,050 feet long. Figure 2-39 shows a typical cross-section of the road and the bridge that would be needed to cross the reservoir. The roadway and bridge profile would be at 2 feet above the maximum flood plus wave height. The maximum flood plus wave height is set at 10 feet above the normal WSE (elevation 498 feet for the 1.5-MAF reservoir).

The bridge structure would consist of a cast-in-place, prestressed concrete box girder that would have two lanes with a total width of 35.5 feet and 4-foot-wide shoulders. The bridge would have California Department of Transportation-approved edge barriers with small-diameter electrical conduits, a suicide prevention barrier, emergency phone service facilities, deck drains, and an opening for potential utilities. The bridge design does not include sidewalks due to the remote rural nature of this site. The bridge would be exposed to high winds; therefore, high wind advisory facilities, such as static roadside signs or extinguishable message signs that are illuminated when instruments measure high winds, would be installed.

The disturbance area for bridge construction would include the footprint of the bridge structure, the staging areas for materials and equipment, and the area needed to construct the facilities and access roads. Traffic that was not construction-related would be diverted around construction disturbance areas in accordance with a TMP. Initial construction activities would involve establishing staging areas, surveying and marking roadways, clearing, and grading. Bridge construction would consist of constructing the foundation and prisms, including drilled-pier installation; bridge columns; and bridge spans.

The Huffmaster Road realignment, which is associated with the easterly segment of Sites Lodoga Road realignment, would move the affected segment out of the Sites Reservoir footprint. The realigned Huffmaster Road would be a gravel road to serve the residences currently located at the end of the existing Huffmaster Road.

ALTERNATIVE 2

2.7.4 New and Existing Roadways

Realignment of Huffmaster Road and construction of the new South Road would occur under Alternative 2 (Figure 2-35). As with Alternative 1, Sites Dam and the inundation area would inundate 4.2 miles of the Sites Lodoga Road and eliminate access on this 13-mile-long collector road. Similar to Alternative 1, the relocated segment of Sites Lodoga Road would include 5-foot-wide shoulders adjacent to the two 12-foot-wide lanes to accommodate bicycles and would provide access to the Stone Corral Creek Recreation Area. Similar to Alternative 1, Huffmaster Road would be realigned for approximately 9 miles. The approximately 20-mile-long South Road would be constructed and connected to the end of the realigned portion of Huffmaster Road. The total length of the realigned portion of Huffmaster Road and the new South Road would be approximately 30 miles, all of which would be paved.

All other permanent access, maintenance, detour, and construction roads would be the same for the reservoir facilities between Alternatives 1 and 2. These roads would be needed regardless of the inundation area size to serve the new facilities and recreation areas.

The bridge described under Alternative 1 would not be built under Alternative 2. The South Road would generally require more excavation and more aggregate when compared to the bridge under Alternative 1. These materials are listed in Table 2C-26 in Appendix 2C.

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/12/2022 11:57:21 AM
To: Hassrick, Jason [Jason.Hassrick@icf.com]
CC: Spranza, John [john.spranza@hdrinc.com]
Subject: RE: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Thanks for the summary Jason. Much appreciated. I support you being part of the discussion with Cyril. Helping Doug get a better understanding of these papers and their implications is important to the Project and this effort is chargeable to Sites. Thanks much!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Thursday, May 12, 2022 9:47 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Spranza, John <john.spranza@hdrinc.com>
Subject: RE: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Ali,

I had a chat with Doug yesterday and clarified a misunderstanding that he had regarding the effect of flow on survival and explained that the main takeaway from that figure is that pulse flows have a much larger effect on survival during dry years than during wet years. He still had some questions regarding Cyril's flow threshold paper being different than our flow-survival curves, so he is going to set up a call with Cyril to get a better understanding of that. Let me know if you support me attending that meeting, as I mentioned that I could be available for it.

Jason

JASON HASSRICK
+1.628.895.6716 direct, +1.530.312.3275 mobile
ICF Fish and Aquatic Science Team

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, May 5, 2022 3:31 PM
To: Hassrick, Jason <Jason.Hassrick@icf.com>; John Spranza <John.Spranza@hdrinc.com>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Jason – I am just following up on previous emails from my vacation. See the email below from Doug. I think he might be miss interpreting your study results. Would you be willing to chat with him? I think we can make this very informal and I am comfortable with you just reaching out directly to him. I don't see the need for anyone from Sites to be on the phone as I want to give Doug a safe space to ask questions freely of you.

Let me know if you'd be willing to reach out to him. This, of course, is chargeable to the Sites Project.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

---

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Thursday, April 14, 2022 3:27 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Jerry Brown <jbrown@sitesproject.org>
Subject: FW: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Dear Jerry and Ali,

Thank you again for sending us the daily diversion tool, and to Jerry for coffee/tea the other morning. I wanted to follow up with two things for you:

First, I wanted to make sure that you were aware of this new peer reviewed scientific study which concludes that for juvenile winter-run Chinook salmon, migratory survival down the Sacramento River is reduced when flows are less than approximately 24,000 cfs (equivalent to 700 cubic meters per second). We've submitted this paper to CDFW (see below), and wanted to make sure that this was included in the JPA's administrative record for NEPA/CEQA since this was new information that was not available at the time of the public comment period on the EIS/EIR.

Second, we've been analyzing the potential changes in water diversions to storage using the daily diversion tool, and it appears that the proposed change to the bypass flow of 10,700 cfs from Oct to June results in an approximately 25% reduction in diversions to storage. It sounds like that is similar to what y'all are finding (our numbers are lower than what WRMWSD reported to their Board). In addition, as we have been exploring the model, we're not sure that the Delta outflow requirements in the model are actually working to limit water diversions to storage. It may be (probably is!) user error on our part, but if we're not able to get the model to work right in the next week or two we may want to check in to make sure the model is actually working correctly.

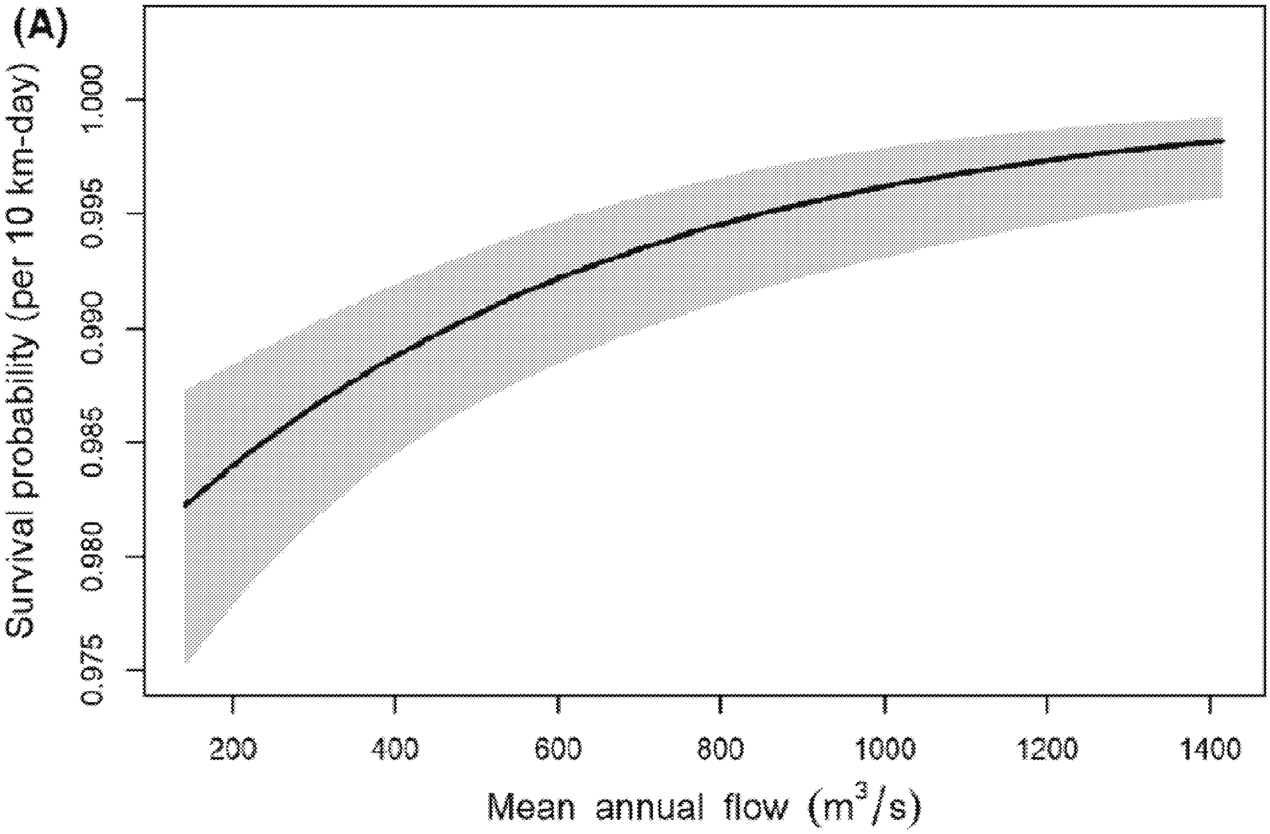
Thanks,
Doug

From: Obegi, Doug
Sent: Friday, March 25, 2022 10:52 AM
To: Kristal Davis-Fadtke <Kristal.Davis-Fadtke@wildlife.ca.gov>
Cc: jon@baykeeper.org
Subject: New study concludes Sac River flows less than 21,000 cfs reduce winter-run survival

Hi Kristal,

I wanted to make sure you were aware of this new paper, which finds that for winter-run Chinook salmon, juvenile migratory survival down the Sacramento River is reduced when flows are less than around 24,000 cfs / 700 cubic meters per second:

"For example, when flow is less than about 700 m3/s, given the confidence interval, pulse flows will have a high probability of having a positive effect on survival. The relationship also indicates what the magnitude of the effect may be. For example, when mean annual flow is 600 m3/s, a pulse flow is going to have half the effect of a pulse event than when mean annual flow is 200 m3/s."



This paper indicates that at least for hatchery winter-run Chinook salmon, higher bypass flow thresholds for Sites Reservoir than 10,700 cfs are necessary to fully mitigate impacts and avoid further reductions in juvenile survival of this endangered species.

Best,
Doug

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Friday, March 25, 2022 9:23 AM
To: Obegi, Doug <dobegi@nrdc.org>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,

Attached is the published paper. Thanks for your interest.

Jason

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Tuesday, February 1, 2022 12:39 PM
To: Hassrick, Jason <Jason.Hassrick@icf.com>; arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Aha – thanks!

From: Hassrick, Jason <Jason.Hassrick@icf.com>
Sent: Tuesday, February 1, 2022 12:38 PM
To: Obegi, Doug <dobegi@nrdc.org>; arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,

We did not work up cumulative survival because that is something that Arnold is preparing for a separate paper. As I mentioned to you before, I'll send out the finalized paper to you after I go through the proofs. I should receive them from the journal this week.

Jason

From: Obegi, Doug <dobegi@nrdc.org>
Sent: Tuesday, February 1, 2022 12:17 PM
To: arnold.ammann <arnold.ammann@noaa.gov>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: RE: FW: Request for pre-publication copy of your recent manuscript

Sorry, no, I was interested in whether y'all had calculated what the survival rate down the length of the Sacramento River would be at different flow levels, based on the survival rate per 10 km reach shown in the flow:survival curve in Figure 8A. In other words, converting the flow:survival graph in Figure 8A into survival down the entire river rather than per 10 km segment.

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 12:09 PM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov; Hassrick, Jason <Jason.Hassrick@icf.com>; Perry, Russell <rperry@usgs.gov>
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Hi Doug,
We have overall river survival by year, and flow varies by year. Is that what you are looking for? I will pull up that data for you.
Arnold

On Tue, Feb 1, 2022 at 11:36 AM Obegi, Doug <dobegi@nrdc.org> wrote:

> While I have your ear... Did y'all calculate what the overall change in survival is in the Sacramento River at the different flow levels in Figure 8A (the cumulative change in survival over the entire river at the various flow levels on that curve, rather than the change per 10 km, assuming flows and other covariables held constant)?
>
> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
> **Sent:** Tuesday, February 1, 2022 11:32 AM
> **To:** Obegi, Doug <dobegi@nrdc.org>
> **Cc:** miles.daniels@noaa.gov
> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>
> Great!
>
> On Tue, Feb 1, 2022 at 11:31 AM Obegi, Doug <dobegi@nrdc.org> wrote:

Yeah, it came through and I'm looking at it now.

From: Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
Sent: Tuesday, February 1, 2022 11:32 AM
To: Obegi, Doug <dobegi@nrdc.org>
Cc: miles.daniels@noaa.gov
Subject: Re: FW: Request for pre-publication copy of your recent manuscript

Were you able to download it? I got a system message saying it was too large.

On Tue, Feb 1, 2022 at 11:24 AM Obegi, Doug <dobegi@nrdc.org> wrote:

> Thanks Arnold! Look forward to reading the paper.
>
> Take care,
>
> Doug
>
> ---
>
> **From:** Arnold Ammann - NOAA Federal <arnold.ammann@noaa.gov>
> **Sent:** Tuesday, February 1, 2022 10:57 AM
> **To:** Obegi, Doug <dobegi@nrdc.org>
> **Cc:** miles.daniels@noaa.gov
> **Subject:** Re: FW: Request for pre-publication copy of your recent manuscript
>
> Hello Doug,
>
> Please find attached the early online version of the paper. Let me know if you have any questions about it.
>
> Cheers,
>
> Arnold
>
> On Mon, Jan 31, 2022 at 1:49 PM Obegi, Doug <dobegi@nrdc.org> wrote:
>
>> Congratulations to you both on this new paper published in CJFAM! Very cool. Any chance that one of you has a pre-publication version that you could share with me?
>>
>> ---
>>
>> **From:** Obegi, Doug
>> **Sent:** Monday, January 31, 2022 1:24 PM
>> **To:** jason.hassrick@icf.com
>> **Subject:** Request for pre-publication copy of your recent manuscript
>>
>> Hi Jason,
>>
>> I hope you're doing well these days. Congratulations on your new paper published in CJFAM! (https://afspubs.onlinelibrary.wiley.com/doi/abs/10.1002/nafm.10748)

Do you have a pre-publication version of the manuscript that you would be willing to share with me, since the paper is currently not open access?

Thanks,

Doug

DOUG OBEGI
*Senior Attorney**
Water Program

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** Admitted to practice in California*

--

Arnold J. Ammann
National Marine Fisheries Service
Fisheries Ecology Division
110 McAllister Way
Santa Cruz, CA 95060
Tel: 831-331-9947
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--

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Tel: 831-331-9947
arnold.ammann@noaa.gov

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 5/12/2022 1:01:24 PM
To: JP Robinette [jrobinette@sitesproject.org]
Subject: FW: Sites - Summary document for CRC conversations
Attachments: PublicDraft_Ch06_SurfaceWaterQuality_KN Highlights.docx; RDEIR-SDEIS - Ch02 - Project Description_KNHighlights.docx; FW: WQ discussions with Bruce Lindquist and CRC; Sites_CBD _Rice Com Summary Brief 2022-0210.docx

Flag: Flag for follow up

Tada!

John Spranza

D 916.679.8858 M 818.640.2487

From: Spranza, John
Sent: Thursday, February 10, 2022 1:40 PM
To: JP Robinette (JRobinette@BrwnCald.com) <JRobinette@BrwnCald.com>
Cc: Kayla Ann Nowlin (Kayla.Nowlin@hdrinc.com) <Kayla.Nowlin@hdrinc.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>
Subject: FW: Sites - Summary document for CRC conversations

JP,
Ali asked that we provide you with some background information on Sites project and CBD relationship in preparation for your meeting with the Rice Commission. Kayla put the attached documents together for you, and includes a summary brief with page references to the attached draft REIR/SEIS document with the referenced the text highlighted. Also included is an email summarizing the conversations I had with Bruce Lindquist and the CRC regarding water quality effects to rice. This is not a comprehensive list of all CBD discussions in the document, but it will give you the baseline information I think you would need (likely more than what you would need)

Please let us know if you have any questions.
John

John Spranza

D 916.679.8858 M 818.640.2487

From: Nowlin, Kayla Ann <Kayla.Nowlin@hdrinc.com>
Sent: Thursday, February 10, 2022 12:16 PM
To: Spranza, John <John.Spranza@hdrinc.com>
Subject: Sites - Summary document for CRC conversations

Hi John,

Here is the document. I moved your email with Bruce to the first information referenced because it's a more informative order to read it in.

Kayla Nowlin
Aquatic Biologist II

HDR

2379 Gateway Oaks, Suite 200
Sacramento, CA 95833
D 916.679.8853 C 971.645.8418
Kayla.Nowlin@hdrinc.com

From: Spranza, John [John.Spranza@hdrinc.com]
Sent: 2/7/2022 3:20:02 PM
To: Nowlin, Kayla Ann [Kayla.Nowlin@hdrinc.com]
Subject: FW: WQ discussions with Bruce Lindquist and CRC

See below

John Spranza

D 916.679.8858 M 818.640.2487

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Friday, June 18, 2021 2:07 PM
To: Spranza, John <John.Spranza@hdrinc.com>
Cc: Williams, Nicole (Nicole.Williams@icf.com) <Nicole.Williams@icf.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: WQ discussions with Bruce Lindquist and CRC

This is fantastic news. Thank you for keeping this moving while I was away and for the great summary to get me up to speed quickly! Much appreciated.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Reservoir Project | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Tuesday, June 8, 2021 3:50 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Williams, Nicole (Nicole.Williams@icf.com) <Nicole.Williams@icf.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: WQ discussions with Bruce Lindquist and CRC

Ali,
We had our meeting with Dr Lindquist today and Tim and Paul from the CRC were also in attendance. Here are the key outcomes of our discussion:
1. Mercury
a. Our anticipated release levels of total Hg and methylmercury are below what Bruce, Tim and Paul (the group) would consider "problem levels" and they are not concerned that project releases would negatively affect rice via accumulation within the grain
b. Bruce will be providing us with some papers on levels that have been measured to back that assertion up

c. Our modeled levels of methylmercury are within the range that has been measured within the CBD. The recycling of water within the rice growers of the CBD result in concentrations that are equal to, or slightly below our modeled release values.

d. Based on Sites release patterns, the group is not concerned that our releases would be of concern during winter flood-up

2. Arsenic

a. Our anticipated release levels of As are below what Bruce, Tim and Paul would consider “problem levels” and they are not concerned that project releases would negatively affect rice via accumulation within the grain

b. Based on information prepared by the CRC for litigation on As levels in rice under Prop 65, the highest measured concentration of As in rice grain was 249 ppb, the group did not think that the modeled levels of As released from the project would result in concentrations greater than that

c. The majority of research into As is not on concentrations in the grain and effects to consumers, but rather on how to reduce the levels of As in source water

3. Temperature

a. Bruce identified a temperature range of 58 or 59 degrees F as a temperature range where blanking (empty kernels on rice panicles) is a concern for rice growers

b. Sites target releases of 65 degrees F to rice fields provides a good buffer from those temperatures and would not be expected to have significant effects

c. A follow up with Western Canal Water District would provide details if we required them

Nicole and Laurie, please let me know if I missed any key items or had differing opinions of the discussion.

Thanks,
John

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916.679.8858 M 818.640.2487
john.spranza@hdrinc.com

hdrinc.com/follow-us
hdrinc.com/follow-us

From: JP Robinette [jrobinette@sitesproject.org]
Sent: 5/12/2022 2:17:35 PM
To: Spranza, John [john.spranza@hdrinc.com]
Subject: Re: Sites - Summary document for CRC conversations

Fantastic, thank you!

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Thursday, May 12, 2022 1:01 PM
To: JP Robinette <jrobinette@sitesproject.org>
Subject: FW: Sites - Summary document for CRC conversations

Tada!

John Spranza

D 916.679.8858 M 818.640.2487

From: Spranza, John
Sent: Thursday, February 10, 2022 1:40 PM
To: JP Robinette (JRobinette@BrwnCald.com) <JRobinette@BrwnCald.com>
Cc: Kayla Ann Nowlin (Kayla.Nowlin@hdrinc.com) <Kayla.Nowlin@hdrinc.com>; aforsythe (aforsythe@sitesproject.org) <aforsythe@sitesproject.org>
Subject: FW: Sites - Summary document for CRC conversations

JP,
Ali asked that we provide you with some background information on Sites project and CBD relationship in preparation for your meeting with the Rice Commission. Kayla put the attached documents together for you, and includes a summary brief with page references to the attached draft REIR/SEIS document with the referenced the text highlighted. Also included is an email summarizing the conversations I had with Bruce Lindquist and the CRC regarding water quality effects to rice. This is not a comprehensive list of all CBD discussions in the document, but it will give you the baseline information I think you would need (likely more than what you would need)

Please let us know if you have any questions.
John

John Spranza

D 916.679.8858 M 818.640.2487

From: Nowlin, Kayla Ann <Kayla.Nowlin@hdrinc.com>
Sent: Thursday, February 10, 2022 12:16 PM
To: Spranza, John <John.Spranza@hdrinc.com>
Subject: Sites - Summary document for CRC conversations

Hi John,

Here is the document. I moved your email with Bruce to the first information referenced because it's a more informative order to read it in.

Kayla Nowlin
Aquatic Biologist II

HDR
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Sites Reservoir Community Interest Task Force
DRAFT Concept Proposal v2
5.13.22

Construction of the Sites Reservoir Project is expected to begin in 2024. Construction activities and later operation of the reservoir are projected to bring jobs and new opportunities to the region, boosting the local economy. Community concerns about reservoir construction and operations include, but aren't limited to, increased traffic through Maxwell and school zones, increased demand for public safety services, and potential loss of the "small town" feel. Some of concerns were highlighted during the recent environmental analysis process, but the Revised Environmental Impact Report is not expected to delve into solutions for all areas of community concern.

Regardless, there may be some creative ways to lessen local impacts, even those considered unavoidable. With that in mind, the Sites Project Authority is interested in establishing a community task force to work on issues of local concern – specifically traffic, public safety, recreation, and jobs/economy – to identify ways to minimize impacts while providing the greatest possible benefit to residents and businesses in Maxwell, Ladoga and surrounding region.

The task force would be convened following adoption of the environmental document and meet no more than monthly. The Authority will direct invitations to potential members to ensure broad representation from stakeholder groups, which would include – but not limited to – Colusa County Public Works, Yolo County Public Works, Knights Landing Drainage District, Maxwell Unified School District, Maxwell Fire Protection District, Maxwell Public Utility District, Maxwell Park & Recreation District, Colusa County Chamber of Commerce, Sacramento Valley Museum, and the Colusi County Historical Society. Meetings will be facilitated by the Authority's public outreach team.

Task force members will be asked to develop a mission and guiding principles that represent their interests and improve engagement. Principles may include:

- Providing a clear process for task force input and expected outcomes
- Clearly identifying project elements that task force members can influence
- Committing resources needed for task force members to provide informed input (for example, access to Authority leadership and project design consultants)
- Valuing task force members' time and involvement, meaning meetings are held only when necessary, and be focused and outcome-oriented

Bi-Weekly Sites-USBR Coordination Draft Agenda

Affordable Water, Sustainably Managed

Our Core Values – Safety, Trust and Integrity, Respect for Local Communities, Environmental Stewardship, Shared Responsibility and Shared Benefits, Accountability and Transparency, Proactive Innovation, Diversity and Inclusivity
Our Commitment – To live up to these values in everything we do

Meeting Participants:

Date: May 17, 2022 **Location:** Join Microsoft Teams Meeting

Start Time: 3:00 p.m. **Finish Time:** 4:00 p.m.

Purpose: Coordinate activities related to planning and permitting of the Sites Reservoir Project. This is a standing bi-weekly meeting.

Meeting Participants:

Jerry Brown, Sites	Henry Luu, Sites	Erin Heydinger, Sites	John Spranza, Sites
Ali Forsythe, Sites	Vanessa King, Bureau	Laurie Warner Herson, Sites	Michael Mosley, Bureau
Richard Welsh, Bureau	Gregory Mongano, Bureau	Jobaid Kabir, Bureau	Melissa Dekar, Bureau
Don Bader, Bureau	Darryl Good, Bureau	Stacey Leigh, Bureau	Susanne Manugian, Bureau
Natalie Taylor, Bureau	Levi Johnson, Bureau	Mark Carper, Bureau	Austin Olah, Bureau
Mark Morberg, Bureau	Luke Davis, Bureau	Shane Hunt, Bureau	Kevin Jacobs, Bureau

Discussion Topic	Topic Leader	Time
1. Introductions	All	
2. Follow-up on action items from the last meeting: a. None		1 min
3. EIR/EIS, Permitting, Operations		20 min
4. Financial Assistance		20 min
5. Other Activities		10 min
6. Review of Action Items		As time allows

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/16/2022 6:24:40 PM
To: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Subject: RE: Cumulative Flow Study

Sounds good to me. Thanks for connecting with him on this!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Monday, May 16, 2022 4:51 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Cumulative Flow Study

Hi Ali,

I was able to connect with Tom at Stantec today. He told me they're doing a post-processing analysis looking at changes to Oroville storage and flows as well as flows in the Delta. They're using historic hydrology, but not the same baseline as we use for our historic analysis. After talking through it, Tom and I thought it would be best to send the updated modeling under historic hydrology (I'm thinking Alt 3A). He said it's not super important if the baselines aren't the same for all the projects, because they'll be looking at comparisons of the project vs. the baseline for each project independently. If it's okay with you, I will send him the same model as MBK used for the WAA.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Okita, David@DWR <David.Okita@water.ca.gov>
Sent: Tuesday, April 26, 2022 10:25 AM
To: Heydinger, Erin <erin.heydinger@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Sun, Yung-Hsin <yung-hsin.sun@stantec.com>; FitzHugh, Thomas <thomas.fitzhugh@stantec.com>
Subject: Re: Cumulative Flow Study

Erin - can you contact the two Stantec Staff cc'd in this email to provide data. They can provide better detail what they need than I do.

Thanks...

David Okita, PE
Department of Water Resources
530 902-7588

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Tuesday, April 26, 2022 8:44 AM
To: Okita, David@DWR <David.Okita@water.ca.gov>; Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Cumulative Flow Study

Hi Dave,

The baseline we're using is called the "benchmark baseline" which was originally developed by Reclamation and DWR in 2020 and was updated in November 2021. It includes actions from both ROC on LTO and the SWP ITP. We do use the latest version in our updated modeling. Based on the email thread below and another Jerry forwarded to me, I think it is the same the one you're referring to, but we may need to have our modeling teams discuss to know for sure. That said, we have two versions that use that baseline – one with climate change hydrology (2035 CT) and one without.

Hope that helps – let me know if you'd like to jump on a call quickly to get this ironed out.

Thanks!
Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Okita, David@DWR <David.Okita@water.ca.gov>
Sent: Tuesday, April 26, 2022 6:39 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Heydinger, Erin <erin.heydinger@hdrinc.com>
Subject: Re: Cumulative Flow Study

Is the "historical baseline" that you mention the 2019 CASIM2 that DWR provided to all WSIP projects? or your own version?

David Okita, PE
Department of Water Resources
530 902-7588

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Monday, April 25, 2022 6:06 PM

To: Okita, David@DWR <David.Okita@water.ca.gov>
Cc: Heydinger, Erin <erin.heydinger@hdrinc.com>
Subject: RE: Cumulative Flow Study

Hi David – We'd be happy to provide what we have. We have updated the modeling since we last provided to you.

A quick question for you – we have CALSIM using a historical baseline and using a 2035 central tendency (a climate change scenario). I think that last time we provided the historical baseline. Is this what you would like again? If so, we are finishing up the historical run and would be able to get that over next week some time.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 25, 2022 8:55 AM
To: Heydinger, Erin <erin.heydinger@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>
Subject: FW: Cumulative Flow Study

Can you help Dave out with the information he is requesting?

From: "Okita, David@DWR" <David.Okita@water.ca.gov>
Date: Monday, April 25, 2022 at 6:46 AM
To: Jerry Brown <jbrown@sitesproject.org>, Maureen Martin <mmartin@ccwater.com>
Subject: Cumulative Flow Study

We are restarting the cumulative flow study for all 7 WSIP studies after some contracting delays when the original contract expired at the end of last year. Stantec is continuing the work.

For background... I had circulated a draft report (6/21/21) that AECOM prepared on cumulative flows - this report was more qualitative. The intent was to do a staged approach to the analysis. The comments we got back led us to decide to do a CALSIM2 post processing analysis - this is what we are working on now. In summary, what we are doing is starting with the Sites CALSIM model and "layering" on LVE operations. The other 4 projects (Pacheco not included) are added post processing. This will be explained better in the drat report we will be providing to all projects.

You both provided CALSIM modeling for this effort. The Chino Project had asked DWR to prepare an update CALSIM2 model that has updated BO and ITP restrictions. We prepared this and distributed (October 2021) to all project for use at their discretion.

My question for Sites and LVE is whether you used the DWR updated CALSIM2 model to update any studies. If so we can use that information in the Stantec new work. Otherwise we will go with what was provided by your staff last year.

David Okita, PE
Department of Water Resources
530 902-7588

From: Jerry Brown [jbrown@sitesproject.org]
Sent: 5/17/2022 1:12:49 PM
To: Kevin Spesert [kspesert@sitesproject.org]; Sara M. Katz [skatz@katzandassociates.com]
Subject: FW: Cleaner Version of Barringer piece

FYI - I would expect this article will get some air time in mainstream media.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Tuesday, May 17, 2022 at 12:45 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Dear Jerry:

It took more time to get the graphics just right, but I think you'll fiund them impressive, particularly the one showing 200 or so of the largest reservoirs.

Here's the link: https://andthewest.stanford.edu/2022/does-drought-prone-california-need-another-reservoir/

Does drought-prone California need another reservoir?

Is California "dammed out?" Or could increasing reservoir capacity help the state ride out the new era of aridification?

andthewest.stanford.edu

Best,

Felicity

Writer in Residence
Bill Lane Center for the American West
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felicitybarringr@gmail.com

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Thursday, May 12, 2022 2:17 PM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Permission granted and thanks for the update.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Thursday, May 12, 2022 at 1:39 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Dear Jerry:

If you had time to wonder, you might be curious why the piece hasn't gone up yet. The reason is my production maven, who is also a terrific graphic journalist, has been swamped with other things, and he is determined to produce a graphic showing all state reservoirs AND their current levels. I'm pushing him to get it up this week, but he's also been dealing with a domestic COVID outbreak.

I promise you'll love his graphic when we get it up, In the meantime, we'd like to use this picture from the Sites Project online materials. Do we have your permission?

Many thanks,

Felicity

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 11:57 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Looks good and thank you for your attention to detail.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Monday, April 11, 2022 at 11:48 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Jerry:

I think I've got it. First, I'll refer to Sites as a $4.5 billion project, if that's the realistic number that will be paid out over five years.

Second, I've recrafted the sentence you're also talking about. Does this work?

The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission conditionally approved spending $875 million in Proposition 1 funds for the Sites project. The federal Environmental Protection Agency then announced Sites can get a $2.2 billion low-interest loan. https://calmatters.org/commentary/2022/03/finally-progress-on-vital-sites-reservoir-project The federal Agriculture Department already agreed to loan Sites $450 million. Federal funds from the 2016 Water Infrastructure Investment Act and last year's infrastructure act will cover some of the remaining cost of $975 million.

Best,

Felicity
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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 10:49 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

See below in red

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Monday, April 11, 2022 at 8:29 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Thanks very much, Jerry.

My only remaining questions -- is there an accurate dollar figure for the amount of money remaining to be paid after the Prop 1 money, the EPA loan and the USDA loan are factored in? yes but – you need to consider that there are different ways to describe the project cost estimate. The $4B (2021 dollars) estimate quoted in your 3rd paragraph is based on project cost only in 2021 dollars. But when you look at financing for the project, this cost estimate will be different because you have to add in interest and inflation during construction which would make the cost estimate closer to $4.5B. This might be confusing to people. In this vein, the remaining to be paid after prop 1, EPA loan, and USDA loan is $975M.

Do the contractors bear any of the capital costs? My suggestion below of indicating the remainder is paid for by Reclamation investment is a plausible, accurate scenario. Its also simplest to explain. We just don't quite yet know what the exact figure of Reclamation investment will come in at. We know that our water district contractors will cover at least $2.65B ($2.2B plus $450M) of the $4.5B. If Reclamation investment is less than $975M, then the water district contractors would pick up any balance to fully fund the project. If you want to explain this nuance, I would have no issue with that approach. Hopefully I've given you enough here to do that, otherwise we could jump on a call real quick and discuss. Let me know.

Thanks so much for taking the time to look at this. You may chuckle at this: Jay Lund, giving his comments, complemented me on keeping it short. For my taste, the piece is significantly overlong, but I see no obvious cuts.

Cheers,

Felicity

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 8:24 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Hi Felicity – Great work on the article. I'm so impressed with your ability to boil a very complicated story down to understandable and interesting terms. Thank you for your work and thank you for your coverage of this important project.

My "fact check" feedback is strictly on the section with the header "Efforts to increase reservoir storage focus on the Sites Project" as follows:

1. 4th paragraph 1st sentence which reads ***"The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission approved sending $875 million in Proposition 1 funds to the Sites project."*** You should know that the CWC gets nervous anytime someone says they have "approved" funds for a project. The Prop 1 statute is written that funds are conditionally awarded, with final

approval withheld until all conditions have been met. We are obviously pursuing to meet all conditions ASAP and banking on this being the case, but we're probably still 2 years away from final approval of these funds. I would suggest using the term "conditionally approved".

2. 4th paragraph, last sentence which reads "***The 23 partner agencies will be responsible for the remaining $TK million".*** The remaining funds being referred to in this sentence are expected to be covered by the Reclamation investment which is supported by the following enacted legislation - the 2016 Water Infrastructure Investment Act (WIIN) and the 2021 Infrastructure Investment and Jobs Act (IIJA).

3. 6th paragraph, 2nd sentence reads "***In dry years, Sites, designed to hold up to 1 million acre-feet of water…".*** The reservoir is being designed to hold 1.5 million acre-feet of water.

Everything else looks good to me. Let me know if you need anything else.

Jerry

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Sunday, April 10, 2022 at 3:06 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Cleaner Version of Barringer piece

Jerry:

If you haven't read it yet, this is a better version -- and I leave the remaining Sites obligation to be paid by its contractors blank, instead of giving two different numbers. I'm hoping you can give me the correct number.

Here's the text:

Storage

By Barringer

The Antelope Valley's sweeping pastures, dotted with cows and bounded by the gentle hills of northern California's Coast Range, spread out about 50 miles north of Lake Berryessa, Napa County's reservoir. In five years' time, if current plans become reality, the cows and grass would be replaced by a lake holding up to 1.5 million acre-feet of Sacramento River water. Antelope Valley would hold a larger version of Lake Berryessa.

This new reservoir, named for the tiny town of Sites in Colusa County, and expansion plans for two other northern and central California reservoirs came closer to reality last month, make it more likely that the additional water will be available in the future to soften the sharp edges of the megadrought threatening farms, cities and the environment.

Financial support is crucial to all three. The financial picture of the $4 billion Sites project improved markedly in the few weeks with announcements that it will receive a $2.2 billion federal loan and $875 million from a state bond. This news came as water year 2022 reached its halfway point and is repeating the feast-and-famine pattern of California's weather.

Atmospheric rivers drifted across the state in October and December; the Sierra snowpack was 160 percent above normal statewide in January. https://water.ca.gov/News/News-Releases/2021/Dec-21/DWR-12-30-21-Snow-Survey That was the end of it. https://calmatters.org/environment/2022/02/california-drought-record-january-february/

On April 1, the snowpack, a reservoir supplying about a third of the state's water, was 39 percent of normal; https://www.mercurynews.com/2022/04/01/california-drought-sierra-snowpack-falls-to-one-of-lowest-levels-in-50-years/

a third year of wrenching drought seems inevitable. But the prospects for the construction or expansion of three northern and central California reservoirs to store the overflow from winter's atmospheric rivers have brightened as the drought gets worse.

For a century, California has grappled with how to store water. Its success has been limited. The 20th century was the heyday of dams. The benefits to agriculture were clear: a 2021 article in Environment Research Letters noted, "Arid regions with access to stored water avoided the 13 percent losses in crop value experienced in areas with more limited storage during droughts." It added, "it is unlikely that the U.S. will witness another dam bonanza like the arid West's in the mid-20th century."

"Every major river in California is dammed and some have two or more," noted the environmental group Clean Water Action. https://www.cleanwateraction.org/features/investing-california%E2%80%99s-future-groundwater-not-dams#:~:text=We%20have%20more%20than%201%2C400,some%20have%20two%20or%20more. After building about 1,500 dams and more than 1,300 reservoirs that can store 43 million acre-feet of water, is California dammed out? If more storage is needed, where can it go and what form would it take?

In principle, more storage is good, said Jay Lund, director of the Center for Watershed Sciences at U.C. Davis. The persistence of droughts and the likelihood that climate change will exacerbate them reinforce this idea. "If you have a bigger house and an extra room is offered for free, you would always take it," he said.

"But if you have to pay for it, you'd think about it more carefully… We have 1,500 rooms -- or regulated dams -- in California. That doesn't mean the 1,501st room is not worthwhile. But you want to scrutinize it more….

"The best sites are already taken. Now we have more expensive sites and generally yield less water… In terms of water delivery and economics, things are not as great as they used to be -- without even getting into the environmental costs," Lund said.

Efforts to increase reservoir storage focus on the Sites project

The largest and most visible of the three pending reservoir projects is the proposed Sites Reservoir. A separate plan to increase the size of Shasta Dam and its reservoir -- the state's largest, located on the upper Sacramento River -- gained steam during the Trump administration, but seems less possible now. But the need for new storage remains pressing. Discussion of Sites Reservoir, its funding, its potential benefits and potential drawbacks are a microcosm of the larger questions facing California.

These include: how much new infrastructure is worth the expense and effort, how much will fish and wetlands suffer from new reservoir projects and should the state also find more storage capacity in depleted aquifers?

Such questions and a host of technical, financial, engineering, ecological and hydrological complications have dogged all suggestions for new storage in the eight years since California voters passed a $7.5 billion state water bond, known as Proposition 1. Some $2.7 billion of the 2014 bond is designated for storage projects.

The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission approved sending $875 million in Proposition 1 funds to the Sites project. The federal Environmental Protection Agency then announced Sites is eligible for a $2.2 billion low-interest loan. https://calmatters.org/commentary/2022/03/finally-progress-on-vital-sites-reservoir-project Tthe federal Agriculture Department already agreed to loan the project $450 million. The 23 partner agencies will be responsible for the remaining $TK million.

Given the conflict over more damming of the state's rivers, the Sites reservoir, like most of the newest reservoirs in the state, will be offstream. Instead of holding back a river, its contents will be pumped in. California's offsteam reservoirs include Diamond Valley Lake in Riverside County, the San Luis Reservoir at the east end of Pacheco Pass at the edge of the central valley, and Contra Costa County's Los Vaqueros Reservoir in the Bay Area..

In Sites' case, the water would come from the Sacramento River, 14 miles away, when big rainfalls leave it water to spare. In dry years, Sites, designed to hold up to 1 million acre-feet of water, could then supply 300,000 to 450,000 acre-feet annually to farms, cities and environmental uses. (An acre-foot, or 326,000 gallons, is enough water to supply the annual indoor and outdoor use of one to two average households.)

Balancing storage increases with the needs of endangered fish

As the economics of the Sites project look more favorable, the sharp environmental objections -- objections that could morph into lawsuits -- remain. The overall concern in environmental groups' and agencies' comments on the project's environmental impact report is that the Sacramento River, its flow and temperature already altered by Lake Shasta and other diversions, would become less supportive of endangered runs of salmon and could push Delta smelt into extinction.

The comments of the Natural Resources Defense Council, the Sierra Club and 10 other fishery or environmental groups argued that the environmental assessments used flawed models, making their conclusions both incomplete and imprecise. The report "fails to adequately account for and assess impacts of the project in light of climate change," the groups contended.

The comments also argued that the proposed Sacramento River diversions to the Sites Reservoir through its new plumbing system would change the river's water temperatures and flows, to the detriment of endangered winter-run salmon. Changes to wetlands could harm migratory birds and 14 miles of new roads would lead to roadkill of other wildlife, they added. Doug Obegi, a senior attorney for NRDC, has called Sites an environmentally destructive dam.

Jerry Brown, the executive director of the Sites Project Authority, feels the most recent plans avoid real environmental harm. "I'm 100 percent confident that Sites Reservoir will be built. It must be built," he said in an interview. In terms of protecting fish, he said, "we are definitely close to the sweet spot around what we can actually accomplish [with storage] and be protective…

"Sites is a project that would draw water off [the Sacramento River] during high flood periods, put it into the reservoir and release it generally during drier periods," he said.

The organizational plan of the Sites project is a departure in California's major water management systems, dominated by the state and federal governments. These control water deliveries from, respectively, the California State Water Project and the Central Valley project. Each is a complex network of dams, reservoirs, power plants, pumps, and canals that remade the natural plumbing of California. Sites will be connected to these networks, but will be managed differently.

"We're trying to do something that has never really been done," Brown said. "It's a group of local agencies that are leading the project and will own and operate it." The 23 agencies investing in the project, he added, would pay the remaining $TK, the obligations of each dependent on their water use. State and federal water authorities are partners, not managers. The Sites Authority, the product of a joint powers agreement, https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/492123/Phase_2__2019__Reservoir_Project_Agreement__2019Mar25_Countersigned_v0_.pdf

controls everything from engineering and operations to environmental planning.

Southern California's 1990's storage investment fends off the consequences of drought

One possible inspiration for the Sites project sits 500 miles to the south, in Riverside County. Northern California water customers have eyed Diamond Valley Lake with envy for more than two decades. In the late 1990's, the Metropolitan Water District of Southern California spent $1.9 billion to build it then filled it with water from the Colorado River and the State Water Project, which in turn gets its water from the Sacramento-San Joaquin delta, the beating heart of the state's main water systems.

When work on the 800,000-acre-foot Diamond Lake reservoir was completed in 2000, it nearly doubled Met's storage capacity. So when the last drought produced severe water restrictions in more northerly areas, southern Californians could use up to 15 percent of the that reservoir's water. https://abc7.com/diamond-valley-lake-california-drought-hemet-ca-conditons/10876074/ So they got off lightly.

Northern California agencies would love that kind of cushion. But though Diamond Valley Lake was a game-changer for southern California water suppliers, Sites and most of the proposals available to northern California water managers offer, at best, partial solutions.

One water expert believes that recognizing that all storage solutions now are partial should prompt engineers and water managers to think more creatively about new tools for storage."There are a lot of possibilities" for solving water shortage problems, said Justin Frederickson, the water and environmental policy analyst at the California Farm Bureau. "We're not in an era where there's a single silver bullet. [We need] buckshot."

He added, "Just like all politics is local, all water management is local.... The space we have within which to move is increasingly local and regional." While the 20th century dams and decisions created, he said, "a statewide system where we wheel water from one end of the state to the other. Our economy is embedded in that." But, he added, "we need to build some flexibility back into the system that we've lost."

Expansion plans would add storage to two major reservoirs

Retrofitting and expanding two off-stream reservoirs -- one in the Bay Area and one at the center of the state -- may increase flexibility and resilience for their customers. The Interior Department just announced it will invest $100 million from the new infrastructure law to strengthen and raise the height of the 55-year-old B.F. Sisk dam, which created the San Luis Reservoir off Pacheco Pass, bordering I-5. https://www.hydroreview.com/dams-and-civil-structures/interior-department-invests-100-million-in-infrastructure-funds-for-dam-safety-project/#gref An earthquake fault runs beneath the reservoir.

The announcement of the grant was framed as an effort at safety and protection from earthquakes; raising the dam would "reduce downstream safety concerns by reducing the likelihood of overtopping if slumping were to occur during a seismic event." https://www.doi.gov/pressreleases/interior-department-invests-100-million-first-dam-safety-project-through-president Unmentioned was the purpose that the Trump administration advertised http://www.westsideconnect.com/community/agencies-finalize-environmental-documents-on-proposed-reservoir-expansion/article_d25e6968-4ba1-11eb-a3bc-3f0379d22068.html in its last month in office: expanding the San Luis reservoir.

Now, both aims are being pursued in tandem. The work on constructing seismic retrofits, which begins this year, will be coordinated with ongoing efforts to further raise the dam and increase the capacity of San Luis Reservoir by 130,000 acre-feet.

That's an incremental increase; about 6.5 percent of the reservoir's current capacity of 2 million acre-feet. The water is pumped into the San Luis reservoir from the river flows going through the Sacramento-San Joaquin Delta. It is pumped out to the canals and sent south to the farmlands of the San Joaquin Valley and the Metropolitan Water District.

Los Vaqueros reservoir sits about 75 miles to the north, serving the residents and businesses of Contra Costa County east of San Francisco Bay as well as other Bay Area and central California water districts. It was completed in 1998, holding 100,000 acre-feet of water. Its capacity expanded to 160,000 acre-feet in 2012; last year the state approved a grant of $470 million in Proposition 1 funds to help pay for a $1 billion expansion to 275,000 acre-feet. The expansion is intended to provide more reliability and flexibility in water deliveries.

Reservoir expansions translate to incremental delivery increases

Most accounts of reservoir construction or expansion focus on total reservoir capacity. But the size of a reservoir is less important than what it can deliver: When complete and filled, Sites would deliver, on average, 243,000 acre-feet of water annually -- and perhaps two-third more in dry years, when all users -- particularly those with environmental needs -- are thirsty. The expanded Los Vaqueros reservoir's annual deliveries would increase by 69,000 acre-feet. Altogether, the average increase is less than one percent of annual use of 37.5 million acre-feet of water by Caliofrnia's farms, businesses, and homes.

Raising the B.F. Sisk dam would increase the size of the San Luis Reservoir by 130,000 acre-feet, but there are no claims it would make new water deliveries. So with all these projects put together, the total increase in water deliveries each year will be real, but incremental.

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from the Public Policy Institute of California noted, "The average volume of new water from these facilities is small, and costs are high. Four projects [including Sites and Los Vaqueros] deemed eligible for state matching grants under Proposition 1 would expand statewide reservoir capacity by about 3.3 million acre-feet, but they would raise ånnual average supply by only 760,000 acre-feet, or 2 percent of annual farm and city use. Their combined cost would be nearly $10 billion."

Still, said Jay Lund of U.C. Davis, most water users want more reservoir storage anyway -- preferably in the closest reservoir, or the one "hydrologically adjacent" which is most easily accessed by the current complex plumbing of California. Sites water, he said, could be of value to Sacramento Valley rice farmers.

Jerry Brown, the executive director of the Sites agency, said these farmers, some of whom got high-priority water contracts when Shasta dam was built, are concerned about the future. "They have some of the highest water-priority rights in the system," Brown said. "You'd think that they'd need this least.... But what they're seeing is changes in the management of water in California that are affecting them. They can foresee what's coming and are taking action to ensure water for their future."

The farmers will pay tens of millions of dollars for construction. But there may also be legal costs, if environmental or tribal opponents, who feel that not all relevant tribal groups were consulted, take the Sites agency to court.

Brown thinks environmental objections can be met. "We agree we don't want to hurt the salmon, because [then] the water project is jeopardized," he said, adding, "Where there's some fundamental disagreement … is the broader way water is managed and used within the state. Some wish and strive to take us back to pre-dams and pre-channelization of the water. Others are trying to take what we have and adapt to what we see coming."

Is reservoir storage the best option for the future?

Opponents of dam expansion are blunt. "I think raising any reservoir is a bad idea," said Newsha Ajami, the chief development officer for research at the Lawrence Berkeley National lab's Earth and Environmental Sciences area. "The extreme ups and downs of this climate era don't lend themselves to the storage model built in the 20th century… How much per acre-foot of water are we spending on these dam raises?"

She added, "I think Sites is a terrible idea. It's off the river so people think it's not going to have fish issues…. You're not stopping the salmon [from going upriver], but you are using their water elsewhere. " Her recipe for decentralized storage involves everything from more groundwater storage in the Central Valley to work by individuals and communities to use, store, and conserve water more efficiently.

A 2017 paper https://www.sciencedirect.com/science/article/abs/pii/S2210670716302773 that Ajami co-authored holds, "The water sector is going through a paradigm shift. Many communities are incorporating decentralized solutions such as water reuse and recycling, stormwater capture and demand-side management in order to address both short- and long-term water resources challenges…"

"You have to look at the cost estimates of different projects and the amount of [storage[capacity they are going to be generating," Ajami said in an interview. "It's easy when you're talking about dams. It's not easy when you're talking about groundwater storage."

California has developed incentives for farmers to send atmospheric rivers back into the depleted aquifers, but knowing how and where to recharge water is complex, as & the West explained in 2019. https://andthewest.stanford.edu/2019/putting-a-tempest-into-a-teapot-can-california-better-use-winter-storms-to-refill-its-aquifers/

There are drawbacks to storage by aquifer recharge. "Recharge is fraught because there are too many hands reaching for too little water," said Lois Henry, founder of SJV Water, the Central Valley's premier water-centric news outlet.

Going forward, "I would say we need a different kind of plan" for storage, said Justin Fredrickson of the state farm bureau. "But there's a lot of inertia. It's difficult to think in a different way. We have two choices. We can have the imagination to build something different … or stay stuck in a place where we don't have a lot of options and just make do."

##

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From: Sara M. Katz [skatz@katzandassociates.com]
Sent: 5/17/2022 7:32:12 PM
To: Jerry Brown [jbrown@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]
Subject: RE: Cleaner Version of Barringer piece

Very in depth, for sure. Thanks Jerry.

Sara M. Katz
Founder/CEO
Mobile: 619-813-9551
San Diego · Los Angeles · San Francisco

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Tuesday, May 17, 2022 1:13 PM
To: Kevin Spesert <kspesert@sitesproject.org>; Sara M. Katz <skatz@katzandassociates.com>
Subject: FW: Cleaner Version of Barringer piece

FYI - I would expect this article will get some air time in mainstream media.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Tuesday, May 17, 2022 at 12:45 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Dear Jerry:

It took more time to get the graphics just right, but I think you'll fiund them impressive, particularly the one showing 200 or so of the largest reservoirs.

Here's the link: https://andthewest.stanford.edu/2022/does-drought-prone-california-need-another-reservoir/

Does drought-prone California need another reservoir?

Is California "dammed out?" Or could increasing reservoir capacity help the state ride out the new era of aridification?

andthewest.stanford.edu

Best,

Felicity

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Thursday, May 12, 2022 2:17 PM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Permission granted and thanks for the update.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Thursday, May 12, 2022 at 1:39 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Dear Jerry:

If you had time to wonder, you might be curious why the piece hasn't gone up yet. The reason is my production maven, who is also a terrific graphic journalist, has been swamped with other things, and he is determined to produce a graphic showing all state reservoirs AND their current levels. I'm pushing him to get it up this week, but he's also been dealing with a domestic COVID outbreak.

I promise you'll love his graphic when we get it up, In the meantime, we'd like to use this picture from the Sites Project online materials. Do we have your permission?

Many thanks,

Felicity

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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 11:57 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Looks good and thank you for your attention to detail.

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Monday, April 11, 2022 at 11:48 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Jerry:

I think I've got it. First, I'll refer to Sites as a $4.5 billion project, if that's the realistic number that will be paid out over five years.

Second, I've recrafted the sentence you're also talking about. Does this work?

The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission conditionally approved spending $875 million in Proposition 1 funds for the Sites project. The federal Environmental Protection Agency then announced Sites can get a $2.2 billion low-interest loan. https://calmatters.org/commentary/2022/03/finally-progress-on-vital-sites-reservoir-project The federal Agriculture Department already agreed to loan Sites $450 million. Federal funds from the 2016 Water Infrastructure Investment Act and last year's infrastructure act will cover some of the remaining cost of $975 million.

Best,

Felicity
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From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 10:49 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

See below in red

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Monday, April 11, 2022 at 8:29 AM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Re: Cleaner Version of Barringer piece

Thanks very much, Jerry.

My only remaining questions -- is there an accurate dollar figure for the amount of money remaining to be paid after the Prop 1 money, the EPA loan and the USDA loan are factored in? yes but – you need to consider that there are different ways to describe the project cost estimate. The $4B (2021 dollars) estimate quoted in your 3rd paragraph is based on project cost only in 2021 dollars. But when you look at financing for the project, this cost estimate will be different because you have to add in interest and inflation during construction which would make the cost estimate closer to $4.5B. This might be confusing to people. In this vein, the remaining to be paid after prop 1, EPA loan, and USDA loan is $975M.

Do the contractors bear any of the capital costs? My suggestion below of indicating the remainder is paid for by Reclamation investment is a plausible, accurate scenario. Its also simplest to explain. We just don't quite yet know what the exact figure of Reclamation investment will come in at. We know that our water district contractors will cover at least $2.65B ($2.2B plus $450M) of the $4.5B. If Reclamation investment is less than $975M, then the water district contractors would pick up any balance to fully fund the project. If you want to explain this nuance, I would have no issue with that approach. Hopefully I've given you enough here to do that, otherwise we could jump on a call real quick and discuss. Let me know.

Thanks so much for taking the time to look at this. You may chuckle at this: Jay Lund, giving his comments, complemented me on keeping it short. For my taste, the piece is significantly overlong, but I see no obvious cuts.

Cheers,

Felicity

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andthewest.stanford.edu

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Monday, April 11, 2022 8:24 AM
To: Felicity Barringer Taubman <febarr@stanford.edu>
Subject: Re: Cleaner Version of Barringer piece

Hi Felicity – Great work on the article. I'm so impressed with your ability to boil a very complicated story down to understandable and interesting terms. Thank you for your work and thank you for your coverage of this important project.

My "fact check" feedback is strictly on the section with the header "Efforts to increase reservoir storage focus on the Sites Project" as follows:

1. 4th paragraph 1st sentence which reads ***"The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission approved sending $875 million in Proposition 1 funds to the Sites project."*** You should know that the CWC gets nervous anytime someone says they have "approved" funds for a project. The Prop 1 statute is written that funds are conditionally awarded, with final approval withheld until all conditions have been met. We are obviously pursuing to meet all conditions ASAP and banking on this being the case, but we're probably still 2 years away from final approval of these funds. I would suggest using the term "conditionally approved".
2. 4th paragraph, last sentence which reads "***The 23 partner agencies will be responsible for the remaining $TK million".*** The remaining funds being referred to in this sentence are expected to be covered by the Reclamation investment which is supported by the following enacted legislation - the 2016 Water Infrastructure Investment Act (WIIN) and the 2021 Infrastructure Investment and Jobs Act (IIJA).
3. 6th paragraph, 2nd sentence reads "***In dry years, Sites, designed to hold up to 1 million acre-feet of water…".*** The reservoir is being designed to hold 1.5 million acre-feet of water.

Everything else looks good to me. Let me know if you need anything else.

Jerry

From: Felicity Barringer Taubman <febarr@stanford.edu>
Date: Sunday, April 10, 2022 at 3:06 PM
To: Jerry Brown <jbrown@sitesproject.org>
Subject: Cleaner Version of Barringer piece

Jerry:

If you haven't read it yet, this is a better version -- and I leave the remaining Sites obligation to be paid by its contractors blank, instead of giving two different numbers. I'm hoping you can give me the correct number.

Here's the text:

Storage

By Barringer

The Antelope Valley's sweeping pastures, dotted with cows and bounded by the gentle hills of northern California's Coast Range, spread out about 50 miles north of Lake Berryessa, Napa County's reservoir. In five years' time, if current plans become reality, the cows and grass would be replaced by a lake holding up to 1.5 million acre-feet of Sacramento River water. Antelope Valley would hold a larger version of Lake Berryessa.

This new reservoir, named for the tiny town of Sites in Colusa County, and expansion plans for two other northern and central California reservoirs came closer to reality last month, make it more likely that the additional water will be available in the future to soften the sharp edges of the megadrought threatening farms, cities and the environment.

Financial support is crucial to all three. The financial picture of the $4 billion Sites project improved markedly in the few weeks with announcements that it will receive a $2.2 billion federal loan and $875 million from a state bond. This news came as water year 2022 reached its halfway point and is repeating the feast-and-famine pattern of California's weather.

Atmospheric rivers drifted across the state in October and December; the Sierra snowpack was 160 percent above normal statewide in January. https://water.ca.gov/News/News-Releases/2021/Dec-21/DWR-12-30-21-Snow-Survey That was the end of it. https://calmatters.org/environment/2022/02/california-drought-record-january-february/

On April 1, the snowpack, a reservoir supplying about a third of the state's water, was 39 percent of normal; https://www.mercurynews.com/2022/04/01/california-drought-sierra-snowpack-falls-to-one-of-lowest-levels-in-50-years/

a third year of wrenching drought seems inevitable. But the prospects for the construction or expansion of three northern and central California reservoirs to store the overflow from winter's atmospheric rivers have brightened as the drought gets worse.

For a century, California has grappled with how to store water. Its success has been limited. The 20th century was the heyday of dams. The benefits to agriculture were clear: a 2021 article in Environment Research Letters noted, "Arid regions with access to stored water avoided the 13 percent losses in crop value experienced in areas with more limited storage during droughts." It added, "it is unlikely that the U.S. will witness another dam bonanza like the arid West's in the mid-20th century."

"Every major river in California is dammed and some have two or more," noted the environmental group Clean Water Action. https://www.cleanwateraction.org/features/investing-california%E2%80%99s-future-groundwater-not-dams#:~:text=We%20have%20more%20than%201%2C400,some%20have%20two%20or%20more. After building about 1,500 dams and more than 1,300 reservoirs that can store 43 million acre-feet of water, is California dammed out? If more storage is needed, where can it go and what form would it take?

In principle, more storage is good, said Jay Lund, director of the Center for Watershed Sciences at U.C. Davis. The persistence of droughts and the likelihood that climate change will exacerbate them reinforce this idea. “If you have a bigger house and an extra room is offered for free, you would always take it,” he said.

“But if you have to pay for it, you’d think about it more carefully… We have 1,500 rooms -- or regulated dams -- in California. That doesn’t mean the 1,501st room is not worthwhile. But you want to scrutinize it more….

“The best sites are already taken. Now we have more expensive sites and generally yield less water… In terms of water delivery and economics, things are not as great as they used to be -- without even getting into the environmental costs,” Lund said.

Efforts to increase reservoir storage focus on the Sites project

The largest and most visible of the three pending reservoir projects is the proposed Sites Reservoir. A separate plan to increase the size of Shasta Dam and its reservoir -- the state’s largest, located on the upper Sacramento River -- gained steam during the Trump administration, but seems less possible now. But the need for new storage remains pressing. Discussion of Sites Reservoir, its funding, its potential benefits and potential drawbacks are a microcosm of the larger questions facing California.

These include: how much new infrastructure is worth the expense and effort, how much will fish and wetlands suffer from new reservoir projects and should the state also find more storage capacity in depleted aquifers?

Such questions and a host of technical, financial, engineering, ecological and hydrological complications have dogged all suggestions for new storage in the eight years since California voters passed a $7.5 billion state water bond, known as Proposition 1. Some $2.7 billion of the 2014 bond is designated for storage projects.

The financial picture of the Sites project became far more secure in recent weeks, after the California Water Commission approved sending $875 million in Proposition 1 funds to the Sites project. The federal Environmental Protection Agency then announced Sites is eligible for a $2.2 billion low-interest loan. https://calmatters.org/commentary/2022/03/finally-progress-on-vital-sites-reservoir-project Tthe federal Agriculture Department already agreed to loan the project $450 million. The 23 partner agencies will be responsible for the remaining $TK million.

Given the conflict over more damming of the state’s rivers, the Sites reservoir, like most of the newest reservoirs in the state, will be offstream. Instead of holding back a river, its contents will be pumped in. California’s offsteam reservoirs include Diamond Valley Lake in Riverside County, the San Luis Reservoir at the east end of Pacheco Pass at the edge of the central valley, and Contra Costa County’s Los Vaqueros Reservoir in the Bay Area..

In Sites’ case, the water would come from the Sacramento River, 14 miles away, when big rainfalls leave it water to spare. In dry years, Sites, designed to hold up to 1 million acre-feet of water, could then supply 300,000 to 450,000 acre-feet annually to farms, cities and environmental uses. (An acre-foot, or 326,000 gallons, is enough water to supply the annual indoor and outdoor use of one to two average households.)

Balancing storage increases with the needs of endangered fish

As the economics of the Sites project look more favorable, the sharp environmental objections -- objections that could morph into lawsuits -- remain. The overall concern in environmental groups’ and agencies’ comments on the project’s environmental impact report is that the Sacramento River, its flow and temperature already altered by Lake Shasta and other diversions, would become less supportive of endangered runs of salmon and could push Delta smelt into extinction.

The comments of the Natural Resources Defense Council, the Sierra Club and 10 other fishery or environmental groups argued that the environmental assessments used flawed models, making their conclusions both incomplete and imprecise. The report "fails to adequately account for and assess impacts of the project in light of climate change," the groups contended.

The comments also argued that the proposed Sacramento River diversions to the Sites Reservoir through its new plumbing system would change the river's water temperatures and flows, to the detriment of endangered winter-run salmon. Changes to wetlands could harm migratory birds and 14 miles of new roads would lead to roadkill of other wildlife, they added. Doug Obegi, a senior attorney for NRDC, has called Sites an environmentally destructive dam.

Jerry Brown, the executive director of the Sites Project Authority, feels the most recent plans avoid real environmental harm. "I'm 100 percent confident that Sites Reservoir will be built. It must be built," he said in an interview. In terms of protecting fish, he said, "we are definitely close to the sweet spot around what we can actually accomplish [with storage] and be protective…

"Sites is a project that would draw water off [the Sacramento River] during high flood periods, put it into the reservoir and release it generally during drier periods," he said.

The organizational plan of the Sites project is a departure in California's major water management systems, dominated by the state and federal governments. These control water deliveries from, respectively, the California State Water Project and the Central Valley project. Each is a complex network of dams, reservoirs, power plants, pumps, and canals that remade the natural plumbing of California. Sites will be connected to these networks, but will be managed differently.

"We're trying to do something that has never really been done," Brown said. "It's a group of local agencies that are leading the project and will own and operate it." The 23 agencies investing in the project, he added, would pay the remaining $TK, the obligations of each dependent on their water use. State and federal water authorities are partners, not managers. The Sites Authority, the product of a joint powers agreement, https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/492123/Phase_2__2019__Reservoir_Project_Agreement__2019Mar25_Countersigned_v0_.pdf

controls everything from engineering and operations to environmental planning.

Southern California's 1990's storage investment fends off the consequences of drought

One possible inspiration for the Sites project sits 500 miles to the south, in Riverside County. Northern California water customers have eyed Diamond Valley Lake with envy for more than two decades. In the late 1990's, the Metropolitan Water District of Southern California spent $1.9 billion to build it then filled it with water from the Colorado River and the State Water Project, which in turn gets its water from the Sacramento-San Joaquin delta, the beating heart of the state's main water systems.

When work on the 800,000-acre-foot Diamond Lake reservoir was completed in 2000, it nearly doubled Met's storage capacity. So when the last drought produced severe water restrictions in more northerly areas, southern Californians could use up to 15 percent of the that reservoir's water. https://abc7.com/diamond-valley-lake-california-drought-hemet-ca-conditons/10876074/ So they got off lightly.

Northern California agencies would love that kind of cushion. But though Diamond Valley Lake was a game-changer for southern California water suppliers, Sites and most of the proposals available to northern California water managers offer, at best, partial solutions.

One water expert believes that recognizing that all storage solutions now are partial should prompt engineers and water managers to think more creatively about new tools for storage."There are a lot of possibilities" for solving water shortage problems, said Justin Frederickson, the water and environmental policy analyst at the California Farm Bureau. "We're not in an era where there's a single silver bullet. [We need] buckshot."

He added, "Just like all politics is local, all water management is local.... The space we have within which to move is increasingly local and regional." While the 20th century dams and decisions created, he said, "a statewide system where we wheel water from one end of the state to the other. Our economy is embedded in that." But, he added, "we need to build some flexibility back into the system that we've lost."

Expansion plans would add storage to two major reservoirs

Retrofitting and expanding two off-stream reservoirs -- one in the Bay Area and one at the center of the state -- may increase flexibility and resilience for their customers. The Interior Department just announced it will invest $100 million from the new infrastructure law to strengthen and raise the height of the 55-year-old B.F. Sisk dam, which created the San Luis Reservoir off Pacheco Pass, bordering I-5. https://www.hydroreview.com/dams-and-civil-structures/interior-department-invests-100-million-in-infrastructure-funds-for-dam-safety-project/#gref An earthquake fault runs beneath the reservoir.

The announcement of the grant was framed as an effort at safety and protection from earthquakes; raising the dam would "reduce downstream safety concerns by reducing the likelihood of overtopping if slumping were to occur during a seismic event." https://www.doi.gov/pressreleases/interior-department-invests-100-million-first-dam-safety-project-through-president Unmentioned was the purpose that the Trump administration advertised http://www.westsideconnect.com/community/agencies-finalize-environmental-documents-on-proposed-reservoir-expansion/article_d25e6968-4ba1-11eb-a3bc-3f0379d22068.html in its last month in office: expanding the San Luis reservoir.

Now, both aims are being pursued in tandem. The work on constructing seismic retrofits, which begins this year, will be coordinated with ongoing efforts to further raise the dam and increase the capacity of San Luis Reservoir by 130,000 acre-feet.

That's an incremental increase; about 6.5 percent of the reservoir's current capacity of 2 million acre-feet. The water is pumped into the San Luis reservoir from the river flows going through the Sacramento-San Joaquin Delta. It is pumped out to the canals and sent south to the farmlands of the San Joaquin Valley and the Metropolitan Water District.

Los Vaqueros reservoir sits about 75 miles to the north, serving the residents and businesses of Contra Costa County east of San Francisco Bay as well as other Bay Area and central California water districts. It was completed in 1998, holding 100,000 acre-feet of water. Its capacity expanded to 160,000 acre-feet in 2012; last year the state approved a grant of $470 million in Proposition 1 funds to help pay for a $1 billion expansion to 275,000 acre-feet. The expansion is intended to provide more reliability and flexibility in water deliveries.

Reservoir expansions translate to incremental delivery increases

Most accounts of reservoir construction or expansion focus on total reservoir capacity. But the size of a reservoir is less important than what it can deliver: When complete and filled, Sites would deliver, on average, 243,000 acre-feet of water annually -- and perhaps two-third more in dry years, when all users -- particularly those with environmental needs -- are thirsty. The expanded Los Vaqueros reservoir's annual deliveries would increase by 69,000 acre-feet. Altogether, the average increase is less than one percent of annual use of 37.5 million acre-feet of water by Caliofrnia's farms, businesses, and homes.

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from the Public Policy Institute of California noted, "The average volume of new water from these facilities is small, and costs are high. Four projects [including Sites and Los Vaqueros] deemed eligible for state matching grants under Proposition 1 would expand statewide reservoir capacity by about 3.3 million acre-feet, but they would raise åannual average supply by only 760,000 acre-feet, or 2 percent of annual farm and city use. Their combined cost would be nearly $10 billion."

Still, said Jay Lund of U.C. Davis, most water users want more reservoir storage anyway -- preferably in the closest reservoir, or the one "hydrologically adjacent" which is most easily accessed by the current complex plumbing of California. Sites water, he said, could be of value to Sacramento Valley rice farmers.

Jerry Brown, the executive director of the Sites agency, said these farmers, some of whom got high-priority water contracts when Shasta dam was built, are concerned about the future. "They have some of the highest water-priority rights in the system," Brown said. "You'd think that they'd need this least.... But what they're seeing is changes in the management of water in California that are affecting them. They can foresee what's coming and are taking action to ensure water for their future."

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Brown thinks environmental objections can be met. "We agree we don't want to hurt the salmon, because [then] the water project is jeopardized," he said, adding, "Where there's some fundamental disagreement ... is the broader way water is managed and used within the state. Some wish and strive to take us back to pre-dams and pre-channelization of the water. Others are trying to take what we have and adapt to what we see coming."

Is reservoir storage the best option for the future?

Opponents of dam expansion are blunt. "I think raising any reservoir is a bad idea," said Newsha Ajami, the chief development officer for research at the Lawrence Berkeley National lab's Earth and Environmental Sciences area. "The extreme ups and downs of this climate era don't lend themselves to the storage model built in the 20th century... How much per acre-foot of water are we spending on these dam raises?"

She added, "I think Sites is a terrible idea. It's off the river so people think it's not going to have fish issues.... You're not stopping the salmon [from going upriver], but you are using their water elsewhere. " Her recipe for decentralized storage involves everything from more groundwater storage in the Central Valley to work by individuals and communities to use, store, and conserve water more efficiently.

A 2017 paper https://www.sciencedirect.com/science/article/abs/pii/S2210670716302773 that Ajami co-authored holds, "The water sector is going through a paradigm shift. Many communities are incorporating decentralized solutions such as water reuse and recycling, stormwater capture and demand-side management in order to address both short- and long-term water resources challenges…"

"You have to look at the cost estimates of different projects and the amount of [storage[capacity they are going to be generating," Ajami said in an interview. "It's easy when you're talking about dams. It's not easy when you're talking about groundwater storage."

California has developed incentives for farmers to send atmospheric rivers back into the depleted aquifers, but knowing how and where to recharge water is complex, as & the West explained in 2019. https://andthewest.stanford.edu/2019/putting-a-tempest-into-a-teapot-can-california-better-use-winter-storms-to-refill-its-aquifers/

There are drawbacks to storage by aquifer recharge. "Recharge is fraught because there are too many hands reaching for too little water," said Lois Henry, founder of SJV Water, the Central Valley's premier water-centric news outlet.

Going forward, "I would say we need a different kind of plan" for storage, said Justin Fredrickson of the state farm bureau. "But there's a lot of inertia. It's difficult to think in a different way. We have two choices. We can have the imagination to build something different … or stay stuck in a place where we don't have a lot of options and just make do."

##

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Bill Lane Center for the American West
473 Via Ortega, Suite 174
Stanford, CA 94305

E-Mail: febarr@stanford.edu
felicitybarringr@gmail.com

Twitter: @felicitybarr

andthewest.stanford.edu

From: Micko, Steve/SAC [Steve.Micko@jacobs.com]
Sent: 5/18/2022 8:52:20 AM
To: Briard, Monique [Monique.Briard@icf.com]; Hendrick, Mike [mike.hendrick@icf.com]
CC: Alicia Forsythe [aforsythe@sitesproject.org]; Heydinger, Erin [erin.heydinger@hdrinc.com]; Leaf, Rob/SAC [Rob.Leaf@jacobs.com]; Thayer, Reed/SAC [Reed.Thayer@jacobs.com]; Saadat, Samaneh [Samaneh.Saadat@jacobs.com]
Subject: Sites BA IOS Model Results
Attachments: IOS_model_results_5_17_22.pdf; Sites_ModelResultsPackage_IOS_May18_2022.pdf

Hi Monique and Mike,

The following model results files are attached:

- **IOS_model_results_5_17_22.pdf**
  - IOS model results report for:
    - NAA 041122 2035CT,
    - ALT3A 041122 2035CT, and
    - ALT3B 041122 2035CT.

I've posted all attached material to the SharePoint as well.

Attached pdf (Sites_ModelResultsPackage_IOS_May18_2022.pdf) briefly describes modeled alternatives and models.

Please let me know if you have any questions.

Best,
Steve

Steve Micko, PE | Jacobs | Project Manager and Water Group Leader
O:916.286.0358 | M:408.834.6614 | Steve.Micko@jacobs.com
2485 Natomas Park Drive Suite 600 | Sacramento, CA 95833

JACOBS

Memorandum

2485 Natomas Park Drive, Suite 600
Sacramento, California 95833-2937
United States
T +1.916.920.0300
F +1.916.920.8463
www.jacobs.com

Project Name Sites Reservoir Project

Subject Model Results to Support the 2022 Biological Assessment: No Action Alternative at 2035CT, Alternative 3A at 2035CT, and Alternative 3B at 2035CT – IOS

Attention Ali Forsythe/Sites Project Authority Monique Briard/ICF
Erin Heydinger/HDR Mike Hendrick /ICF

From Robert Leaf/JACOBS Steve Micko/JACOBS
Reed Thayer/JACOBS Samaneh Saadat/JACOBS

Date May 18, 2022

1. Introduction

The Sites Reservoir Project team has developed model simulations to support quantitative analysis of Sites long-term operations as part of developing a Biological Assessment, for completion in 2022.

The results of these model simulations are provided for informational and review purposes. If there are any questions regarding the results of these simulations, please contact the modeling team.

2. Modeled Scenarios

Model results are provided for the alternatives tabulated below.

Model Name	**Label Name (as seen in spreadsheet)**	**Description**
No Action Alternative 041122 2035CT	NAA 041122 2035CT	Baseline simulation (Reclamation 2021 Benchmark at 2035CT and 15 cm of sea level rise)
Alternative 3A 041122 2035CT	ALT3A 041122 2035CT	1.5 MAF Reservoir with 345 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise
Alternative 3B 041122 2035CT	ALT 3B 041122 2035CT	1.5 MAF Reservoir with 230 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise

IOS is a salmonid life-cycle model. Model description is provided in the deliverable pdf.

3. Model Simulations for Modeled Scenarios

3.2 IOS Model

A pdf report, IOS_model_results_5_17_22.pdf, is provided.

Sites Reservoir Project

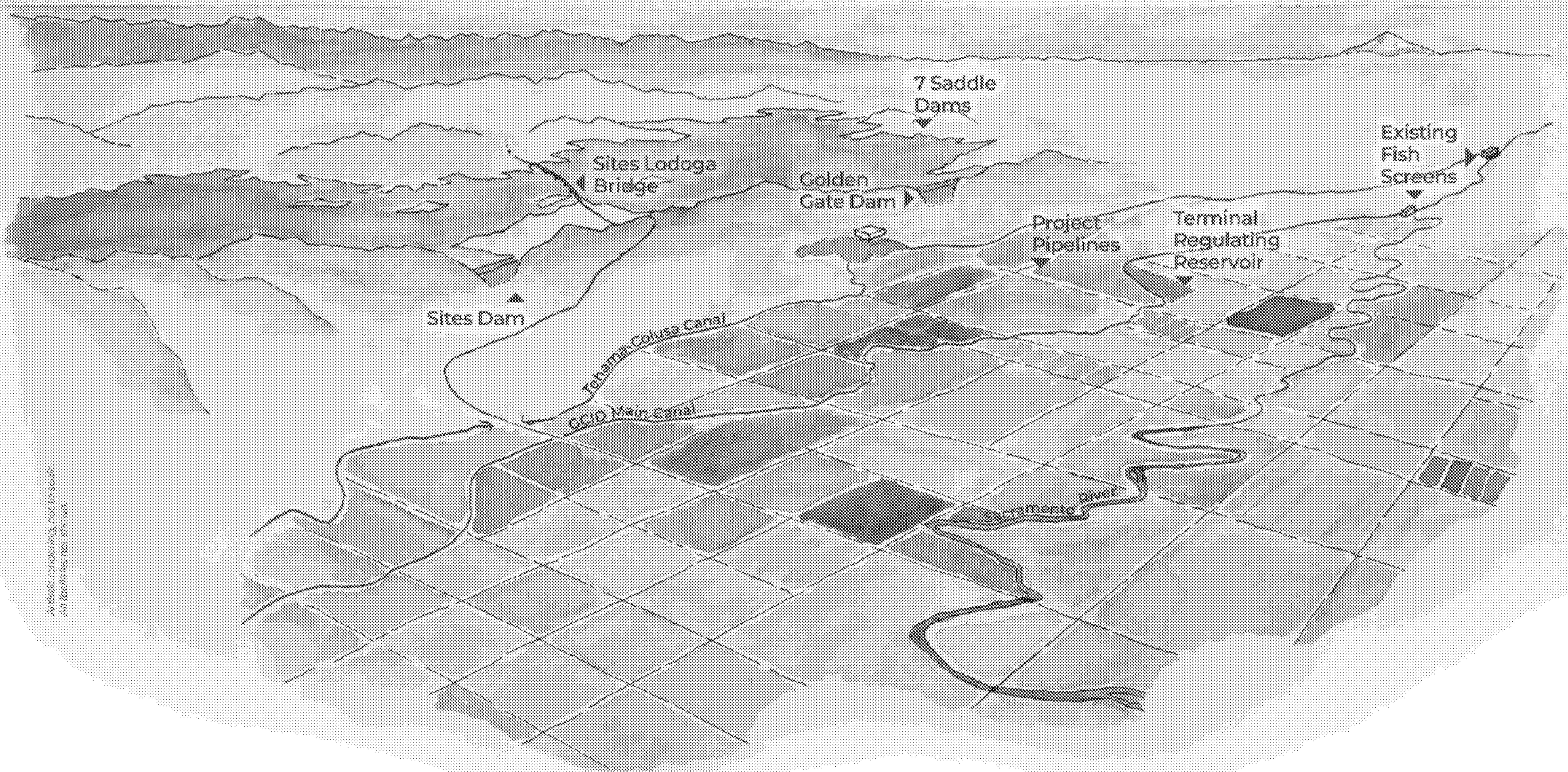
Colusa Drain Mutual Water Company
Board Meeting

May 18, 2022

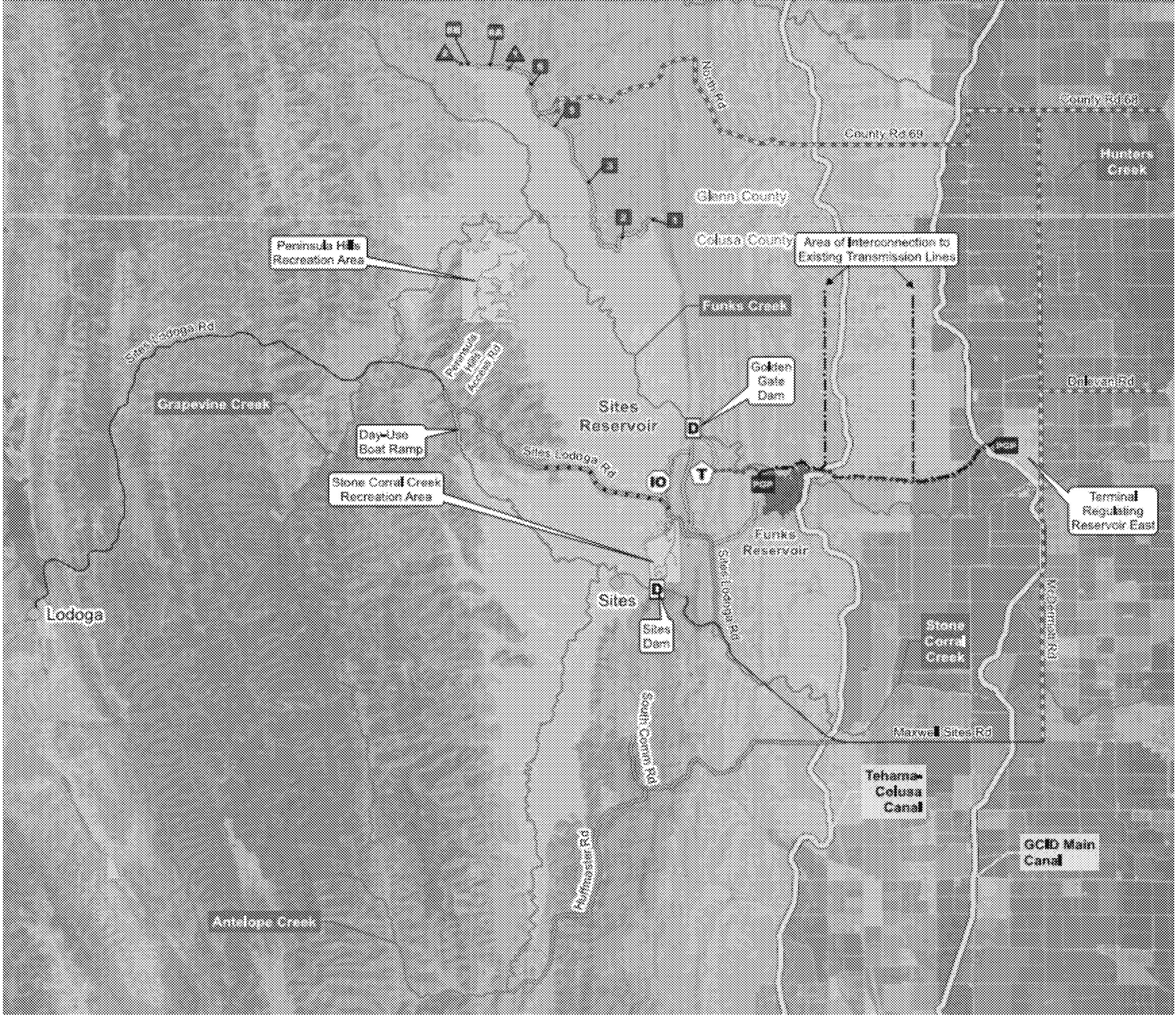
Outline

- Project Overview
- Sites Water Right Application
- Hydraulics and Seasonality
- Real Estate and Agreements
- Next Steps

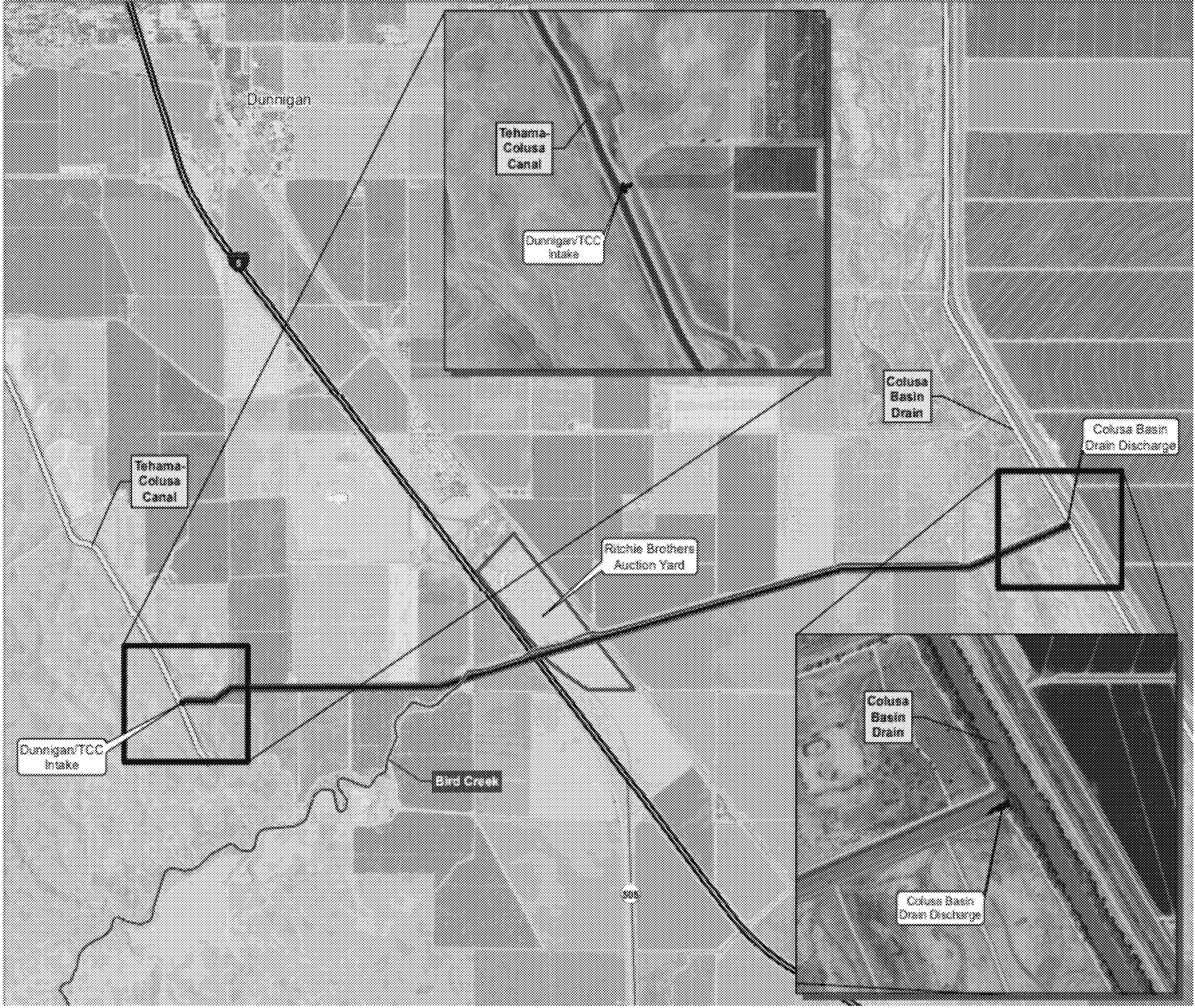
Project Overview



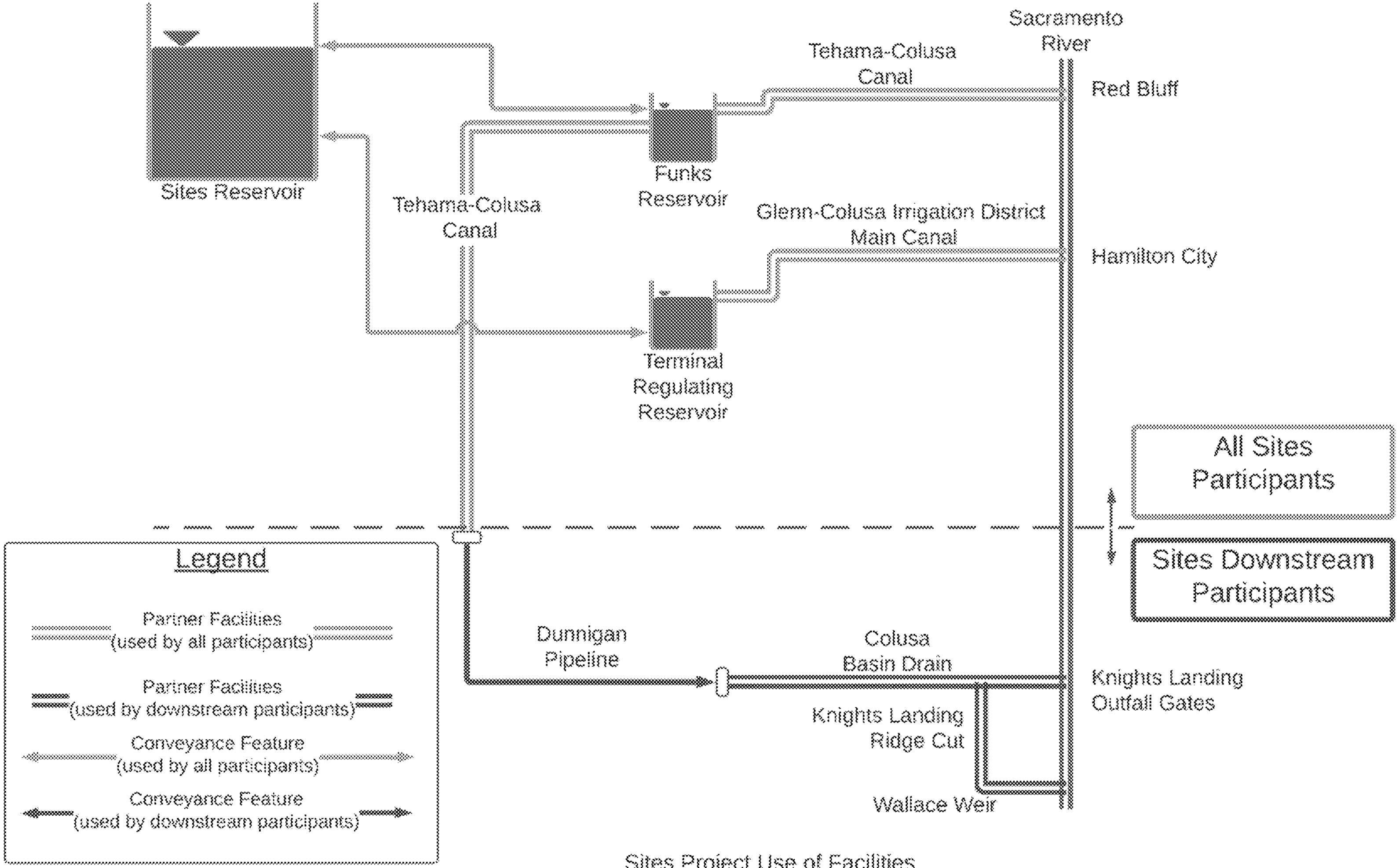
Project Map


County Rd 68
County Rd 69
Hunters Creek
Glenn County
Colusa County
Area of Interconnection to Existing Transmission Lines
Peninsula Hills Recreation Area
Funks Creek
Sites Lodoga Rd
Grapevine Creek
Golden Gate Dam
Delevan Rd
Sites Reservoir
D
Day-Use Boat Ramp
Sites Lodoga Rd
IO
T
Stone Corral Creek Recreation Area
Funks Reservoir
Terminal Regulating Reservoir East
Lodoga
Sites
D
Sites Dam
Sites Lodoga Rd
Stone Corral Creek
McDermott Rd
South Comm Rd
Maxwell Sites Rd
Tehama-Colusa Canal
GCID Main Canal
Huffmaster Rd
Antelope Creek

Project Map


Dunnigan
Tehama-Colusa Canal
Dunnigan/TCC Intake
Colusa Basin Drain
Colusa Basin Drain Discharge
Tehama-Colusa Canal
Ritchie Brothers Auction Yard
Dunnigan/TCC Intake
Bird Creek
505
Colusa Basin Drain
Colusa Basin Drain Discharge

How Sites Will Work



Sacramento River

Red Bluff

Tehama-Colusa Canal

Sites Reservoir

Funks Reservoir

Tehama-Colusa Canal

Glenn-Colusa Irrigation District Main Canal

Hamilton City

Terminal Regulating Reservoir

All Sites Participants

Sites Downstream Participants

Dunnigan Pipeline

Colusa Basin Drain

Knights Landing Outfall Gates

Knights Landing Ridge Cut

Wallace Weir

Legend

Partner Facilities (used by all participants)

Partner Facilities (used by downstream participants)

Conveyance Feature (used by all participants)

Conveyance Feature (used by downstream participants)

Sites Project Use of Facilities

Project Phases

- Phase 1 – Formation of JPA and state funding Prop 1 award (Complete)
- Phase 2 – Certification of environmental impact report and statement and acquisition of key permits (In-progress)
- Phase 3 – Final design and right-of-way acquisition (Mid 2023-2024)
- Phase 4 – Construction and commissioning (Mid-late 2024-2030)
- Phase 5 – Construction close-out and operations (2030 and beyond)

**Delays in securing permits or water rights, could affect the Construction schedule & it will be adjusted accordingly.

Feasibility Project Cost Estimate

approved June 2021

Serving California's **environment**, **families**, and **farms** takes:

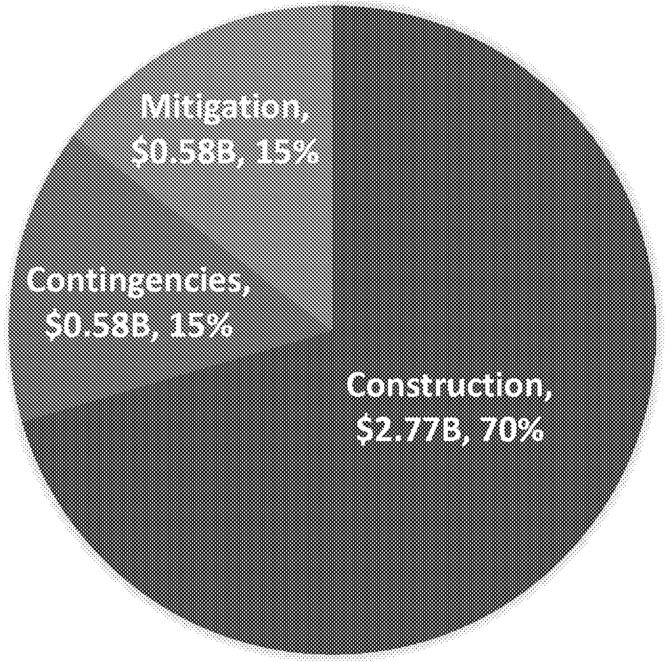
1.5 **million acre-ft of storage**

9 **new dams**

23 **miles of big pipes (9-23ft)**

20 **million cubic yards of fill**

ESTIMATED PROJECT COSTS
($3.9B, 2021$)



Estimated construction costs are based on the class 4 cost estimate for alternative 1 approved by the Reservoir Committee and Authority Board in June 2021

Recent Project Achievements

- Revised Draft EIR/Supplemental Draft EIS (Nov 2021)
- Prop 1 Feasibility Determination - ~$875 million (Dec 2021)
- WIFIA Loan Invitation - ~$2.2 billion (49% of project costs)
- Water Right Application submitted (May 11th)

Sites Water Right Application

Water Right Application Timing

Application submitted on May 11th

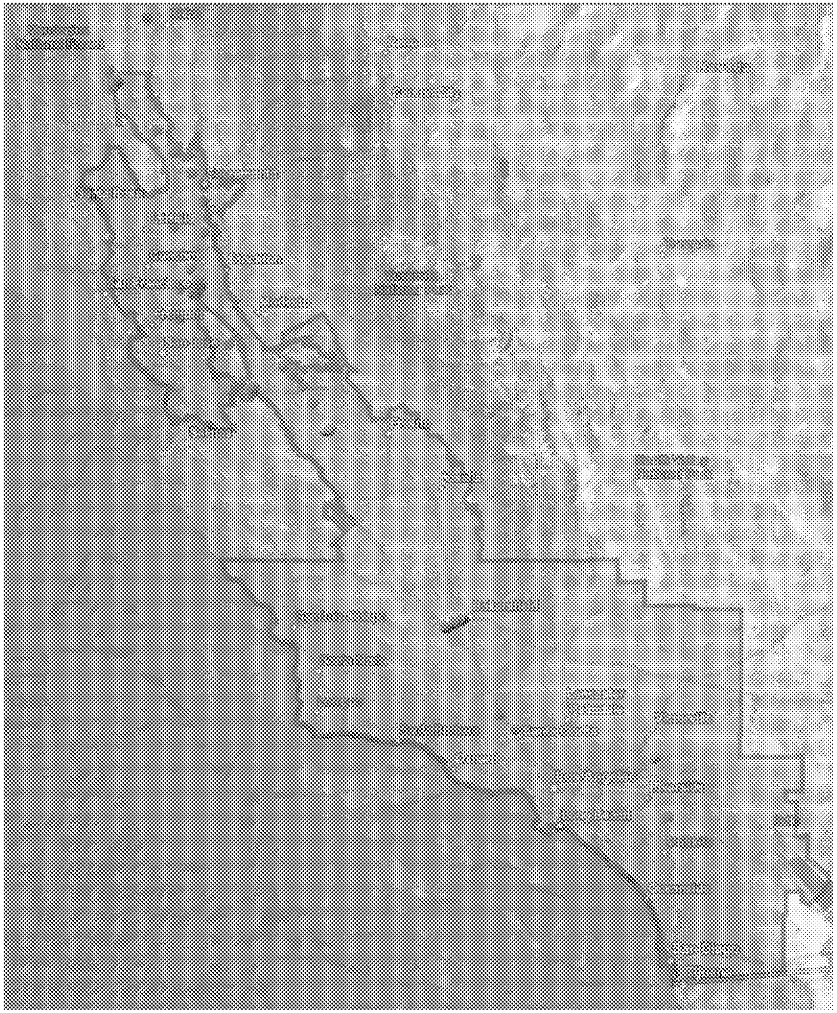
Sites diverts water from the **Sacramento River** between Sep 1 and Jun 14

- Sites impounds Funks and Stone Corral Creeks

Sites diverts in **wet conditions**

- Diversions occur when Delta is in excess conditions
- Flows at Wilkins Slough must exceed 10,700 cfs October through June, 5,000 cfs at all other times

Map of Place of Use with Points of Re-diversion



Hydraulics and Seasonality

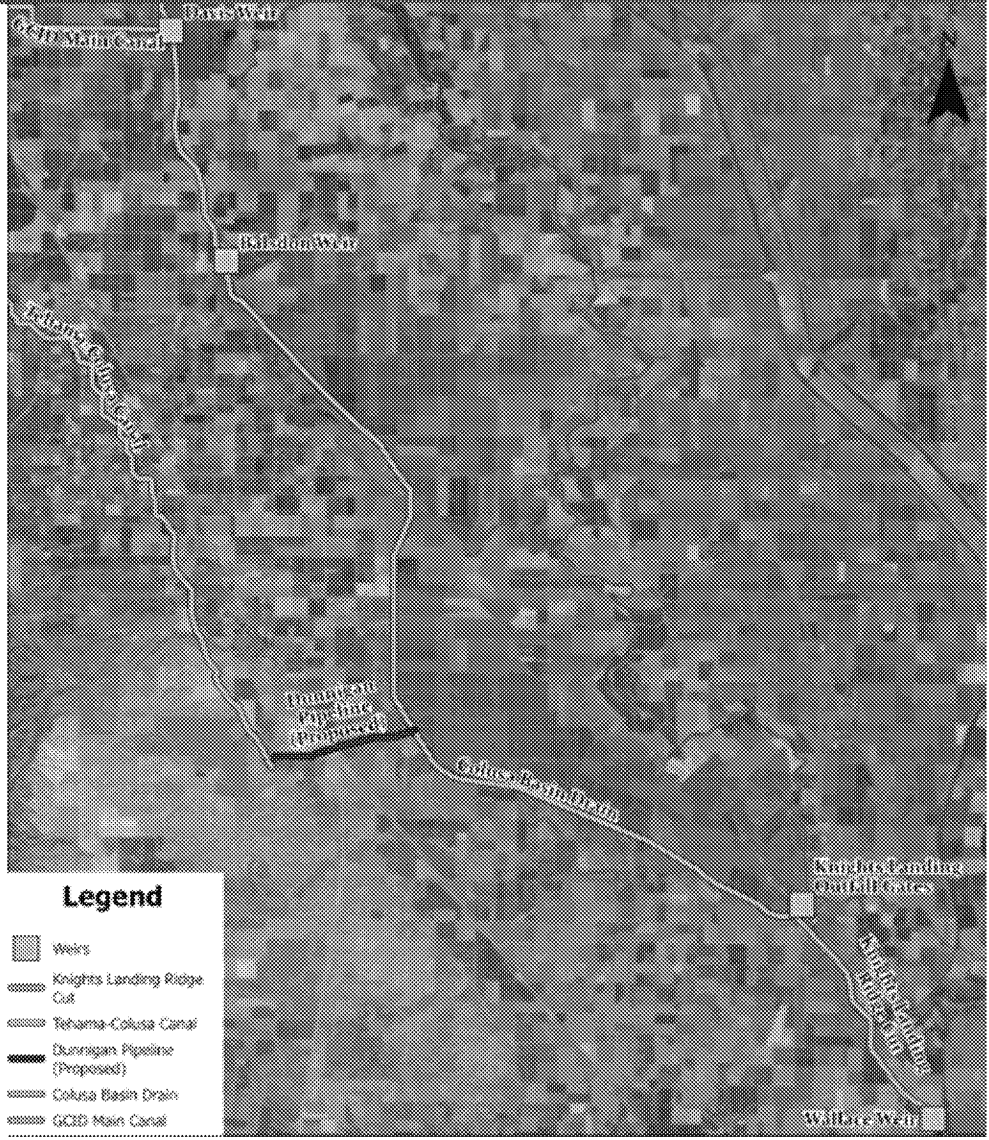
By the Numbers

Offstream Storage: 1.5 million acre-ft

Sites diversions:

- Red Bluff: 2,100 cfs plus losses
- Hamilton City: 1,800 cfs plus losses

Release capacity into CBD: up to 1,000 cfs



Hydraulics

Timing:

- Flow increases:
  - June through November
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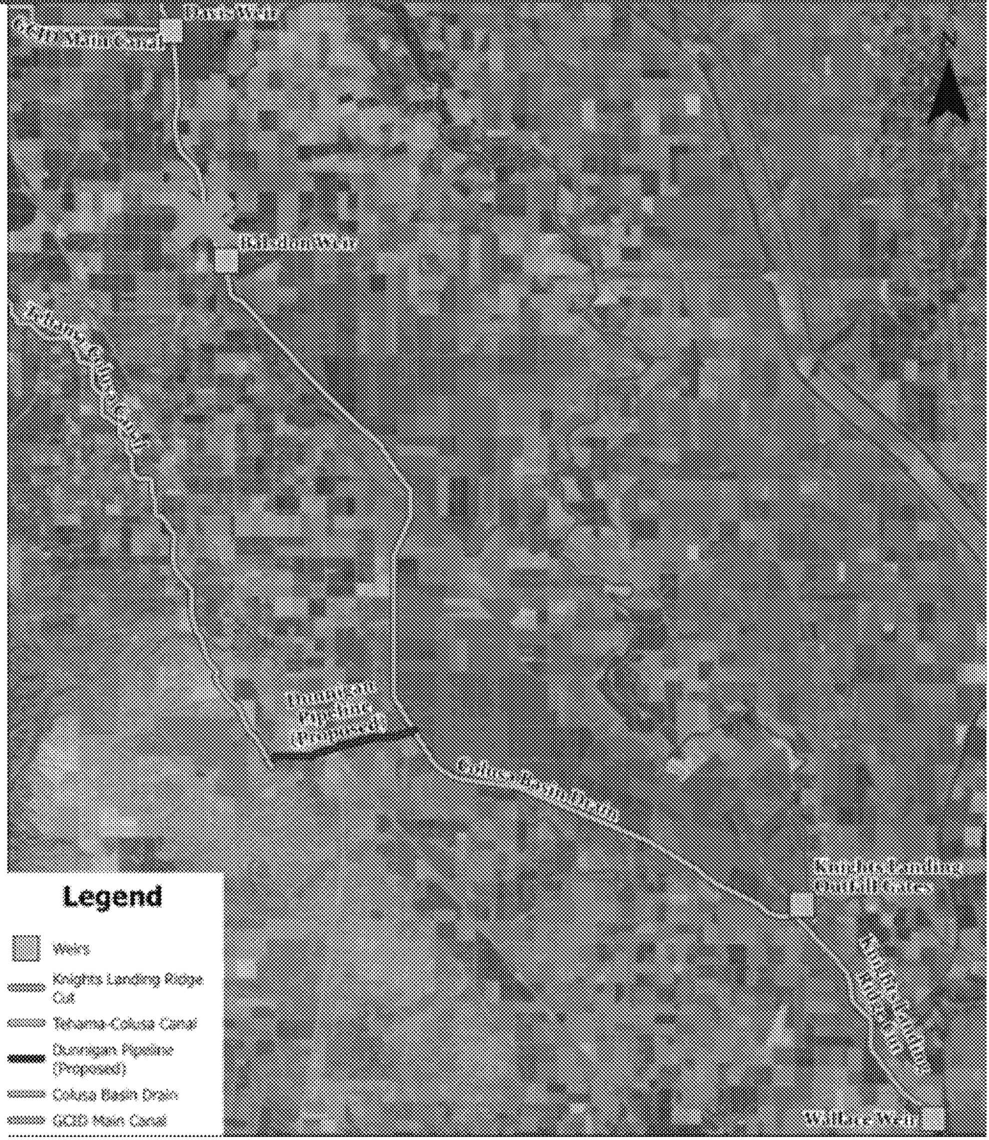
Benefits of Sites Water in the CBD

- Seasonal Water Quality Improvements
- Improved access to MWC water

Hershey Agreement



Real Estate and Agreements

Ownership of the Drain & Potential Agreements

Ownership of the Drain

- Sites has been coordinating with landowners along the Drain & Ridge cut
- Some segments of the Drain have underlying land owned by private interests
- There is currently no active, coordinated maintenance program for the lower Colusa Basin Drain
- Impact concerns for adjacent properties will be addressed by the Sites Project

Potential Agreements

- Maintenance of the lower Colusa Basin Drain and Knights Landing Ridge Cut
- Operation of KLOG
- Operation of Wallace Weir
- Individual landowners & water users

Next Steps

Next Steps

Stay informed: sitesproject.org

Contact:

- JP Robinette – jrobinette@sitesproject.org
- Kevin Spesert – kspesert@sitesproject.org

Questions?

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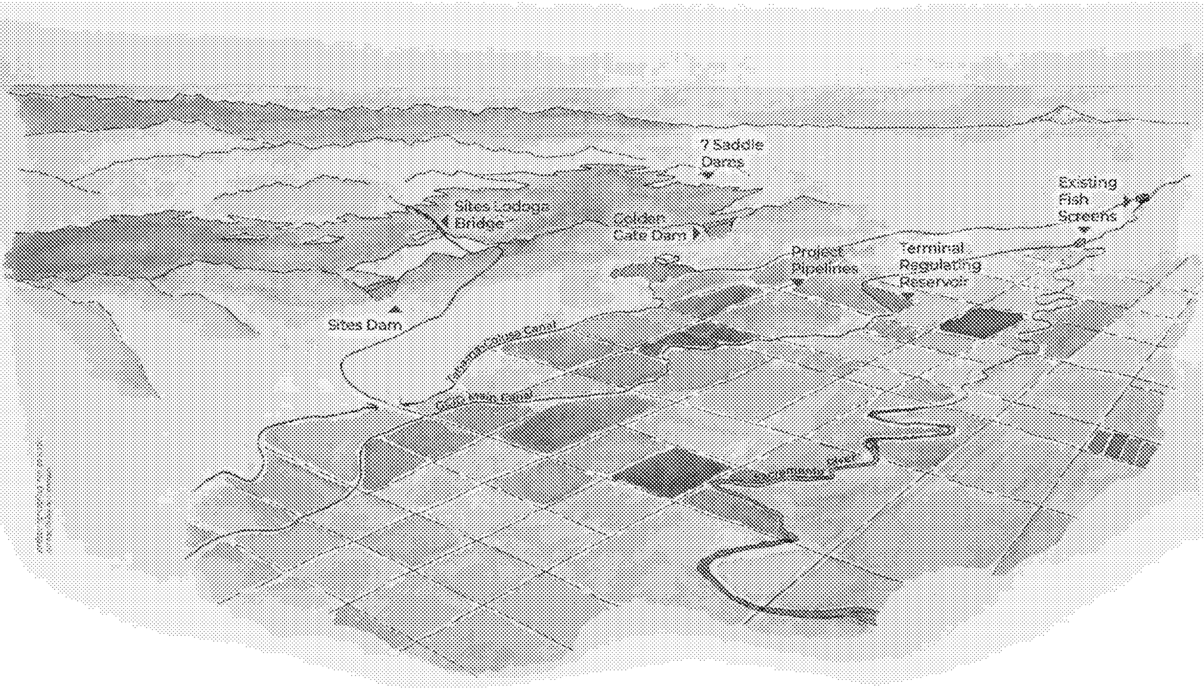
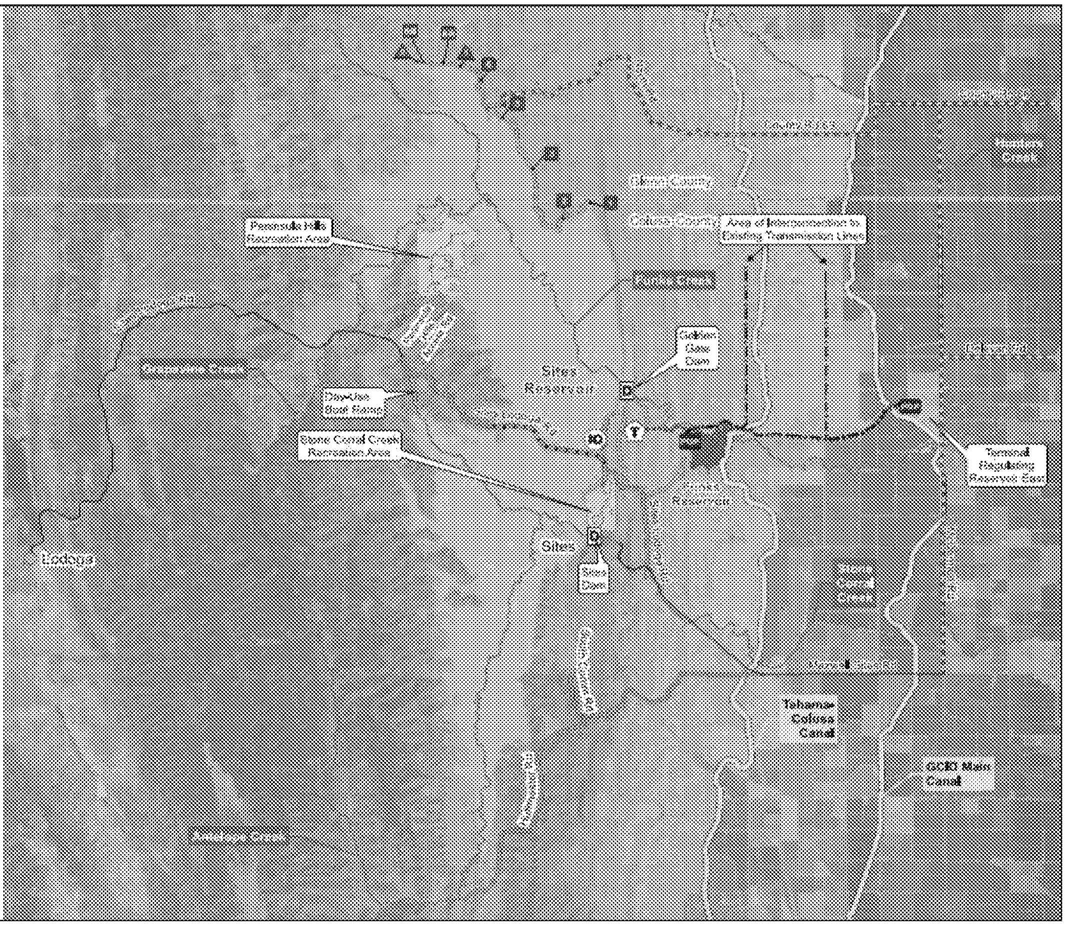


Project Map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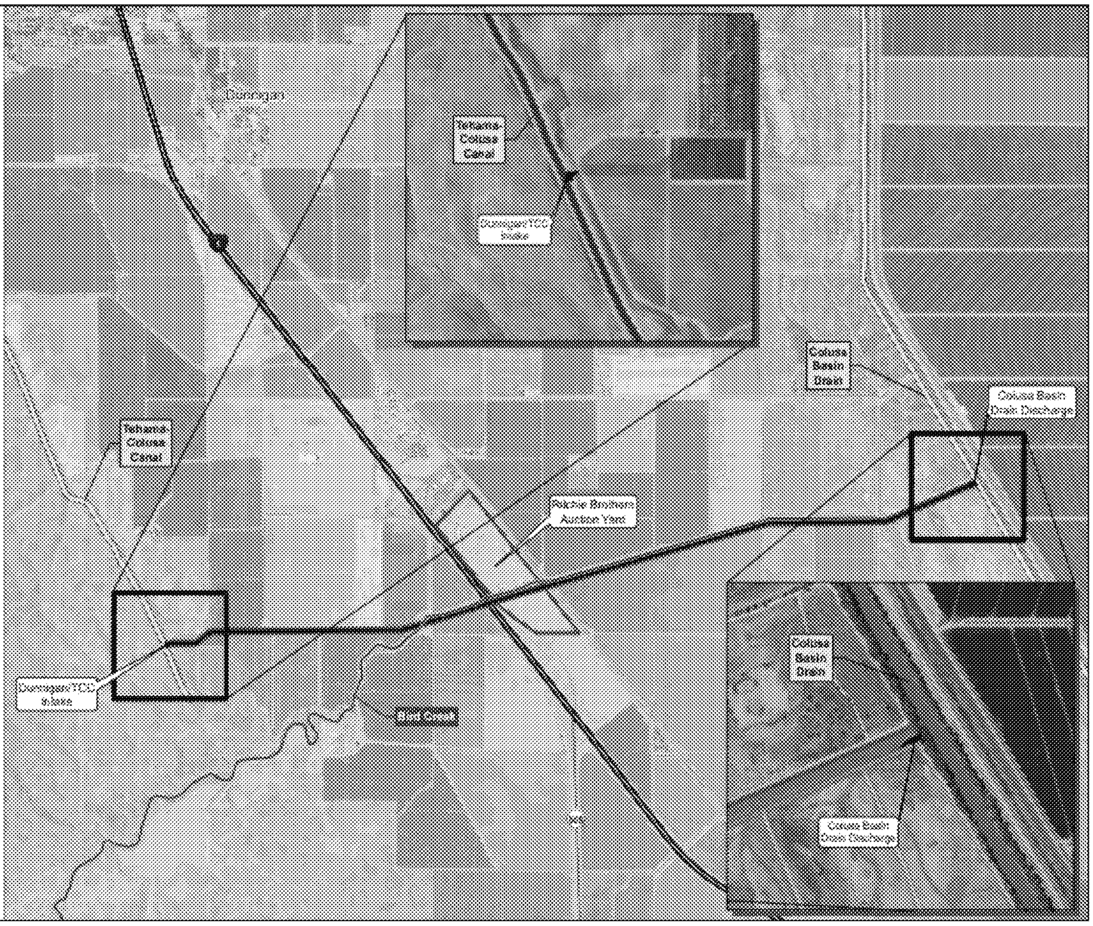
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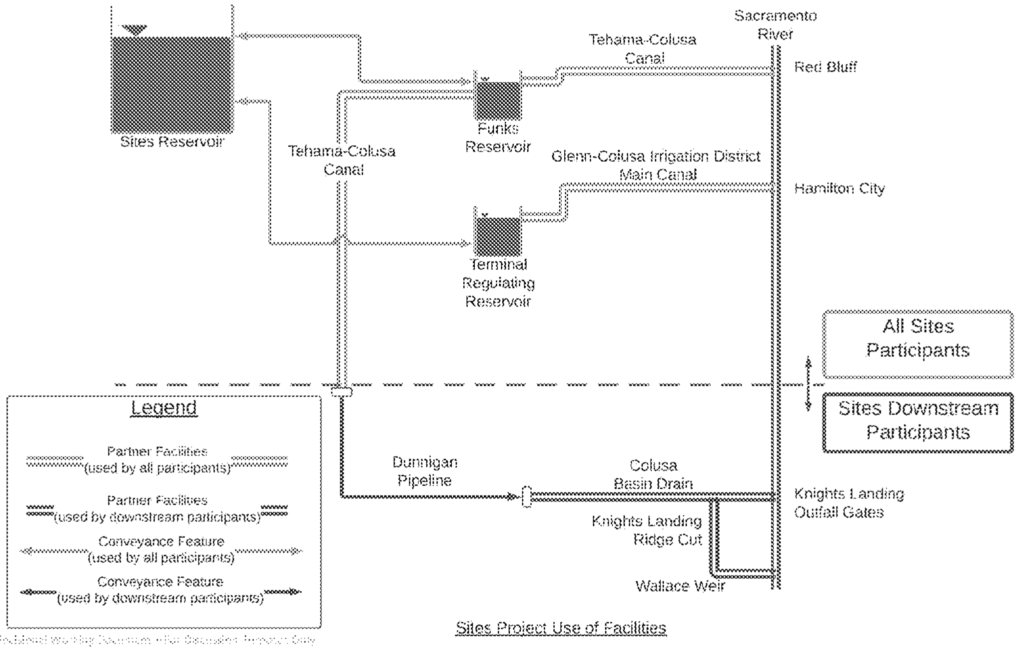
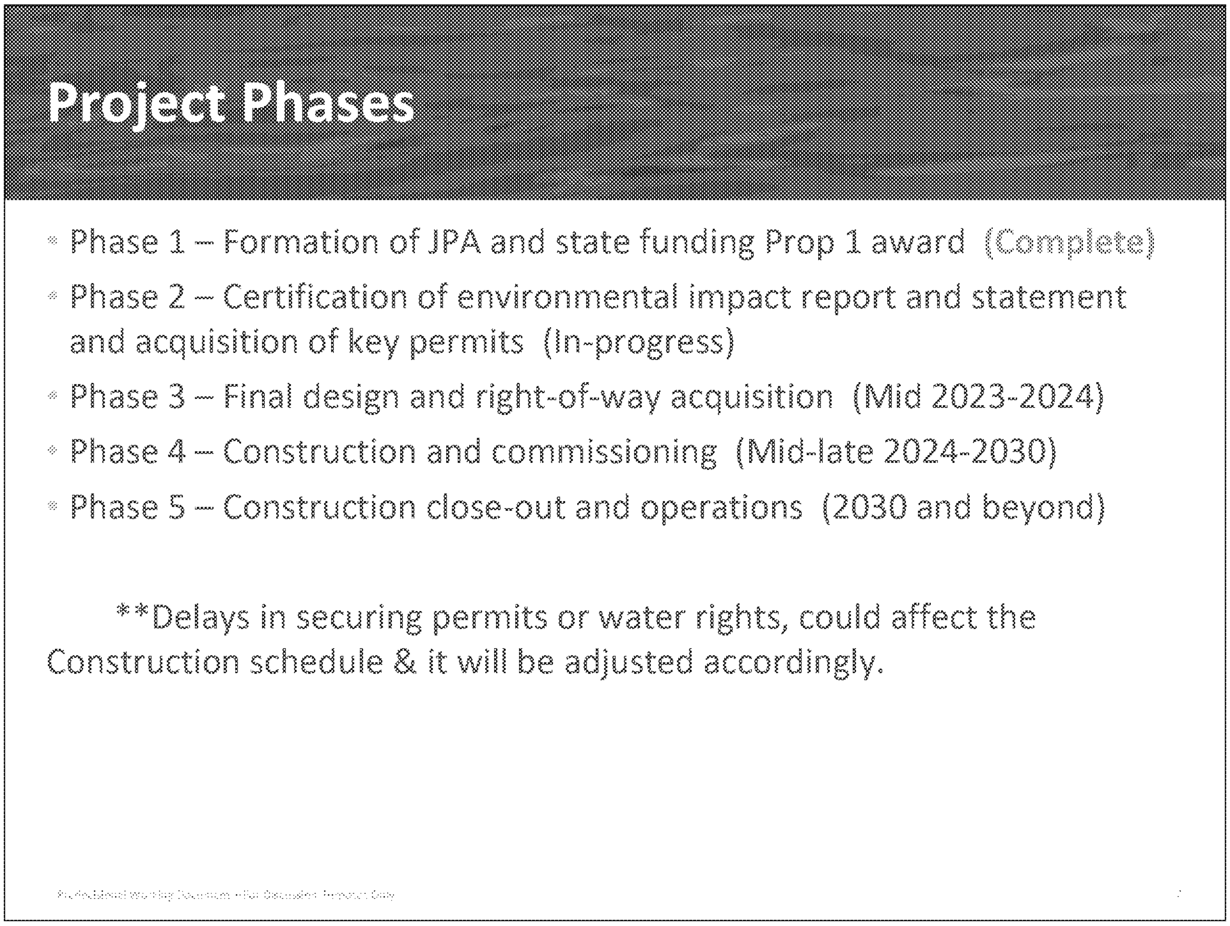
How Sites Will Work



Sites Project Use of Facilities



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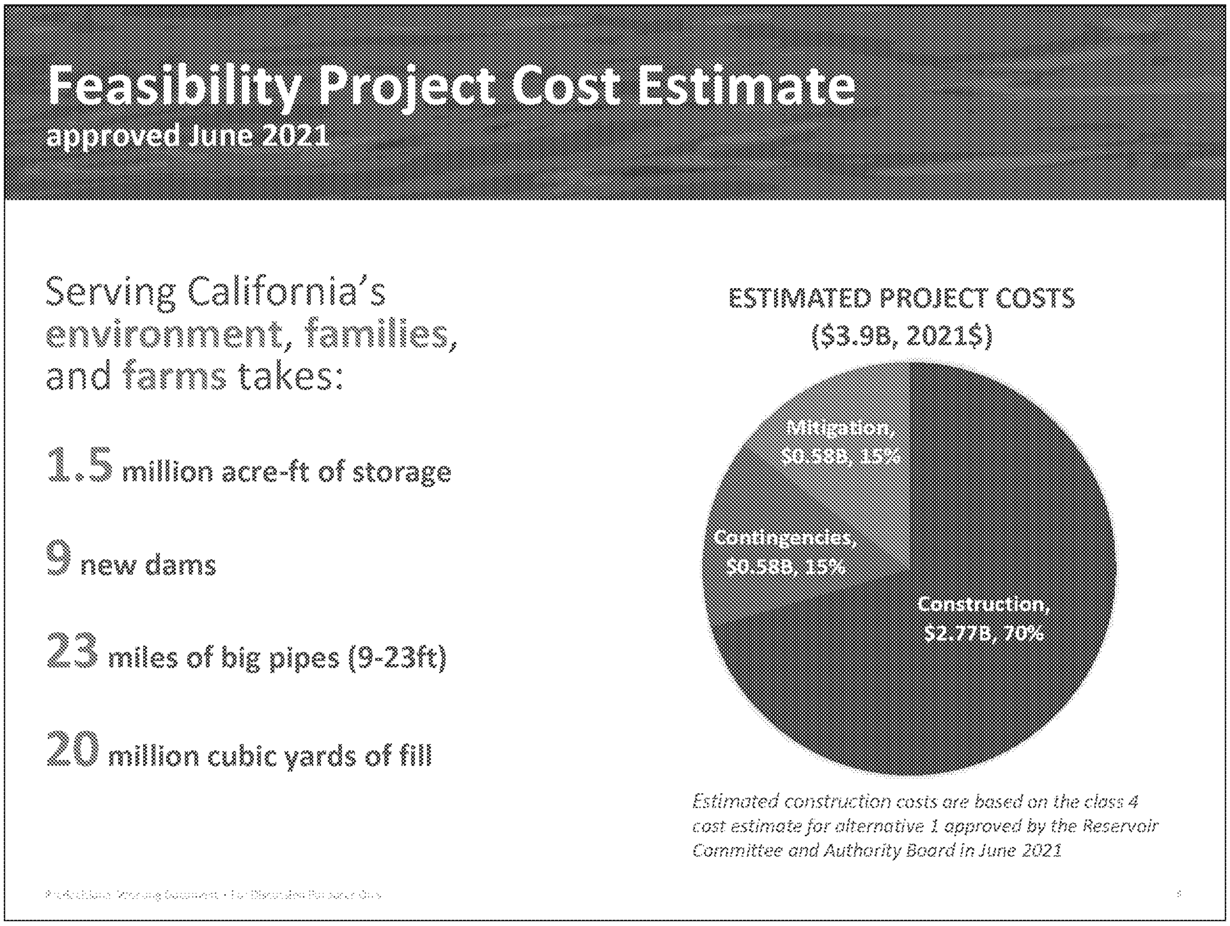

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23 miles of big pipes (9-23ft)

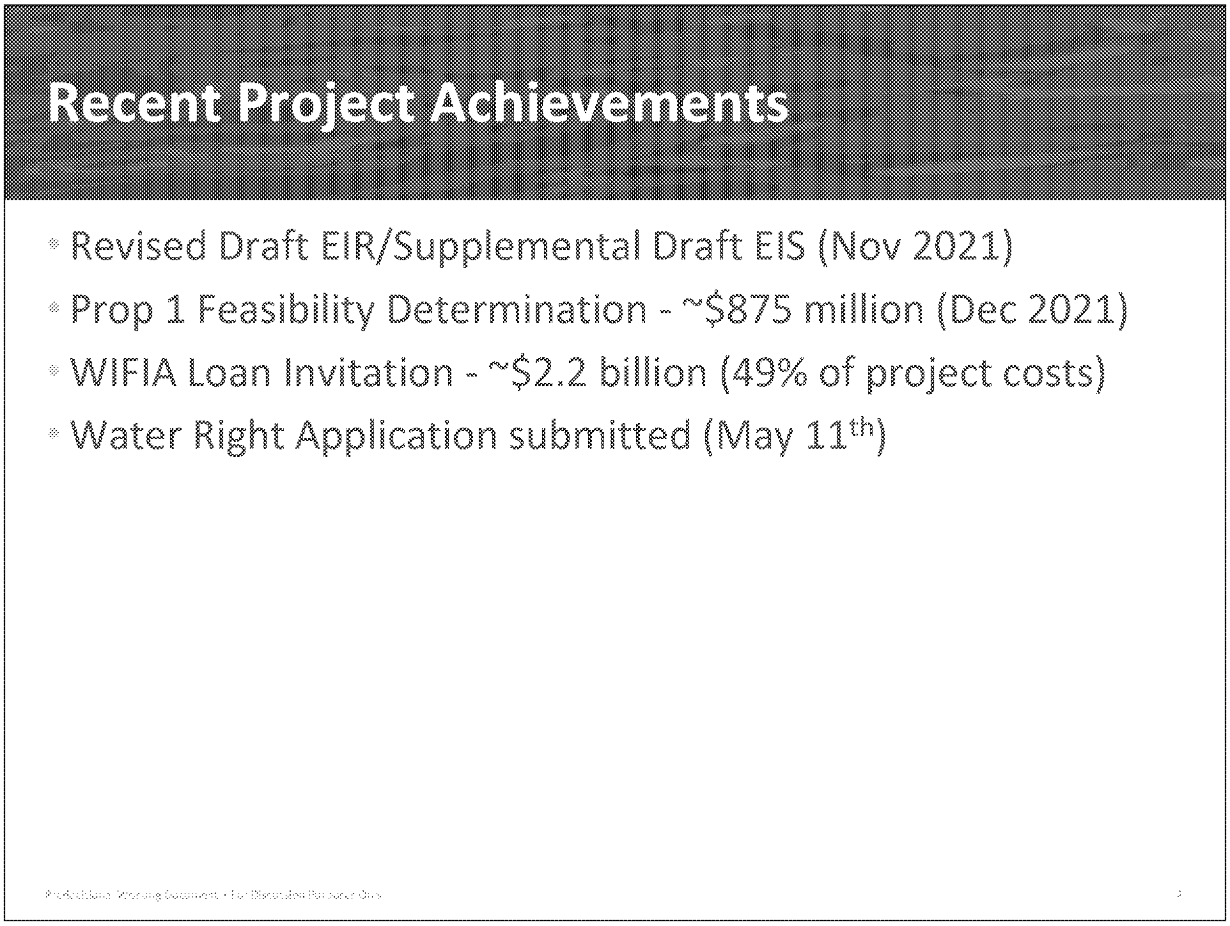
20 million cubic yards of fill

ESTIMATED PROJECT COSTS
($3.9B, 2021$)

Estimated construction costs are based on the class 4 cost estimate for alternative 1 approved by the Reservoir Committee and Authority Board in June 2021

To state the obvious, this is a big project. The June approved class 4 estimate of $3.9B in 2021 dollars 70% for construction, and 15% for both contingencies and mitigation. I like to think in terms of concrete, steel, and copper, so I have provided some of the facility stats to remind us that while there are things we can change, for the purpose of this exercise today we should assume these are the project costs we can expect. Some fun stats.
1.5 million acre-ft is 65 billion cubic feet, or the volume of an almost mile diameter sphere, or 75% of the volume of mount Everest
20 million cubic yards of fill is 55% of the concrete used on the three gorges dam

Explain the difference between the costs in 2021 dollars vs the cost in future dollars. Future dollars vs. 2021 dollars is simply just a matter of adjusting for inflation over a specific period of time. A dollar today will not be worth a dollar in 10 years. It is pretty much like interest earned on money in the bank, but for future dollar of expenses you are dealing with inflation instead. Expenses in todays money is less than expenses in the future because you adjust for inflation



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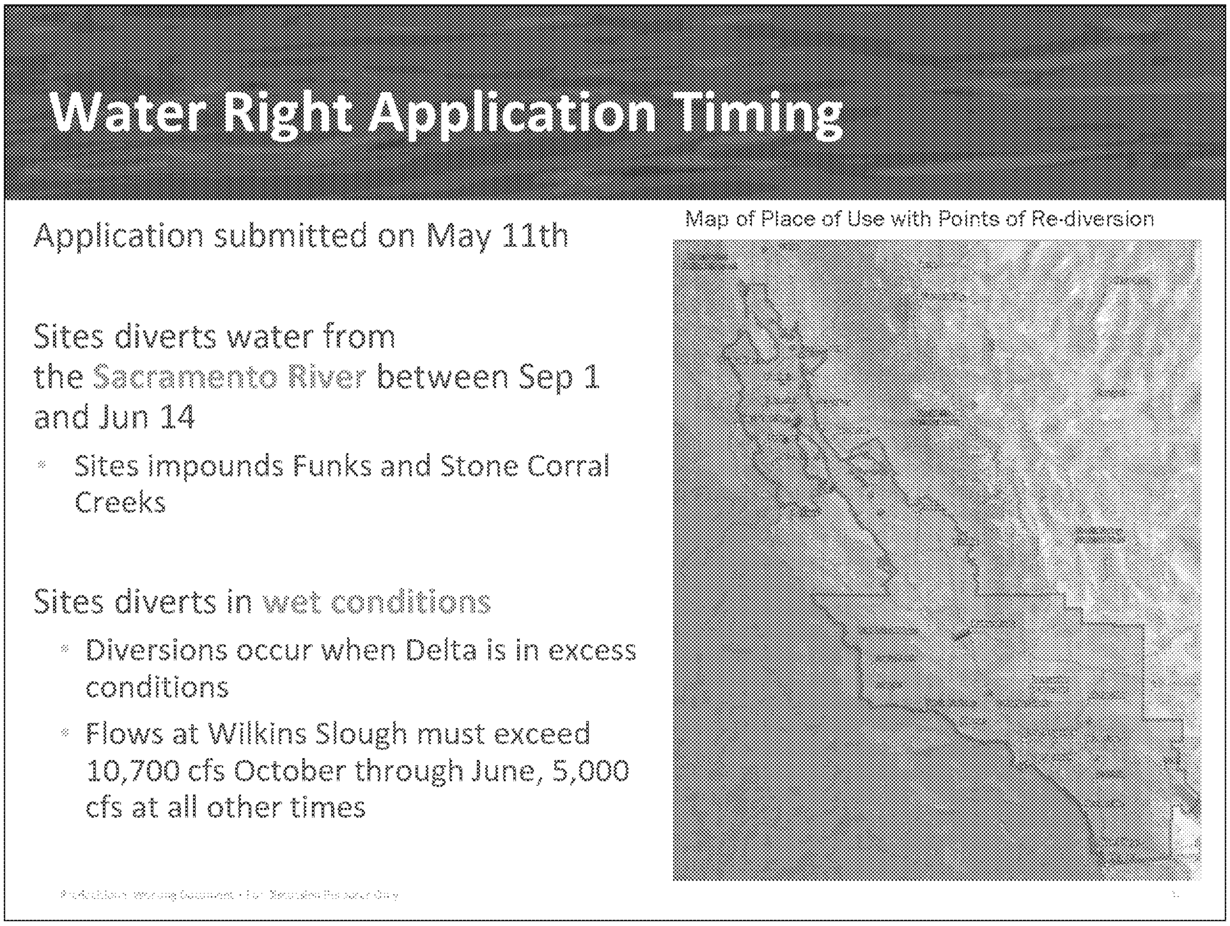

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Sites diverts in wet conditions

- Diversions occur when Delta is in excess conditions
- Flows at Wilkins Slough must exceed 10,700 cfs October through June, 5,000 cfs at all other times

Map of Place of Use with Points of Re-diversion

An important milestone, in particular for financing as the Board has decided not to enter into long-term debt until a water right is secured.

Hydraulics and Seasonality

By the Numbers

Offstream Storage: 1.5 million acre-ft

Sites diversions:

- Red Bluff: 2,100 cfs plus losses
- Hamilton City: 1,800 cfs plus losses

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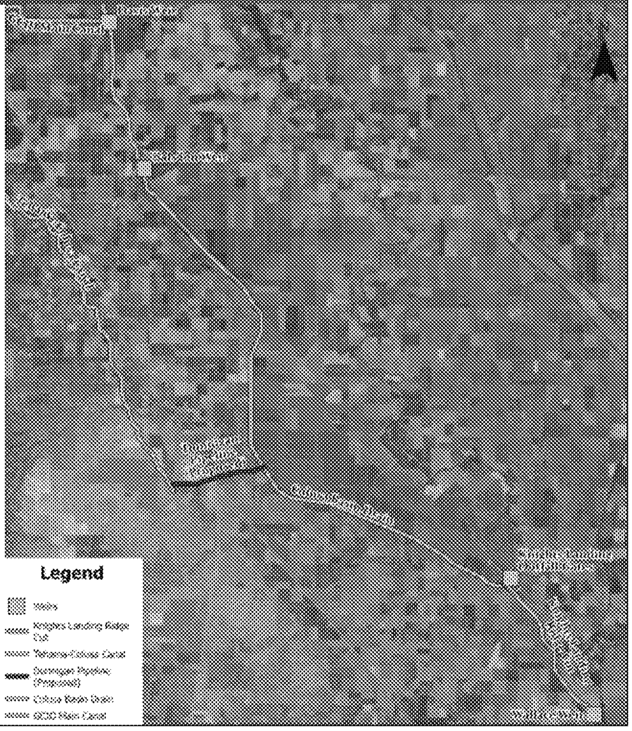

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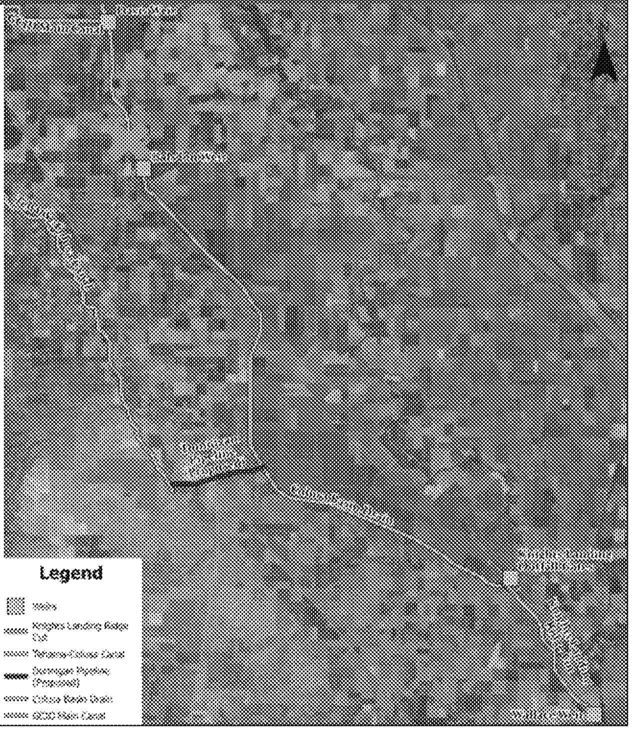

Predecisional Working Document - For Discussion Purposes Only

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Contact:

- JP Robinette – jrobinette@sitesproject.org
- Kevin Spesert – kspesert@sitesproject.org

Questions?

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 5/19/2022 9:41:50 AM
To: Janis Offermann [janis@horizonh2o.com]; Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]
Subject: RE: [EXTERNAL] Re: meeting with Laverne Bill this afternoon
Attachments: 20220519_Sites-Yocha Dehe AB52_Meeting-Agenda.docx

Please see attached, I kept an item for Janis on the status of the site records and GIS data. If we don't need it, we can delete that row.

From: Janis Offermann <janis@horizonh2o.com>
Sent: Thursday, May 19, 2022 9:08 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: [EXTERNAL] Re: meeting with Laverne Bill this afternoon

Wonderful. Thank you, Ali. It has been since last fall since we last met as a group, so we are overdue.

Laurie, do you want to pull together the agenda for distribution, as you have done in the past? Or would you like me to do that today?

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, May 19, 2022 8:53 AM
To: Janis Offermann <janis@horizonh2o.com>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: [EXTERNAL] Re: meeting with Laverne Bill this afternoon

Okay – Its been a really long time since I have talked with Laverne – so lets hold the meeting today. Maybe just 20 or so minutes and then the rest of us can drop off and Janice, if you want to stay on with Laverne and go through the materials, that works. Here's an agenda for the first piece:

General Project Updates
    Status of Final EIR/EIS
    Water Right application submittal and process
    Construction ITP
    Operations ITP and BA
    WIFIA Loan and Water Commission Findings in December
Upcoming Geotechnical Work
    2022-2024 Priority 1A – EA, permits, schedule
    More geotech after this
    How did things go with field monitoring earlier this year?
Open topics

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

---

From: Janis Offermann <janis@horizonh2o.com>
Sent: Thursday, May 19, 2022 7:57 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: [EXTERNAL] Re: meeting with Laverne Bill this afternoon

OK thanks

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, May 19, 2022 7:56 AM
To: Kevin Spesert <kspesert@sitesproject.org>; Janis Offermann <janis@horizonh2o.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: [EXTERNAL] Re: meeting with Laverne Bill this afternoon

I have some topics. Should be quick. Let me get the kids to school and I'll send a follow up email.

Ali

————————

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Reservoir Project | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

---

From: Kevin Spesert <kspesert@sitesproject.org>
Sent: Thursday, May 19, 2022 7:25:00 AM
To: Janis Offermann <janis@horizonh2o.com>; Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: meeting with Laverne Bill this afternoon

I don't have any specific topics.

Kevin

From: Janis Offermann <janis@horizonh2o.com>
Sent: Thursday, May 19, 2022 7:23 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Kevin Spesert <kspesert@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: meeting with Laverne Bill this afternoon

Hi, All
We have our regularly scheduled meeting with Laverne this afternoon. I was about to email him and ask if he wanted to meet this afternoon, or wait until they have had time to digest the data we recently provided to them. However, I wanted to check in with you to see if there are topics that you would like to discuss with him other than the GIS data.

Also, when we had originally sent the GIS info to him, Laverne and I had planned to meet to go over the data together. I was going to offer that to him again, if that is OK.

Thanks
janis

Janis Offermann, MA, RPA
Cultural Resources Practice Lead
Horizon Water and Environment
1800 7th Street, Suite 100
Sacramento, CA 95811
530.220.4918

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CONFIDENTIALITY NOTICE: The contents of this email message and any attachments are intended solely for the addressee(s) and may contain confidential, proprietary and/or privileged information and may be legally protected from disclosure. If you are not the intended recipient of this message or their agent, or if this message has been addressed to you in error, please immediately alert the sender by reply email and then delete this message and any attachments and the reply from your system. If you are not the intended recipient, you are hereby notified that any disclosure, use, dissemination, copying, or storage of this message or its attachments is strictly prohibited.

File Provided Natively

Sites Reservoir Daily Divertible & Storable Flow Tool

1. Objective

The Daily Divertible & Storable Flow Tool (Divertible Flow Tool/Daily Modeling Tool) has been developed to evaluate and test diversion criteria in a real-time operations context. The Tool determine daily divertible and storable flow for Sites Project in October 1st, 2008 – May 31st, 2018 based on water availability and user specified conveyance constraints and diversion criteria. The spreadsheet generates timeseries of diverted and stored flow at three intake locations – Red Bluff, Hamilton City, and Delevan (by default, diversions through Delevan are set to zero in version 2022-05-10). Furthermore, the Divertible Flow Tool can be used to supplement CalSim II by:

- Representing the effects of operations criteria on a daily timestep
- Allowing for relative comparisons between monthly and daily approaches
- Providing results for more recent years (WY 2009 – 2018)

Several differences between CalSim II and the daily Divertible Flow Tool should be considered when both models are used in conjunction to evaluate Sites operations. Firstly, CalSim II yields results on a monthly timestep and the Divertible Flow Tool operates on a daily timestep. Different approaches are sometimes necessary to simulate monthly conditions as opposed to daily conditions, and implementing operation criteria on a daily timestep tends to be more conservative. Additionally, the two modeling tools include different simulation periods. CalSim II includes WY 1922 – 2003 while the Divertible Flow Tool includes WY 2009 – 2018. Table 1-1 shows the difference in proportion of Water Year Types (WYTs) for each modeling tool. As shown, the Divertible Flow Tool includes a drier period than does CalSim II.

Table 1-1. Proportion of Water Year Types in CalSim II and the Daily Divertible Flow Tool

WYT	CalSim II (1922-2003)	Divertible Flow Tool (2009-2018)
Wet	32%	20%
Above Normal	15%	0%
Below Normal	17%	40%
Dry	22%	20%
Critical	15%	20%

Another key difference is that CalSim II provides a continuous simulation over an 82-year period, while the Divertible Flow Tool simulates each year as a separate event. Furthermore, the daily modeling tool only provides estimated fill volumes, whereas CalSim II also includes release operations.

With the above considerations in mind, the daily Divertible Flow Tool serves as a valuable resource that can supplement CalSim II by evaluating Sites operations in real-time.

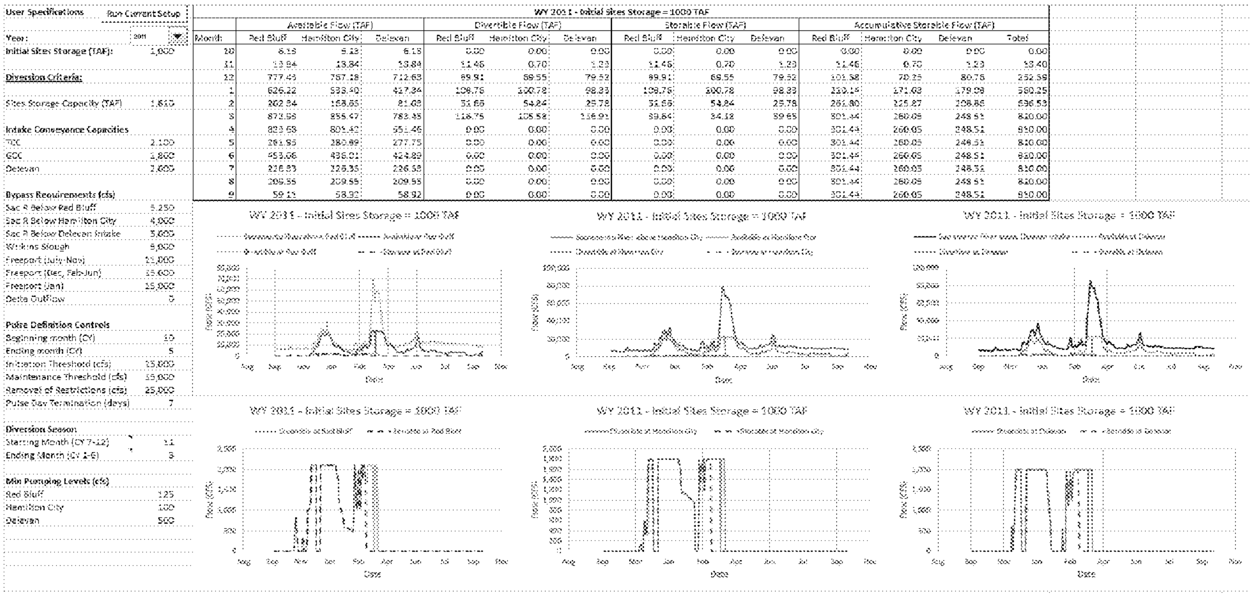
2. Available, Divertible, and Storable Flow

The Divertible Flow Tool uses outputs from the Flow Availability Tool, which estimates flow available for potential diversion to Sites Reservoir, subject to hydrology and regulations outside the scope of Sites Project operations (i.e., Delta Outflow standards, downstream water quality regulations, and other criteria from D-1641). The Divertible Flow Tool can then be used to evaluate various combinations of hydrology and Sites-related operations criteria. Divertible and storable flow are defined as follows:

- Divertible Flow = Flow available for potential diversion to Sites Reservoir subject to flow requirements and conveyance constraints associated with Sites Project.
- Storable Flow = "Divertible Flow" subject to storable capacity.

3. User Specifications and Input Assumptions

Figure 3-1 shows a snapshot of the Tool's dashboard, where users can specify various regulations and constraints corresponding to project operations. The table situated in the top-center displays monthly available, divertible, and storable flows associated with user specifications. The charts show daily hydrographs for the Sacramento River and the divertible and storable flow available at each intake.


User Specifications Run Current Setup

Year: 2011

Initial Sites Storage (TAF): 1,000

Diversion Criteria:

Sites Storage Capacity (TAF) 1,610

Intake Conveyance Capacities

TCC 2,100

GCC 1,800

Delevan 2,000

Bypass Requirements (cfs)

Sac R Below Red Bluff 3,250

Sac R Below Hamilton City 4,000

Sac R Below Delevan Intake 5,000

Wilkins Slough 5,000

Freeport (July-Nov) 11,000

Freeport (Dec, Feb-Jun) 15,000

Freeport (Jan) 15,000

Delta Outflow 0

Pulse Definition Controls

Beginning month (CY) 10

Ending month (CY) 5

Initiation Threshold (cfs) 15,000

Maintenance Threshold (cfs) 15,000

Removal of Restrictions (cfs) 25,000

Pulse Day Termination (days) 7

Diversion Season

Starting Month (CY 7-12) 11

Ending Month (CY 1-6) 3

Min Pumping Levels (cfs)

Red Bluff 125

Hamilton City 100

Delevan 500

WY 2011 - Initial Sites Storage = 1000 TAF

	Available Flow (TAF)			Divertible Flow (TAF)			Storable Flow (TAF)			Accumulative Storable Flow (TAF)			
Month	Red Bluff	Hamilton City	Delevan	Red Bluff	Hamilton City	Delevan	Red Bluff	Hamilton City	Delevan	Red Bluff	Hamilton City	Delevan	Total
10	6.15	5.13	6.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	13.84	13.84	13.84	11.46	0.70	1.23	11.46	0.70	1.23	11.46	0.70	1.23	13.40
12	777.45	767.18	712.63	89.91	69.55	79.52	89.91	69.55	79.52	101.38	70.25	80.75	252.39
1	626.22	583.40	417.34	108.76	100.72	98.33	108.76	100.72	98.33	210.14	171.03	179.08	560.25
2	202.84	158.65	81.08	51.66	54.84	25.78	51.66	54.84	25.78	261.80	225.87	208.86	696.53
3	873.58	855.47	783.45	116.75	105.58	116.91	39.64	34.12	39.65	301.44	260.05	248.51	810.00
4	823.63	801.42	551.46	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00
5	281.95	280.89	277.75	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00
6	453.06	436.01	424.89	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00
7	226.83	226.35	226.58	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00
8	209.55	209.55	209.55	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00
9	59.15	58.92	58.92	0.00	0.00	0.00	0.00	0.00	0.00	301.44	260.05	248.51	810.00

Figure 3-1. Snapshot of the Divertible Flow Tools User Dashboard.

The dashboard gives users the ability to specify the following:

- Year (hydrology) (WY 2009 – 2018)
- Initial Sites Storage (end of September storage)
- Climate Conditions (Historic or 2035CT)
- Sites Storage Capacity (TAF)
- Intake Conveyance Capacity (cfs)
    - Red Bluff (TCC)

  - Hamilton City (GCC)
  - Delevan
- Bypass Flow Requirements (cfs)
  - Sacramento River at Red Bluff
  - Sacramento River at Hamilton City
  - Sacramento River at Delevan
  - Sacramento River at Wilkins Slough
  - Sacramento River at Freeport
- Pulse Flow Criteria at Bend Bridge
  - Initiation Flow Threshold
  - Maintenance Flow Threshold
  - Pulse Duration Limit
- Delta Outflow Criteria
- Fremont Weir Notch (on/off switch)
- Weir Spill Protection
  - Fremont Weir Spills
  - Aggregate Weir Spills to Sutter Bypass (from Moulton Weir, Colusa Weir, & Tisdale Weir)
- Minimum Pumping Level (cfs)
  - Red Bluff (TCC)
  - Hamilton City (GCC)
  - Delevan
- Low Level Pumping (diversion rate at each intake when Sacramento River flow at a certain location is less than its associated bypass flow requirement) (cfs)
  - Wilkins Slough Bypass override
  - Freeport override
  - Bend Bridge pulse protection override
- Intake Prioritization
- Diversion Season (range of months)
- Intake Season (specify when diversions are permitted at each intake) (range of months)

- Surplus Outflow (February – March)

3.1 Year (Hydrology)

Users can toggle through 10 different Water Years (WYs) – 2009 through 2018. However, WY 2018 only includes information up to May 31st. Each year provides a different hydrologic condition. The water year hydrologic classifications associated with each year are provided in Table 3-1. Water Year Hydrologic Classification Index (CDEC, 2019).Table 3-1. Each year is associated with flow availabilities that were estimated in the Flow Availability Tool.

Table 3-1. Water Year Hydrologic Classification Index (CDEC, 2019).

Water Year	Water Year Type
2009	D
2010	BN
2011	W
2012	BN
2013	D
2014	C
2015	C
2016	BN
2017	W
2018	BN

3.2 Initial Sites Storage (End of September)

Initial Sites storage has potential to affect the quantity of flow that is stored in the reservoir. Through a range of initial Sites storages, users can evaluate the duration for the reservoir to reach capacity, which occurs when storable flow no longer equals divertible flow. In drier years, storage capacity may never be reached even when initial storage is set relatively high. The default initial storage is 60 TAF.

3.3 Initial Sites Storage (End of September)

Flow inputs to the Divertible Flow Tool can be adjusted for historic conditions or 2035CT conditions using the climate switch in Cell B5 of the User_Specifications sheet. The flow inputs effected by climate change can be found in the “Divertible_Flows_Calcs” sheet.

3.4 Sites Storage Capacity

The default Sites storage capacity is 1.5 MAF. However, users can enter any desired value.

3.5 Intake Capacity

The default intake capacities of the Tehama Colusa Canal (Red Bluff intake), Glenn Colusa Canal (Hamilton City intake) are 2,100 cfs and 1,800 cfs, and respectively. However, users can enter any desired value.

3.6 Bypass Flow Requirements

A bypass flow requirement can be specified along the Sacramento River at five locations:

1. Red Bluff (default = 3,250 cfs)
2. Hamilton City (default = 4,000 cfs)
3. Delevan (default = none)
4. Wilkins Slough (default = 8,000 cfs in April – May)
5. Freeport (default = none)

Furthermore, users can specify a range of months at which the Wilkins Slough and Freeport bypass requirements are implemented (by entering the starting month in column C and entering the ending month in column D). Freeport includes four different cells at which bypass criteria can be entered. The first cell ("B22") dictates bypass criteria over a user-specified range of months. The next three cells ("B23:B25") dictate bypass criteria that persist under the primary Freeport bypass criteria for various times of the year.

3.7 Pulse Flow Criteria at Bend Bridge

The pulse flow criteria at Bend Bridge was developed to protect fish migration during naturally occurring, storm-induced, pulse flow events in the Sacramento River. Pulse flows are defined as extended peak river flows at Bend Bridge that originate from storm event tributary inflows downstream of Keswick Dam. A pulse is initiated once the three-day running average flow at Bend Bridge exceeds the "Initiation Threshold". The pulse persists as long as the three-day running average flow at Bend Bridge remains above the "Maintenance Threshold". If the three-day running average flow at Bend Bridge exceeds the "Removal of Restrictions Threshold", then Sites diversions are permitted if flow at Bend Bridge remains above the Maintenance Threshold. The "Reset Threshold" represents the value at which the 3-day moving average flow at Bend Bridge must not exceed for a given number of days before another pulse protected event can be triggered. The "Pulse Protection Duration" can be used to set the number of consecutive days that a pulse period can last before the protection criteria is removed. For example, if the Pulse Duration Limit is set to 7 days, then diversions to Sites are permitted after flow at Bend Bridge exceeds the pulse flow threshold for over 7 consecutive days. The Bend Bridge pulse protection criteria can be further modified in the "BB_Pulse_Definitions" tab. The current set of criteria assumes the following:

1. Season:
    a. Pulse protection can be initiated in October through May
2. Initiation:
    a. 3-day moving average Sacramento River flow at Bend Bridge must exceed 8,000 cfs,
    b. And the 3-day moving average tributary flow upstream of Bend Bridge (Cow Creek, Cottonwood Creek, and Battle Creek) must exceed 2,500 cfs
3. Duration:
    a. Pulse protection lasts for 7 days upon initiation
4. Re-setting condition:
    a. After completion of a pulse protection period, the following conditions must occur before another pulse event is triggered:

i. 3-day moving average of Bend Bridge flow was less than 7,500 cfs for 7 consecutive days,

ii. 3-day moving average tributary flow up upstream of Bend Bridge (Cow Creek, Cottonwood Creek, and Battle Creek) was less than 2,500 cfs for 7 consecutive days

3.8 Delta Outflow Criteria

The Divertible Flow Tool includes a few options to constrain Sites diversion based on Delta Outflow requirements. “Delta Outflow (SWP ITP) is intended to represent the 44,500 cfs flow requirement included in the 2020 SWP ITP. “Delta Outflow (Additional) is intended for any supplemental delta outflow constraints.

Users can also turn on or off NDOI criteria, which implements Delta Outflow targets for a specified period (default of March 1st through May 31st) based on WaterFix longfin smelt protection criteria (Incidental Take Permit No 2081-2016-055-03, WaterFix, CDFW, page 186). Outflow targets are determined based on a table derived from a linear relationship between the 50% exceedance forecast for the current month’s Eight River Index (8RI) and recent historic Delta outflow (1980 – 2016). These tables have been stored in the “Ref. Tables” tab. The NDOI criteria is set off by default.

3.9 Fremont Weir Notch Spill Protection

The Fremont Weir Notch and its associated flow protection criteria can be turned on or off in the Divertible Flow Tool. Spills over the Fremont Weir Notch are based on a rule curve used in CalSim II. Furthermore, the Sites diversion criteria protects spills of up to 6,000 cfs from November 1st through March 15th. Figure 3-2 and Figure 3-3 demonstrate the effect of the Fremont Weir notch and its associated protection criteria on spills and diversions to Sites in an example scenario for WY 2010. The notch protection criteria cause a reduction in diversions to Sites, most notably in February when nearly all diversions are restricted because notch spills range from 0 – 6,000 cfs for most of the month.

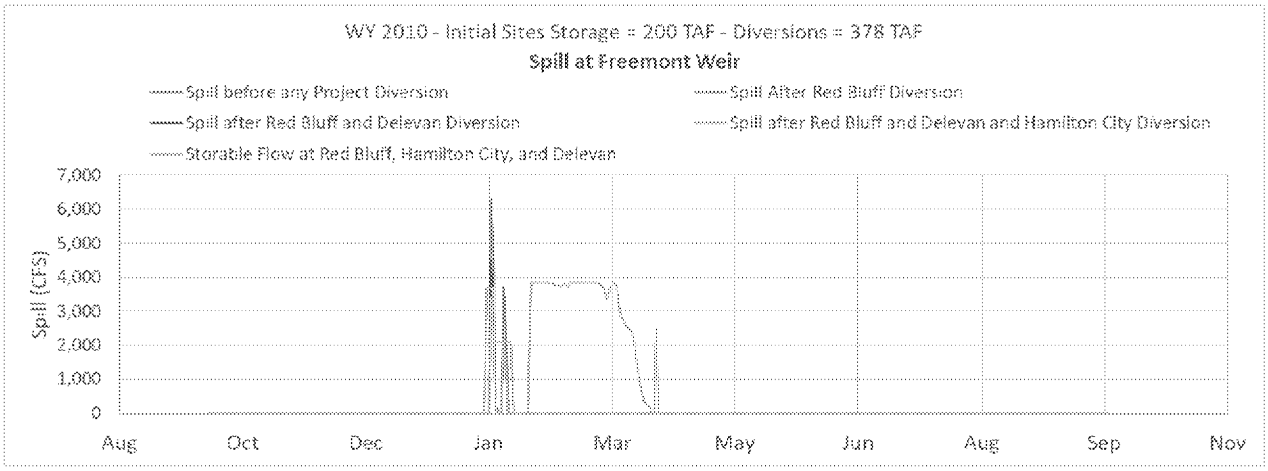


Figure 3-2. Spill at Fremont Weir vs Storable Flow – Without the Fremont Weir Notch.

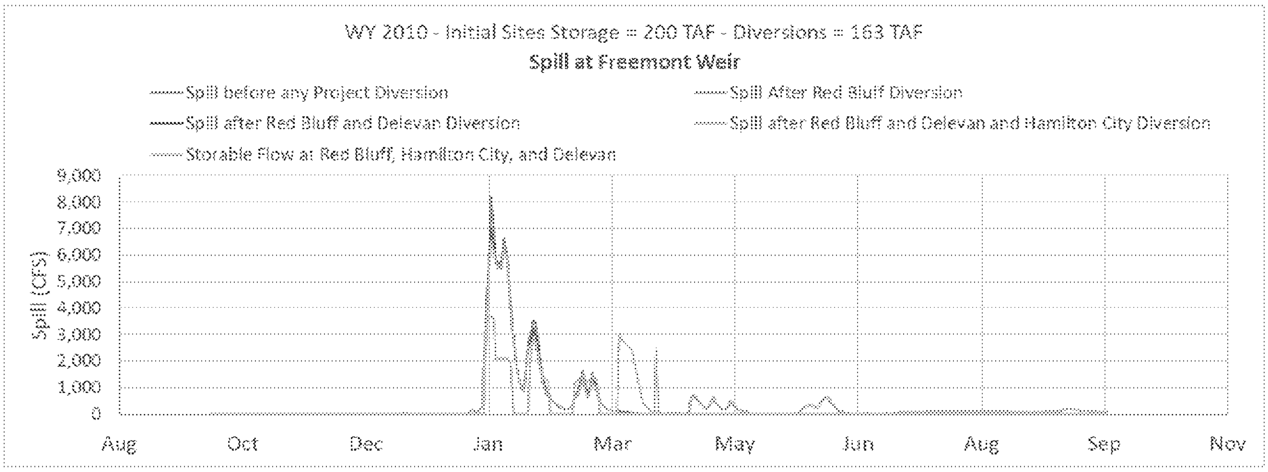


Figure 3-3. Spill at Fremont Weir vs Storable Flow – With the Fremont Weir Notch (and associated protection criteria).

In the daily modeling tool, users may specify buffer values for Fremont Weir notch protection. Two buffer values may be specified – one for spills between 0 and 600 cfs (low-spill buffer), and one for spills between 600 and 6,000 cfs (high-spill buffer). The buffer values are entered as percentages of flow above certain thresholds that may be diverted to Sites. For example, consider a case where the user enters a low-spill buffer of 1% and a high-spill buffer of 10%. The following would take effect:

- November 1 – March 15
    - When spills range between 0 – 600 cfs, 1% of the spill may be impacted for Sites diversion
    - When spills range between 600 – 6,000 cfs, 10% of the of the spill may be impacted for Sites diversion

3.10 Protection of Aggregate Weir Spills to the Sutter Bypass

The Tool provides users the ability to implement protection of spills into the Sutter Bypass via Colusa Weir, Moulton Weir, and Tisdale Weir. Users can specify the upper bound of the total spill range that must be protected, a buffer on the specified spill range, and the percent of spill that can be diverted to Sites in the specified spill range. Aggregate Sutter Bypass weir spill protection is set off by default.

3.11 Minimum Pumping Level

Each intake is assigned a minimum level of flow that can be diverted into Sites Reservoir. If flow availability is below an intake's minimum pumping level, then the intake will not be utilized. The smallest pumps at Red Bluff and Hamilton City have capacities of 125 cfs and 100 cfs, respectively.

3.12 Low Level Pumping

Users can specify low level pumping rates when Sacramento River flow at a certain location is less than its associated bypass flow requirement and above the user specified "low level pumping initiation flow". For example, if the low level pumping rate at Red Bluff is set to 300 cfs, the initiation flow rate at Wilkins Slough is 5,000 cfs, the bypass flow rate at Wilkins Slough is 10,000 cfs, and the actual flow rate at Wilkins Slough is 8,000 cfs, then the Red Bluff intake can divert up to 300 cfs from the river. Low level pumping rates can be used to override three bypass flow criteria: Bend Bridge pulse protection, Wilkins Slough bypass flows, and Freeport bypass flows. Low level pumping is set off by default.

3.13 Intake Prioritization

Intake prioritization is not modifiable in this version of the Divertible & Storable Flow Tool. The current setup prioritizes diversions at Red Bluff and then at Hamilton City (by default, Delevan is not used in version 2022-05-10).

3.14 Diversion Season

A diversion window can be defined to constrain the months in which the Divertible Flow Tool will attempt to allocate water into Sites Reservoir. Users can enter a starting month (from July through December) and ending month (from January through June). The default diversion season is November through May. Diversions to Sites would not be expected in June through October, as this is the period coincides with the season of Sites deliveries.

3.15 Intake Season

The Intake Season refers to the months in which diversions are permitted at each intake. For example, if the Red Bluff starting month is set to 1 and its ending month is set to 6, then diversion through the Red Bluff intake can only be made from January through June. By default, the Red Bluff and Hamilton City intakes are only limited by the diversion season (default = November through May), while the intake season for Delevan is turned off.

3.16 Freeport Pulse and Post Pulse Protective Criteria

Pulse & Post-Pulse criteria based on the 2016 CWF ITP have been integrated into the Daily Divertible Flow Tool. These criteria are set off by default. If specified by users, Sites intakes can be operated within a range of pulse protection and post-pulse protection levels (1 through 3) in place when winter run chinook salmon (CHNWR) and spring run chinook salmon (CHNSR) migration is occurring. The post-pulse protection operations are defined in Sub Table A of the CWF ITP. In the daily modeling tool, two interpretations of the criteria for transition among pulse-protection levels are included:

- Fish presence (Knights Landing Catch Index (KLCI)) (CWF ITP)
- Sacramento River flow at Freemont (CalSim II based logic)

Table 3-2 identifies the assumptions implemented in the CWF ITP (criteria based on fish presence) and the assumptions implemented in CalSim II.

Table 3-2. Pulse and Post-Pulse Assumptions of CWF ITP vs CalSim II.

Pulse and Post-Pulse Assumptions	
CWF ITP	**CalSim II**
• **All pulses** of CHNWR and CHNSR shall be protected from October 1 – June 30.	• **One or two pulses** shall be protected from October 1 – June 30 (depending on whether a pulse ends before December 1).
• Beginning October 1st, whenever the initial pulse begins, low level pumping takes effect.	• Beginning October 1st, whenever the initial Sacramento River pulse begins, low level pumping takes effect.
• A Sacramento River pulse is determined based on real-time monitoring of juvenile fish movement (see Condition of Approval 9.9.5.1). A fish pulse is defined as a **Knights Landing Catch**	• The initiation of the pulse is defined by the following criteria: (1) **Wilkins Slough flow changing by more than 45% within a five day**

Index (KLCI) ≥ 5 where KLCI = (# of CHNWR + # of CHNSR)/(Total Hours Fished/24). • Pulse protection operations shall be implemented within 24 hours of detection of a fish pulse.	**period** and (2) **Wilkins Slough flow becomes greater than 12,000 cfs**.
• Pulse protection ends after **five consecutive days of daily KLCI < 5**.	• The pulse protection and the low level pumping continues until (1) **Wilkins Slough returns to pre-pulse flows** (flow on first day of the within-5 day increase), (2) **Wilkins Slough flows decrease for five consecutive days**, or (3) **Wilkins Slough flows are greater than 20,000 cfs for 10 consecutive days**.
• Number of allowable pulses is not specified; ASSUME ALL ELIGIBLE PULSES (KLCI ≥ 5) ARE PROTECTED.	• Number of allowable pulses in unlimited; ASSUME ALL ELIGIBLE PULSES ARE PROTECTED.
• Once the pulse protection ends, **post-pulse bypass flow operations may remain at Level 1 diversion depending on fish presence, abundance, and movement in the north Delta**; however, the exact levels will be determined through initial operating studies evaluating the level of protection provided at various levels of diversions.	• After a pulse has ended, the allowable diversion will go to post-pulse operations through June that can transition through three levels of protection.
• The criteria for transitioning between and among pulse-protection, **Level 1, Level 2, and/or Level 3 operations are based on real-time fish monitoring** and hydrologic/ behavioral cues upstream of and in the Delta that will be studied as part of the Project's Adaptive Management Program. Based on the outcome of the studies pursued under that program, additional information about appropriate triggers, off-ramps, and other RTO management of NDD intake operations may be integrated into the Test Period Operations Plan and the Full Project Operations Plan.	• After the initial pulse(s), **Level I post-pulse bypass rules are applied until 15 days of bypass flows above 20,000 cfs have accrued since the pulse ended**. Then **Level II post-pulse bypass rules are applied until 30 days of bypass flows above 20,000 cfs have accrued** since the pulse ended. Then Level III post-pulse bypass rules are applied.
• **The NDDTT shall develop criteria for transitioning between and among pulse protection, Levels 1, 2 and 3 based on best available science**. The NDDTT shall recommend transitional criteria to the TOT and IICG for consideration through the Adaptive Management Program, to ensure that the Project will achieve the objectives of Biological Criteria 1 and 2.	• Under the post-pulse operations allowable diversion will be greater of the low-level pumping or the diversion allowed by the following post-pulse bypass flow rules.

Taken from the "Pulse_Post-Pulse_Figs" tab of the daily modeling tool, Figure 3-4. Fish-based Pulse and Post-Pulse Protection Levels in WY 2016. Figure 3-4 and Figure 3-5 demonstrate the difference in pulse and post-pulse protection levels under the two interpretations. In Figure 3-4, the purple dots represent the KCLI for winter run and spring run chinook salmon. Whenever the KCLI exceeds 4, pulse protection operations are initiated, as represented by the red shading. In the daily modeling tool, users may specify KCLI thresholds to determine pulse and post-pulse conditions. In this example, post-pulse Levels 1 and Level 2 have KCLI thresholds of 3 and 1, respectively. Thus, if the KCLI for a given day is between 3 and

5, Level 1 is implemented. If the KCLI is between 1 and 3, Level 2 is implemented. Finally, if the KCLI is 0, Level 3 operations take effect.

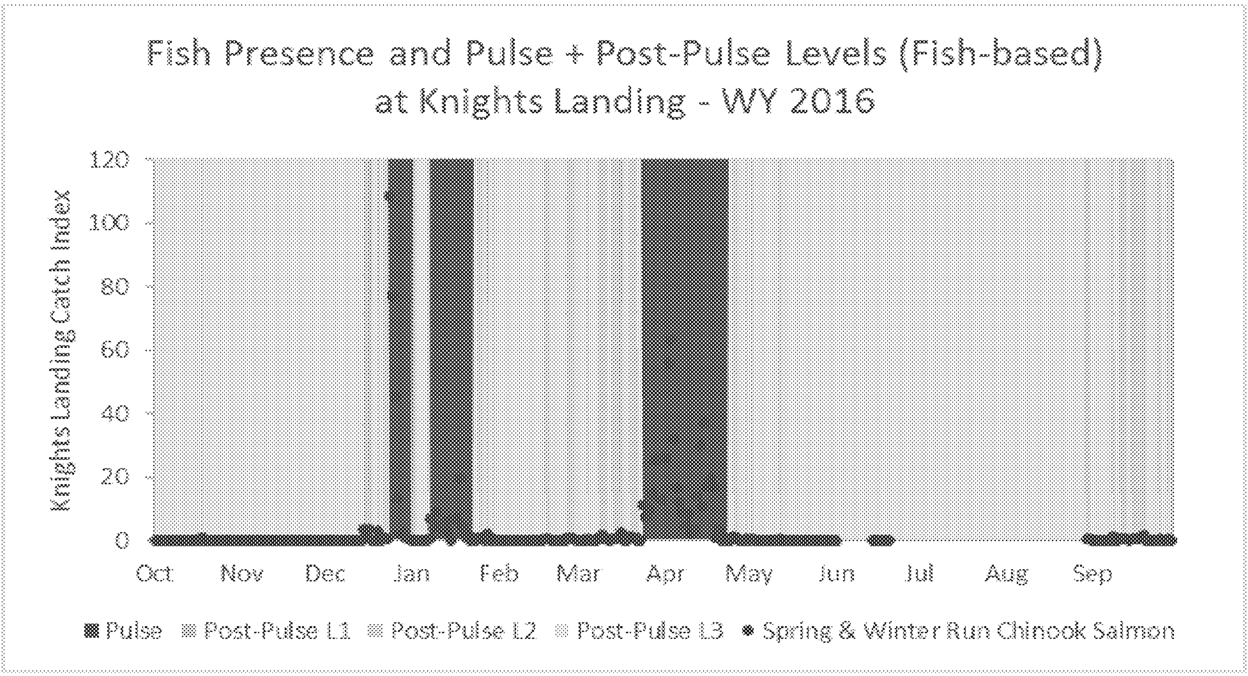


Figure 3-4. Fish-based Pulse and Post-Pulse Protection Levels in WY 2016.

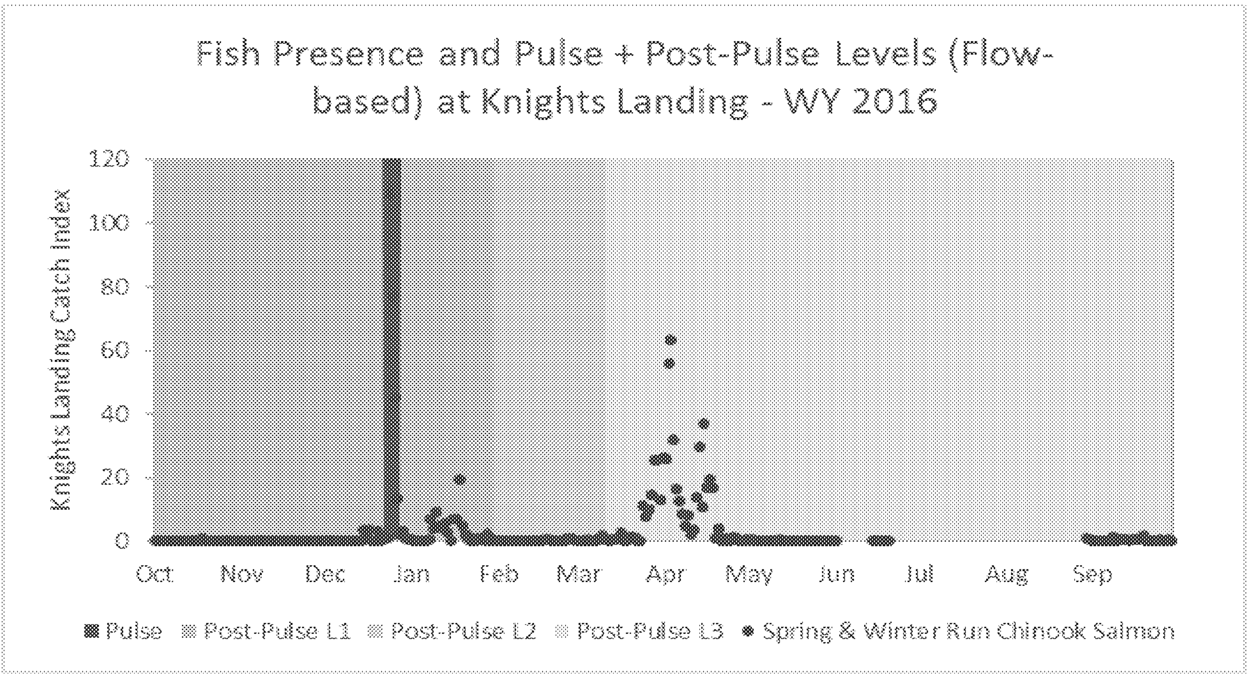


Figure 3-5. Flow-based (CalSim II) Pulse and Post-Pulse Protection Levels in WY 2016.

In the daily modeling tool, users may specify starting and ending months of the pulse and post-pulse protection periods (i.e., the October through June period defined in the CWF ITP may be modified).

3.17 Surplus Outflow (Feb-Mar)

This criterion provides a margin of safety to prevent shifting the regulatory burden of X2 onto SWP or CVP operations. It is only applied to February and March. Diversions are only permitted after a specified number of days that flow is available in February through March (default = 7 days).

3.18 Additional Protective Criteria

The “Table1” and “ProtectiveCrit” tabs includes additional protective criteria to limit project diversions under user-specified flow conditions and time periods. The table in “Table1” can be used to implement a set of rules to limit diversion at each intake to a certain percentage of total Sacramento River flow, based on local conditions. Inputs to this table can be specified in the “Protective Criteria & Ramp Down Specs” section of the “User_Specifications” tab.

The tables in “ProtectiveCrit” perform similar functions; however, diversions are instead limited to a proportion of total intake conveyance capacity.

The additional protective criteria set off by default and are only activated if Cell B91 in the “User_Specifications” tab is set to “Yes”.

4. Results

The Divertible Flow Tool evaluates various combinations of hydrographs, diversion regulations, and initial storage conditions. For example, users can manipulate pulse flow protection criteria, minimum pumping levels, or intake diversion seasons to generate different divertible and storable flow results under a range of hydrologic conditions. Consequently, the tool may be useful in evaluating the effects of varying operations criteria on diversions to Sites Reservoir.

4.1 Sacramento River Flow, Delta Outflow, and X2

Monthly available, divertible, and storable flow results for a given water year are displayed in the table and figures of the “User_Specifications” tab. The table also includes accumulated storage, representing the total amount of water diverted into Sites throughout the year.

The “Hydrographs” tab includes figures that show Sacramento River flows before and after project diversions at the following locations:

- Red Bluff
- Hamilton City
- Delevan
- Wilkins Slough
- Knights Landing
- Spill at Fremont Weir
- Freeport

The “Hydrographs” tab also includes the figures demonstrating the effect of Sites diversions on Delta Outflow and X2 position. Figure 4-1 through Figure 4-9 demonstrate example charts from the “Hydrographs” tab.

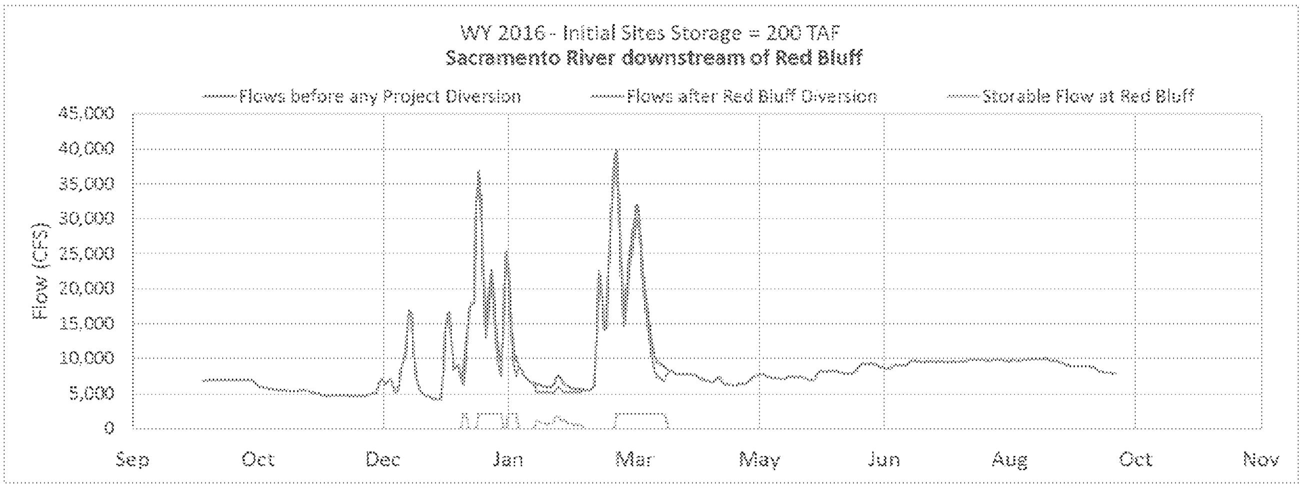


Figure 4-1. Sites Storable Flow Effect on Sacramento River Flow at Red Bluff – WY 2016.

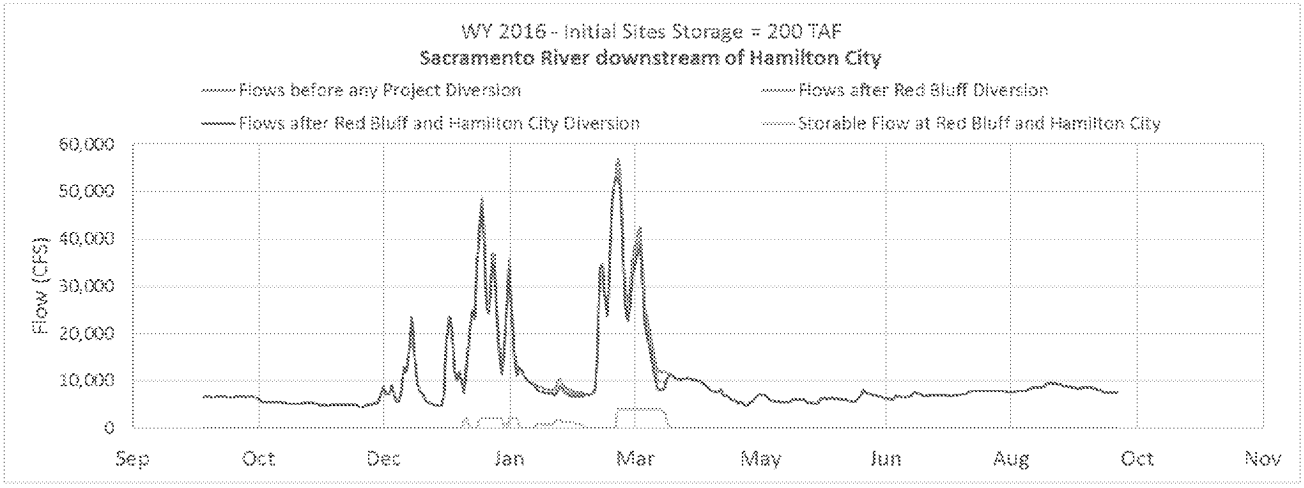


Figure 4-2. Sites Storable Flow Effect on Sacramento River Flow at Hamilton City – WY 2016.

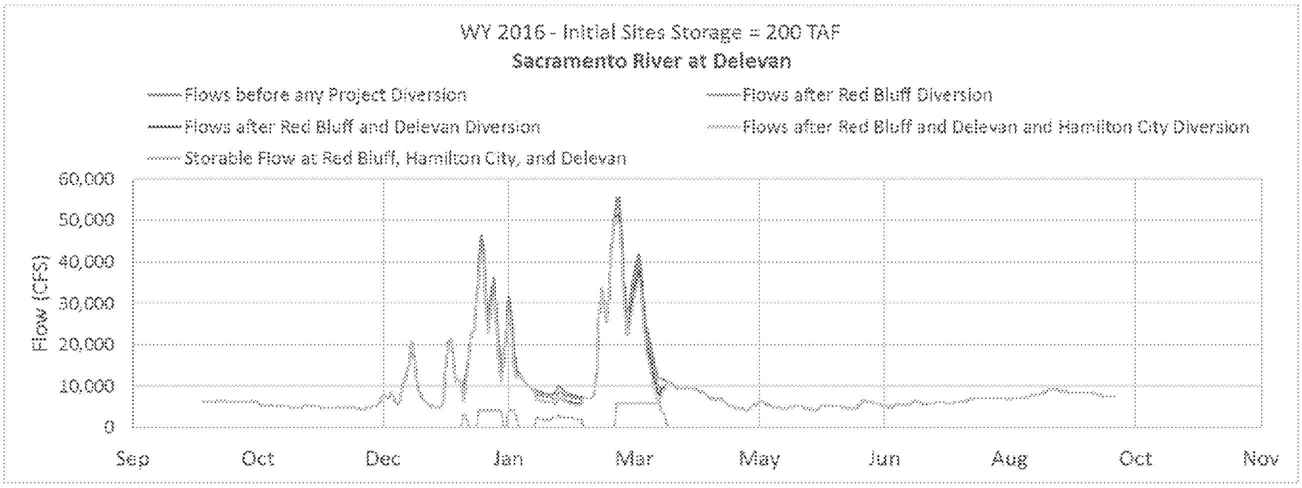


Figure 4-3. Sites Storable Flow Effect on Sacramento River Flow at Delevan – WY 2016.

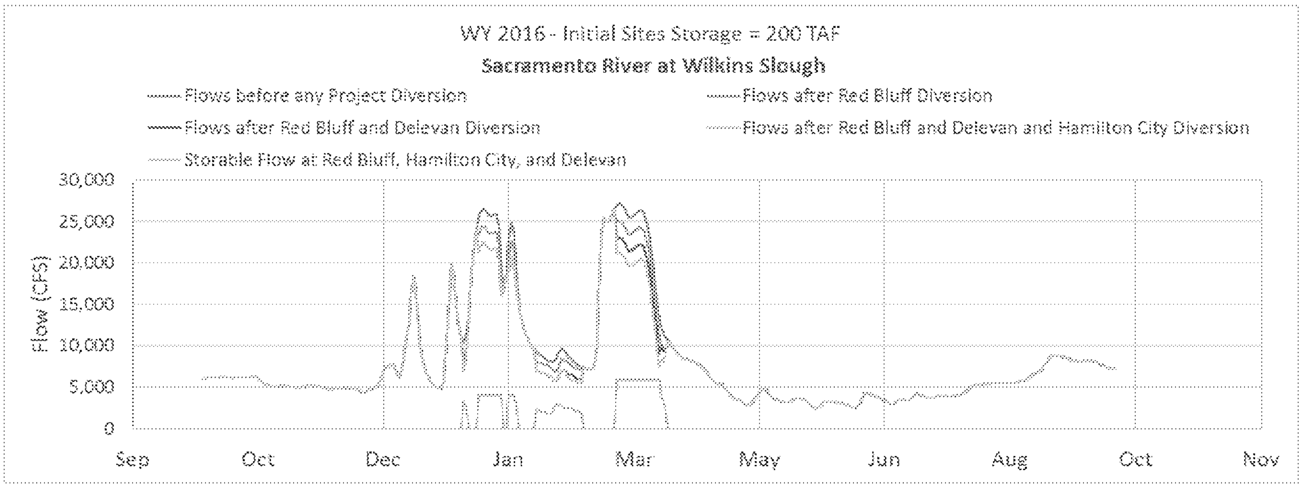


Figure 4-4. Sites Storable Flow Effect on Sacramento River Flow at Wilkins Slough – WY 2016.

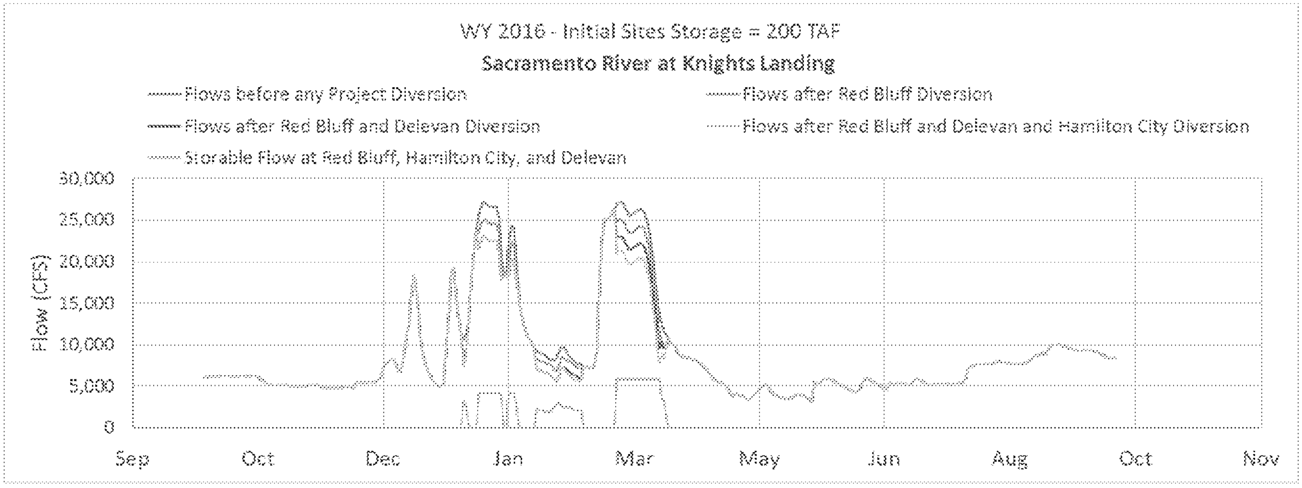


Figure 4-5. Sites Storable Flow Effect on Sacramento River Flow at Knights Landing – WY 2016.

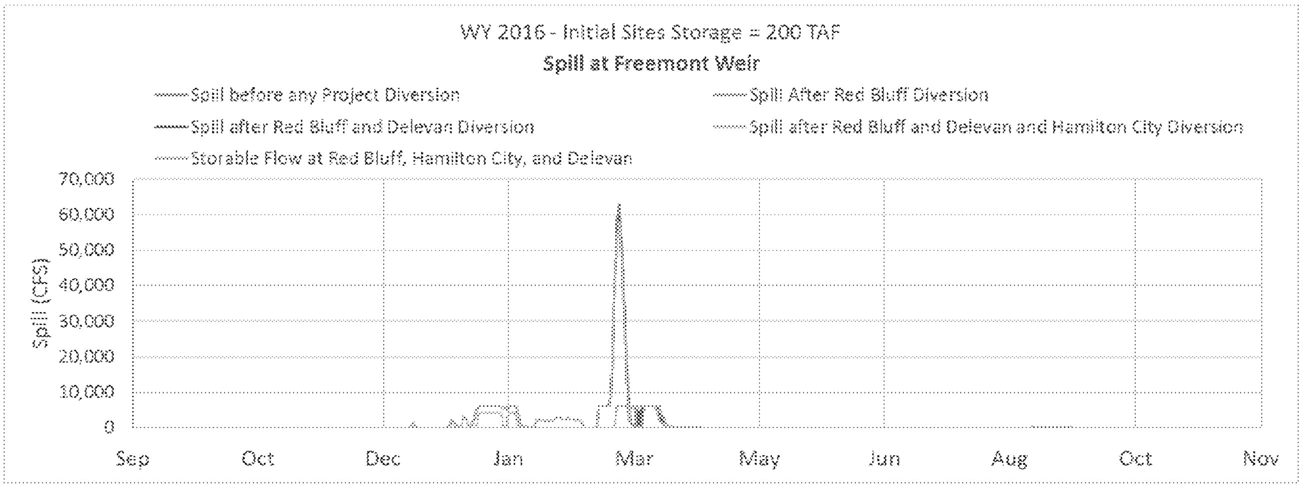


Figure 4-6. Sites Storable Flow Effect on Fremont Weir Spills – WY 2016.

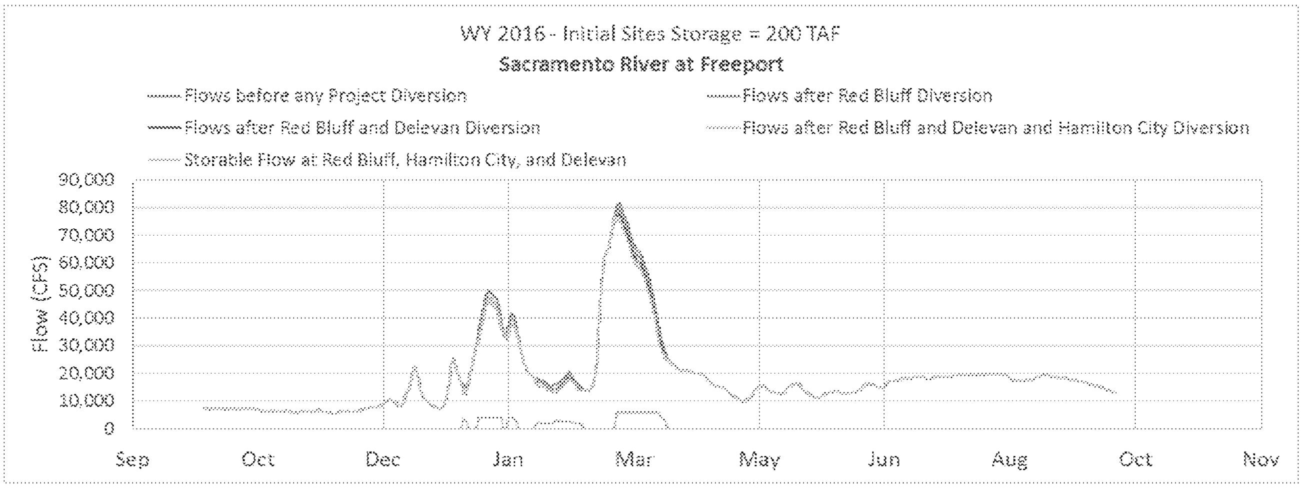


Figure 4-7. Sites Storable Flow Effect on Sacramento River Flow at Freeport – WY 2016.

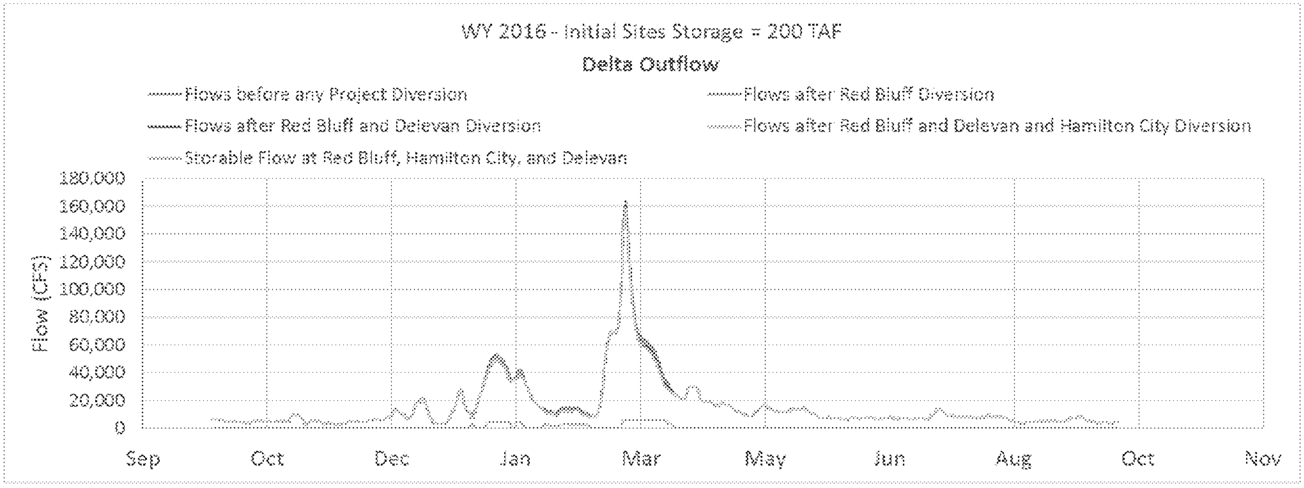


Figure 4-8. Sites Storable Flow Effect on Delta Outflow – WY 2016.

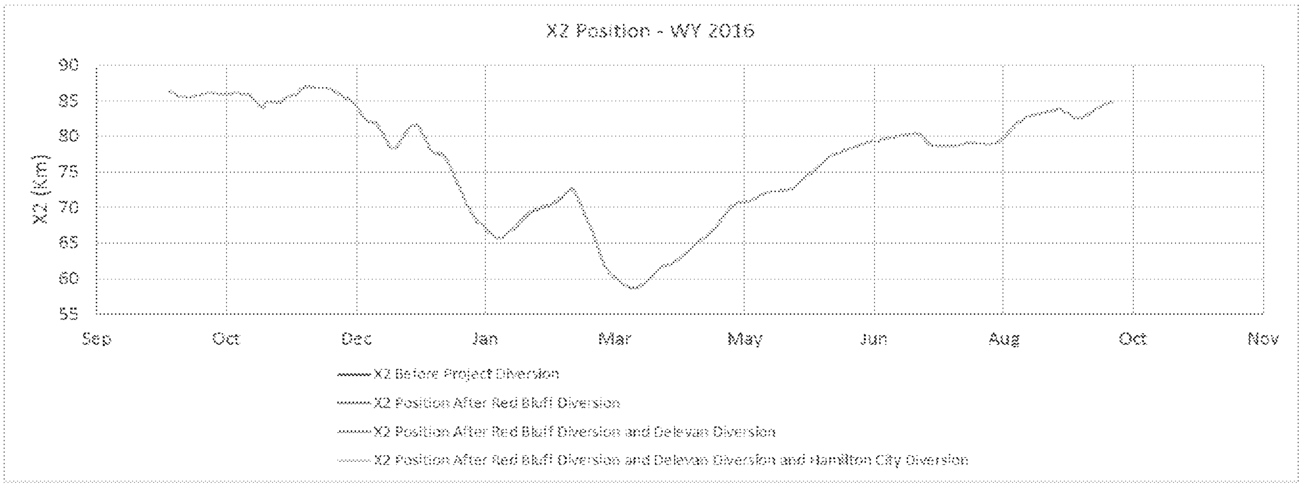


Figure 4-9. Sites Storable Flow Effect on X2 – WY 2016.

4.2 Fish Presence

Sacramento River fish data has been collected and integrated into the Divertible Flow Tool at the following locations:

- **Red Bluff Dam** (October 1st 2008 – May 31st 2018)
    - Source: Red Bluff Fish & Wildlife Office, USFWS (collated into a spreadsheet by LeAnne Rojas, 4/15/2019, using data from: http://www.cbr.washington.edu/sacramento/data/query_redbluff_daily.html)
- **Hamilton City** (March 2nd 2013 – May 31st 2018)
    - Source: GCID (collated into a spreadsheet by LeAnne Rojas on 4/16/2019, based on data provided by GCID (Josef Loera) via John Spranza (HDR) on 4/1/2019)
- **Tisdale** (July 7th 2010 – May 31st 2018)
    - Source: CDFW (collated into a spreadsheet by LeAnne Rojas on 4/18/2019, from data provided by Diane Coulon (DFW) on 4/11/2019)
- **Knights Landing** (October 1st 2008 – May 31st 2018)
    - Source: CDFW (collated into a spreadsheet by LeAnne Rojas based on workbooks provided by Jason Julienne (DFW) on 4/24/2019)

The relationship between flows and fish presence can be evaluated in several tabs towards the back of the spreadsheet. The "Fish_Count_OneYr" tab include figures of Sacramento River flow and storable flow vs fish count at the four locations listed above. Figure 4-10 demonstrates an example figure from this tab. At Red Bluff, the term "fish count" is defined as the estimated daily number of fish passage through the Sacramento River at Red Bluff. At Hamilton City, Tisdale, and Knights Landing, "fish count" is defined as the estimated daily number of fish caught in rotary screw traps at each location.

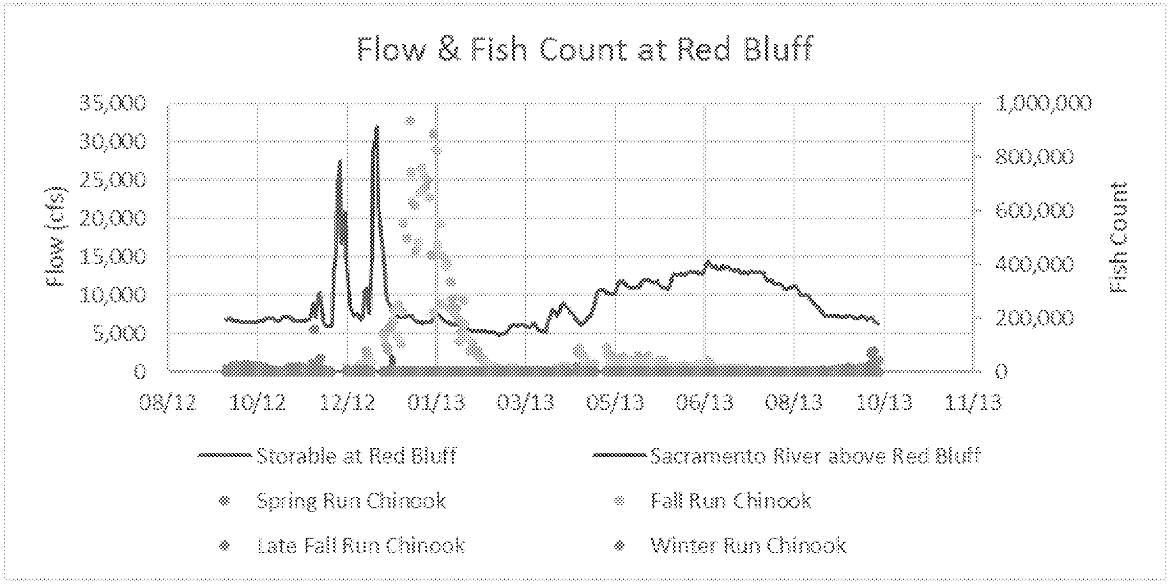


Figure 4-10. Sacramento River Flow vs Fish Presence at Red Bluff in WY 2013.

4.3 Controlling Constraints

The “Controls” tab includes tables displaying the number of instances each constraint controls the quantity of storable flow in each month of the selected year. A controlling constraint is defined as the primary limiter of storable flow to Sites Reservoir. For example, if no flow is available for the project because the river is in “Balanced Conditions”, then the controlling constraint is identified as “Balance” in the Divertible Flow Tool. A table of controls has been developed for each intake location (Red Bluff, Hamilton City, and Delevan) in the “Controls” tab. Additionally, daily timeseries of controlling constraints can be viewed in columns “BG:BH” of the “Divertible_Flow_OneYr” tab.

4.4 Annual Simulations

On the “User_Specification” tab, users can generate results for all 10 years (WY 2009 – 2018) by clicking on the “Run Current Setup” button at the top of the page. This button will simulate available flow, divertible flow, and storable flow for each year under current user specifications. Furthermore, the initial Sites storage will be reset at the start of each year. Daily inputs and outputs will be copied into the “ScenID_Main” tab, monthly results are populated in the “Monthly_Report” tab, and annual inputs and outputs are populated in the “Ann_Fills” tab.

The Excel spreadsheet includes several macros to iterate through multiple combinations of years and input conditions (user-specified constraints). Before running one of these macros using the “Run Full Simulation Period” button on the “User_Specifications” tab, the macros should be updated to accommodate for whatever analysis is desired. The daily, monthly, and annual results will be copied into the “ScenID_Main” tab, “Monthly_Report” tab, and “Ann_fills” tab. Each 10-year period will be assigned a Scenario ID number corresponding to a particular set of inputs.

5. Limitations

5.1 Exclusion of Release Operations, Evaporation, and Losses

The Divertible Flow Tool does not include full operations of Sites Project. Fill volumes are estimated each year without the consideration of Sites Reservoir releases. The storage level is only dependent on the user-specified initial storage condition and diversions to the reservoir. Evaporation and losses are not explicitly considered. In addition, the storage level is re-set to the user-defined initial storage condition at the beginning of each year.

5.2 Simulation Period

The Divertible Flow Tool is limited to 10/1/2008 – 5/31/2018, a period that is quite dry relative to the years simulated by CalSim II (WY 1922 – 2002). The Divertible Flow Tool lacks Above Normal years, as determined by DWR’s Water Year Hydrologic Classification Indices. Extending the Divertible Flow Tool’s simulation period would allow it to provide more insight on the daily effects of Sites Project and its corresponding operations criteria by including greater hydrologic variability.

5.3 2035CT Climate Adjustment

The 2035CT flow inputs were calculated using scaling ratios between historic and 2035CT average monthly flows from recorded and simulated data. Operational conditions, such as reservoir releases, are not explicitly modified in the adjustment from historic to 2035CT conditions. Flow availability inputs (from the Flow Availability Tool) are not adjusted when users select 2035CT climate conditions. Sacramento River flow at Freeport is also not updated with the 2035CT adjustment.

From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 5/20/2022 11:05:55 AM
To: Spranza, John [john.spranza@hdrinc.com]; Alicia Forsythe [aforsythe@sitesproject.org]; Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Subject: RE: Diversion Chronology
Attachments: Diversion Criteria Chronology_2022-0520.docx

Okay I chatted with Ali briefly and we updated it with "excess implied" for 2017 and required for draft/final. See attached for the latest – I am going to send this out to the Environmental Water Manager group.

Thanks John for pulling this together!
Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

hdrinc.com/follow-us

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, May 20, 2022 10:44 AM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

I guess that could be implied through that statement. I also don't think they had thought this through all the way.

John Spranza

D 916.679.8858 M 818.640.2487

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Friday, May 20, 2022 10:24 AM
To: Spranza, John <John.Spranza@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

Okay so seems like fully appropriated wasn't included, but I'm wondering if excess was based on the highlighted?

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Friday, May 20, 2022 10:17 AM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

I don't think the 2017 document included those requirements. Appendix 6A says this:

Excess flows are defined as river flows, in addition to those required to meet the following:

- Senior downstream water rights, existing CVP and SWP and other water rights diversions including SWP Article 21 (interruptible supply), and other more senior excess flow priorities (diversions associated with Freeport Regional Water Project and existing Los Vaqueros Reservoir)
- Existing regulatory requirements including State Water Resources Control Board D-1641, CVPIA 3406(b)(2), the 2008 USFWS BO, and the 2009 NMFS BO and other instream flow requirements
- Flow conditions needed to maintain and protect anadromous fish survival and Delta water quality

It does not mention excess conditions or identify fully appropriated. In fact, a few pages later the doc includes the following "year-round" text that to me, does not include excess conditions or acknowledge the appropriate status of the river:

Diversions to Sites Reservoir storage using existing Tehama-Colusa and GCID Main canals conveyance are allowed year-round if the bypass flow criteria noted above is first met. The deliveries for TCCA and GCID service areas have priority for using the canals. Diversion to Sites Reservoir will utilize the unused capacities of these two canals.
Under Alternative A, diversions through the new Delevan Pipeline are allowed year-round assuming Sacramento River flow conditions are above the bypass flow criteria described above. In summer months, preference would generally be given to Sites Reservoir releases to the river, resulting in limited diversions to storage, given the pipeline could only convey flows in one direction at a time

John Spranza

D 916.679.8858 M 818.640.2487

From: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Sent: Friday, May 20, 2022 10:02 AM
To: Spranza, John <John.Spranza@hdrinc.com>; Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

Hi all,

Sorry my slow response on this. Do we want to add anything about the fully appropriated stream condition and that the Delta be in excess? I don't know whether these items were included in the 2017 draft.

Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Tuesday, May 17, 2022 8:05 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <Erin.Heydinger@hdrinc.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

They used the top end of the navigation control flow at WS, which is 5,000 cfs. I have updated the table with that information, included Ali's edit, and formatted it landscape so it fits on one page.

John Spranza

D 916.679.8858 M 818.640.2487

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, May 17, 2022 7:46 AM
To: Spranza, John <john.spranza@hdrinc.com>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>
Subject: RE: Diversion Chronology

Just a minor change in the attached. Did we really not have a Wilkins Slough criteria in the 2017 document? I thought it was 5,000 cfs, which is the navigation standard, but maybe I am getting this confused.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Alicia Forsythe <ali@forsythe-group.com>
Sent: Tuesday, May 17, 2022 7:36 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: FW: Diversion Chronology

Alicia Forsythe | Forsythe Group | 916.880.0676 | ali@forsythe-group.com

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Monday, May 16, 2022 2:59 PM
To: Heydinger, Erin <Erin.Heydinger@hdrinc.com>
Cc: Laurie Warner Herson <laurie.warner.herson@phenixenv.com>; Alicia Forsythe <ali@forsythe-group.com>
Subject: Diversion Chronology

Here you go.

John Spranza, MS, CCN
Senior Ecologist / Regulatory Specialist

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916.679.8858 M 818.640.2487
john.spranza@hdrinc.com

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From: Heydinger, Erin [Erin.Heydinger@hdrinc.com]
Sent: 5/20/2022 11:11:59 AM
To: Lucy Caine [lcaine@edf.org]; Jay Ziegler [jay_ziegler@TNC.ORG]; Caitrin Chappelle [c.chappelle@TNC.ORG]; Jennifer Harder, McGeorge School of Law [jharder@pacific.edu]; Ann Hayden [ahayden@edf.org]; Anthony Saracino [anthony@asaracino.com]; Maurice Hall [mhall@edf.org]; julie.zimmerman@TNC.ORG; jeanette_howard@TNC.ORG; Jeanne Brantigan [jbrantigan@TNC.ORG]
CC: Marcia Kivett [MKivett@sitesproject.org]; Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]
Subject: RE: Sites EWM Meeting
Attachments: Diversion Criteria Chronology_2022-0520.pdf; 20220510_Sites Env Water Manager Meeting_PRE.pdf

Hi all,

Thank you for your patience as we pulled together a table on the Sites diversion criteria over time. That table is attached as well as the presentation from last week's meeting. Please reach out if you have questions on either of these items.

Thanks and have a great weekend,
Erin

Erin Heydinger PE, PMP
D 916.679.8863 M 651.307.9758

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-----Original Appointment-----
From: Marcia Kivett <MKivett@sitesproject.org>
Sent: Tuesday, April 26, 2022 1:51 PM
To: Lucy Caine; Jerry Brown, Sites Project Authority; Ali Forsythe, Sites Project Authority; Jay Ziegler; Caitrin Chappelle; Jennifer Harder, McGeorge School of Law; Ann Hayden; Anthony Saracino; Maurice Hall; julie.zimmerman@TNC.ORG; jeanette_howard@TNC.ORG
Cc: Marcia Kivett; Jeanne Brantigan; Heydinger, Erin
Subject: Fw: Sites EWM Meeting
When: Tuesday, May 10, 2022 1:00 PM-2:30 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Microsoft Teams Meeting

Jerry asked me about this today.

He would like to have a pre-discussion before the May 10th meeting. Who should I invite to that meeting? Steve Miko or Rob Leaf? Also, besides you two and Jerry, who should attend the May 10 meeting?

To: Marcia Kivett <MKivett@sitesproject.org>; Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>
Subject: FW: Sites EWM Meeting
When: Tuesday, May 10, 2022 1:00 PM-2:30 PM.
Where: Microsoft Teams Meeting

Here is the action item this meeting is supposed to fulfill:

a. Jerry and Ali to prepare briefing on Sites fill and release criteria for Steering Committee, TNC science group, and other interested parties.

It does not appear that all of the Sites project team members best capable of providing this briefing and answering questions has been invited.

Can you work with Ali and Erin to make sure the right people are present. Thanks

---

From: lcaine@edf.org
When: 1:00 PM - 2:30 PM May 10, 2022
Subject: Sites EWM Meeting
Location: Microsoft Teams Meeting

Microsoft Teams meeting

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Phone Conference ID: 569 868 253#
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From: Lucy Caine <lcaine@edf.org>
Sent: Monday, April 18, 2022 4:57:42 PM (UTC) Coordinated Universal Time
To: Lucy Caine <lcaine@edf.org>; Jerry Brown, Sites Project Authority <jbrown@sitesproject.org>; Ali Forsythe, Sites Project Authority <aforsythe@sitesproject.org>; Jay Ziegler <jay_ziegler@TNC.ORG>; Caitrin Chappelle <c.chappelle@TNC.ORG>; Jennifer Harder, McGeorge School of Law <jharder@pacific.edu>; Ann Hayden <ahayden@edf.org>; Anthony Saracino <anthony@asaracino.com>; Maurice Hall <mhall@edf.org>; julie.zimmerman@TNC.ORG <julie.zimmerman@TNC.ORG>; jeanette_howard@TNC.ORG <jeanette_howard@TNC.ORG>
Cc: Marcia Kivett <MKivett@sitesproject.org>; Jeanne Brantigan <jbrantigan@TNC.ORG>
Subject: Sites EWM Meeting
When: Tuesday, May 10, 2022 8:00 PM-9:30 PM.
Where: Microsoft Teams Meeting

Microsoft Teams meeting

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Location (Listed from North to South)	2017 EIR/EIS	RDEIR/SDEIS with Mitigation Included	Revised and Expected in the Final EIR/EIS with Mitigation Included
Bend Bridge Pulse Protection	Protection of all qualified precipitation-generated pulse events (i.e., peaks in river flow rather than scheduled operational events) from October to May based on the detection of fish presence and migration during the beginning of the flow event. For each event where fish presence and migration is detected, diversions from the Sacramento River would cease for 7 days	Same as 2017 DEIR/EIS	Similar except the following: (1) a qualified precipitation-generated pulse event is determined based on forecasted flows and (2) pulse protection may cease earlier than 7 days if flows at Bend Bridge exceed 29,000 cfs and Project diversions subtracted from Bend Bridge flows continue to be at least 25,000 cfs
Minimum Bypass Flows in the Sacramento River at the RBPP	3,250 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design	No change	No change
Minimum Bypass Flows in the Sacramento River at the Hamilton City Pump Station	4,000 cfs minimum bypass flow at all times; rate of diversion controlled by fish screen design	No change	No change
Minimum Bypass Flows in the Sacramento River at Wilkins Slough	Diversions allowed when flows below Wilkins Slough are above 5,000 cfs	10,700 cfs in March through May; 5,000 cfs all other times	10,700 cfs October through June; 5,000 cfs September (not diverting from June 15 to end of August)
Fremont Weir Notch Protections	No specific criteria	No more than 1% reduction in flow over weir when spill over the weir are less than 600 cfs. No more than a 10% reduction in flow over weir when spills over the weir are between 600 cfs and 6,000 cfs. No restriction when flows over the weir are greater than 6,000 cfs	No longer included. Revised minimum bypass flows in the Sacramento River at Wilkins Slough and Bend Bridge Pulse Protection provide protections for Fremont Weir Notch

Sites Project Diversion Criteria Chronology 05/20/22

Sacramento River Fully Appropriated Stream	No specific criteria	Diversions allowed only when the Sacramento River is not fully appropriated (September 1 through June 14)	No change
Excess conditions, as determined by DWR and Reclamation and defined in COA	Excess conditions implied but not specifically stated	Delta must be in excess for Sites diversions	No change
Freeport, Net Delta Outflow Index, X2, and Delta Water Quality	Diversions only be allowed when a Sacramento River flow of 15,000 cfs is present at Freeport in January; 13,000 cfs in December and February through June; and 11,000 cfs in all other months.	Operations consistent with all applicable laws, regulations, biological opinions and incidental take permits, and court orders in place at the time that diversion occurs	No change

Environmental Water Manager

Overview of Sites Reservoir Prop 1 Benefits and Assumptions

May 10, 2022

Sites

Agenda

- Introductions
- Purpose
- What is the Benefit?
- Modeling – CWC Feasibility Report
- Storage Principles
- Potential Concepts
- Next Steps

What is the Benefit?

Erin Heydinger & Jeff Herrin

Sites

Background

- Proposition 1 of 2014 dedicated $2.7 billion for investments in water storage projects
- Administered by the California Water Commission (CWC) through the Water Storage Investment Program (WSIP)
- CWC completed rigorous review process of projects, open to the public
- July 2018, CWC made maximum conditional eligibility determinations (MCEDs) for 8 projects
  - Amount of Proposition 1 funding available to a given project
- Dec 2020 and April 2022, CWC increased MCEDs for all remaining projects to account for some inflation
- April 2022, CWC increased funding for Sites to fully fund the remaining unfunded benefits

Prop 1 Benefits Awarded to Sites

- CWC awarded the following benefits:
  - Ecosystem Improvement – Refuge water supply
  - Ecosystem Improvement – Yolo Bypass flows
  - Recreation
  - Flood Control

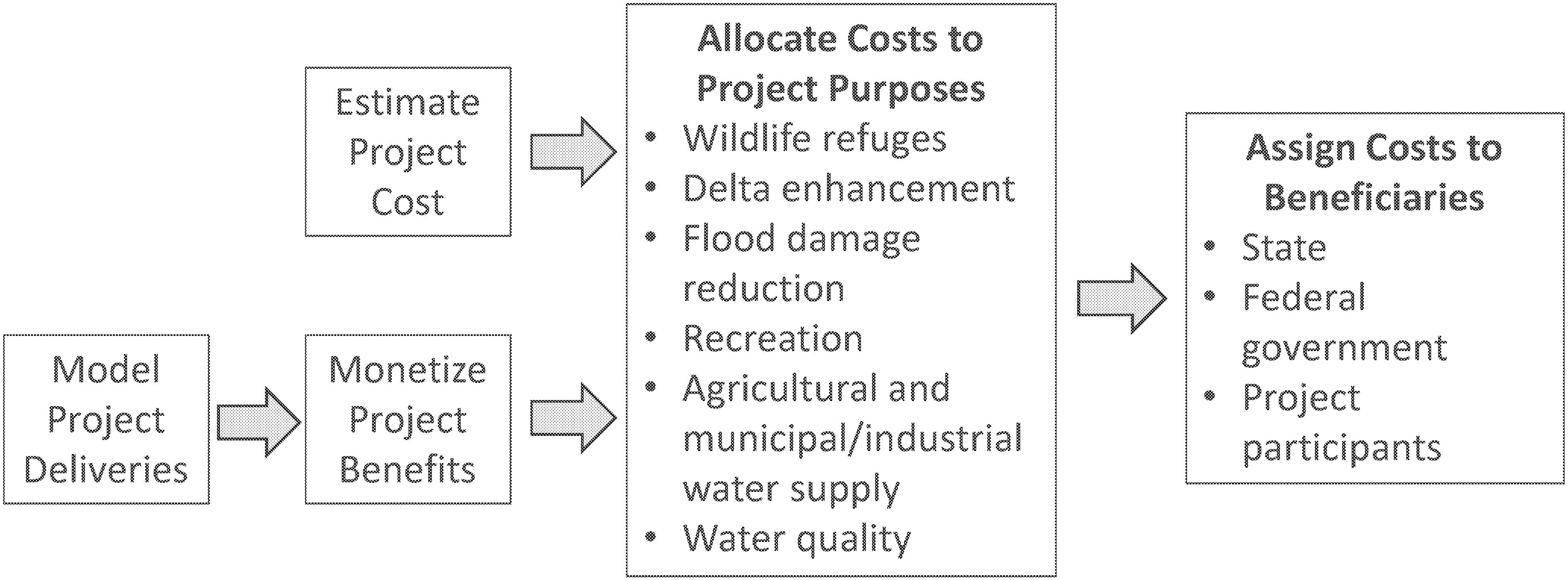
	2018 MCED	2021 MCED*	2022 MCED**	Early Funding***
Sites Project	$816,377,686	$836,787,128	$875,396,369	$40,818,884

*Additional MCED added in 2021 was to account for some inflation costs

**Additional MCED added in 2022 was to fully fund previously unfunded benefits and to account for some inflation costs

***Early funding amount included in the MCEDs

Feasibility Analysis



Estimate Project Cost

Model Project Deliveries

Monetize Project Benefits

Allocate Costs to Project Purposes

- Wildlife refuges
- Delta enhancement
- Flood damage reduction
- Recreation
- Agricultural and municipal/industrial water supply
- Water quality

Assign Costs to Beneficiaries

- State
- Federal government
- Project participants

Monetizing Project Benefits for WSIP Feasibility Report

- Methodology from WSIP Technical Reference (CWC, November, 2016)
- Water deliveries monetized using WSIP unit values (CWC, revised May 2018)
  - Conveyance cost added for south of Delta deliveries
- Water quality benefits to participants estimated using the Lower Colorado River Basin Water Quality Model
- Flood damage reduction monetized based on expected annual damage to structures in Maxwell, adjacent agricultural lands, and disruption to traffic
- Recreation based on visitation estimate

Summary of Benefits

Beneficiary	Benefit Value (2015$)	Benefit Value (2021$)
WSIP Public Benefits	**$841.3**	**$955.3**
Ecosystem improvement	$591.3	$671.4
Incremental Level 4 Refuge	$286.6	$325.5
Yolo Bypass	$304.6	$345.9
Recreation	$197.2	$231.6
Flood Reduction	$44.6	$52.3
Non-Proposition 1 Eligible Benefits	**$4,066.5**	**$4,617.9**
Water Supply	$4,047.8	$4,596.6
JPA	$3,575.0	$4,059.7
CVP Operational Flexibility	$312.9	$355.3
SWP Deliveries	$102.4	$116.3
Water Quality	$57.5	$65.2
Residual Value (2123) (a)	**$18.7**	**$21.3**
Total Benefits	**$4,907.8**	**$5,573.2**

Benefits-Costs Analysis Approach

RESULTS	PROJECT W/ IDC – WSIP TG	PROJECT W/ IDC – JPA
Total Benefits – NPV (a)	$5,573	$5,573
Total Cost – NPV	$5,384	$5,247
Net Benefits – NPV	$190	$326
Benefit Cost Ratio	1.04	1.06

Total Costs Allocated to Purposes (Annualized)

Category	Non-WSIP Eligible Benefits			WSIP Public Benefits				
	CVP Operational Flexibility	SWP	JPA	Level 4 Refuge	Delta Enh'ment Yolo Bypass	Flood Damage Reduction	Recreation	Total
Allocated Total Cost								
Total Project Costs								**$189.0**
Benefits by Purpose	$12.5	$4.1	$145.4	$11.5	$12.2	$1.8	$8.2	$195.7
Single Purpose Cost	$12.5	$4.1	$168.1	$11.5	$12.2	$3.2	$152.7	-
Justifiable Expenditures	$12.5	$4.1	$145.4	$11.5	$12.2	$1.8	$8.2	$195.7
Separable Costs	$0.2	$0.0	$15.6	$0.1	$0.0	$0.0	$1.5	$17.4
Remaining Benefits (Justifiable Expenditures Less Separable Costs)	$12.4	$4.1	$129.8	$11.4	$12.2	$1.8	$6.7	$178.3
Percent (Distribution of Remaining Benefits)	6.9%	2.3%	72.8%	6.4%	6.8%	1.0%	3.7%	100%
Allocated Joint Costs	$11.9	$3.9	$124.9	$10.9	$11.7	$1.8	$6.4	$171.6
Total Allocated Costs (Separable Plus Allocated Joint Costs)	**$12.1**	**$3.9**	**$140.6**	**$11.0**	**$11.7**	**$1.8**	**$7.9**	**$189.0**

Assignment of Costs to Beneficiaries

			Total Cost (Capital and OM&R) - Present Value							
	Total		Federal		WSIP/State Public		Other State		Non-Federal Partners	
Purpose/Action	Percent	Cost ($M)	Percent	Cost ($M)	Percent	Cost ($M)	Percent	Cost ($M)	Percent	Cost ($M)
Cost Assignment:										
JPA	74.4%	$3,987							100%	$3,987
CVP Ops Flex	6.4%	$342	100%	$342						
Level 4 Refuge	5.8%	$313			100%	$313				
SWP	2.1%	$112					100%	$112		
Yolo	6.2%	$333			100%	$333				
Flood Damage Reduction	0.9%	$50			100%	$50				
Recreation	4.2%	$224			100%	$224				
Total	100%	$5,362	6.4%	$342	17.2%	$921	2.1%	$112	74.4%	$3,987

Ensuring Benefits are Realized

- Contracts with
  - CDFW to administer the ecosystem benefits
  - DWR to administer the recreation and flood control benefits
- Contracts shall contain (Regs, Section 6014)
  - Adaptive management plan
    - Public benefit monitoring metrics
    - Monitoring locations, frequencies and timing
    - Metric evaluation methodology and associated threshold or trigger levels
    - Decision making process when trigger is reached
    - Funding sources and financial commitments to implement adaptive management
  - Description of benefits being administered
  - Reporting requirements
  - Assurances regarding operations, maintenance, repair, replacement
  - Provision allowing the administrating agency to inspect during construction and operations
  - Actions administrating agency may take if project fails to comply with contract

Ensuring Benefits are Realized (cont)

- Contract process
  - Drafted between CDFW or DWR and Authority
  - Draft provided to CWC for review and public review
  - Comments incorporated
  - Execution of final contract
- Necessary for final encumbrance of funds by the CWC
- Supersede any preliminary operations, monitoring, and management commitments made in the application
- Once operational, CWC tracks public benefits and provides access to data and reports

Modeling – CWC Feasibility Report

Steve Micko & Erin Heydinger

Sites

Modeling – Proposition 1 Storage Account

- Sites Reservoir includes 244 TAF of storage for Proposition 1 ecosystem benefits
  - Yolo Bypass Habitat: Increase productivity in the lower Cache Slough and lower Sacramento River areas
  - Incremental Level 4 (IL4) Refuges: Support water supply for wildlife refuges North and South of the Delta
- Proposition 1 funding for ecosystem benefits are based on the volume of water delivered

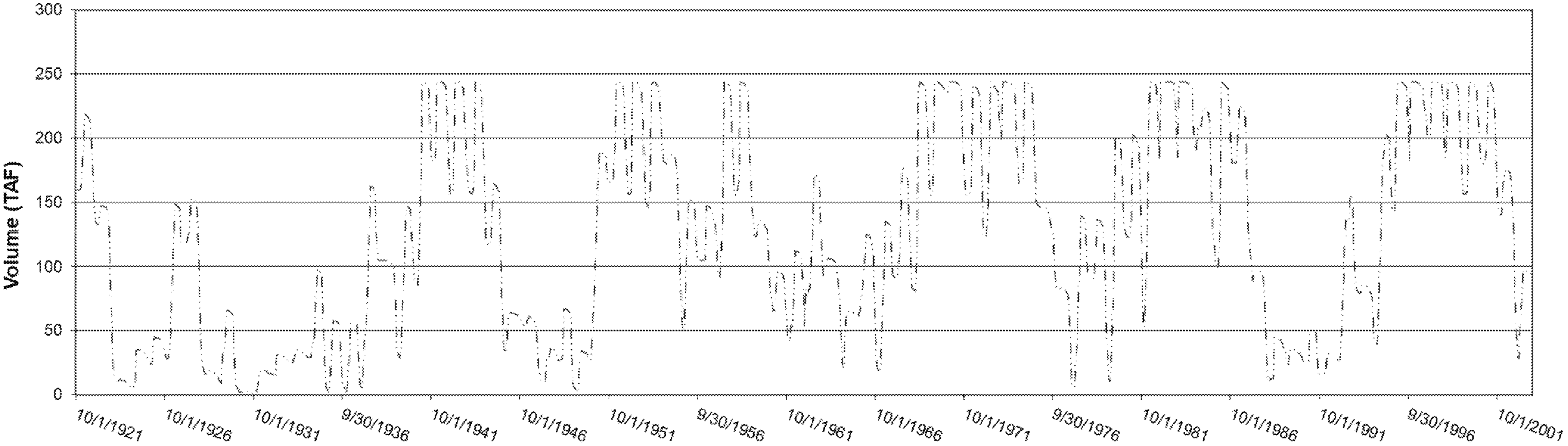
Modeling – Proposition 1 Releases

- Yolo Bypass Habitat
  - Season: Aug – Oct
  - Deliver water as-available (all water year types)
- Incremental Level 4 Refuges Water Supply
  - Season: Jan – Dec (mostly Jul – Dec), with a focus to Sep – Nov
  - Preference for deliveries in Dry and Critically Dry years

Destination	Long-term Average Releases (TAF)	Dry and Critically Dry Year Releases (TAF)
Yolo Bypass	42	25
IL4 Refuges (NOD)	5	7
IL4 Refuges (SOD)	14	20
Total	**61**	**52**

Modeling – Storage Timeseries

Proposition 1 Storage Account Timeseries



Storage Principles

Ali Forsythe & Erin Heydinger

Sites

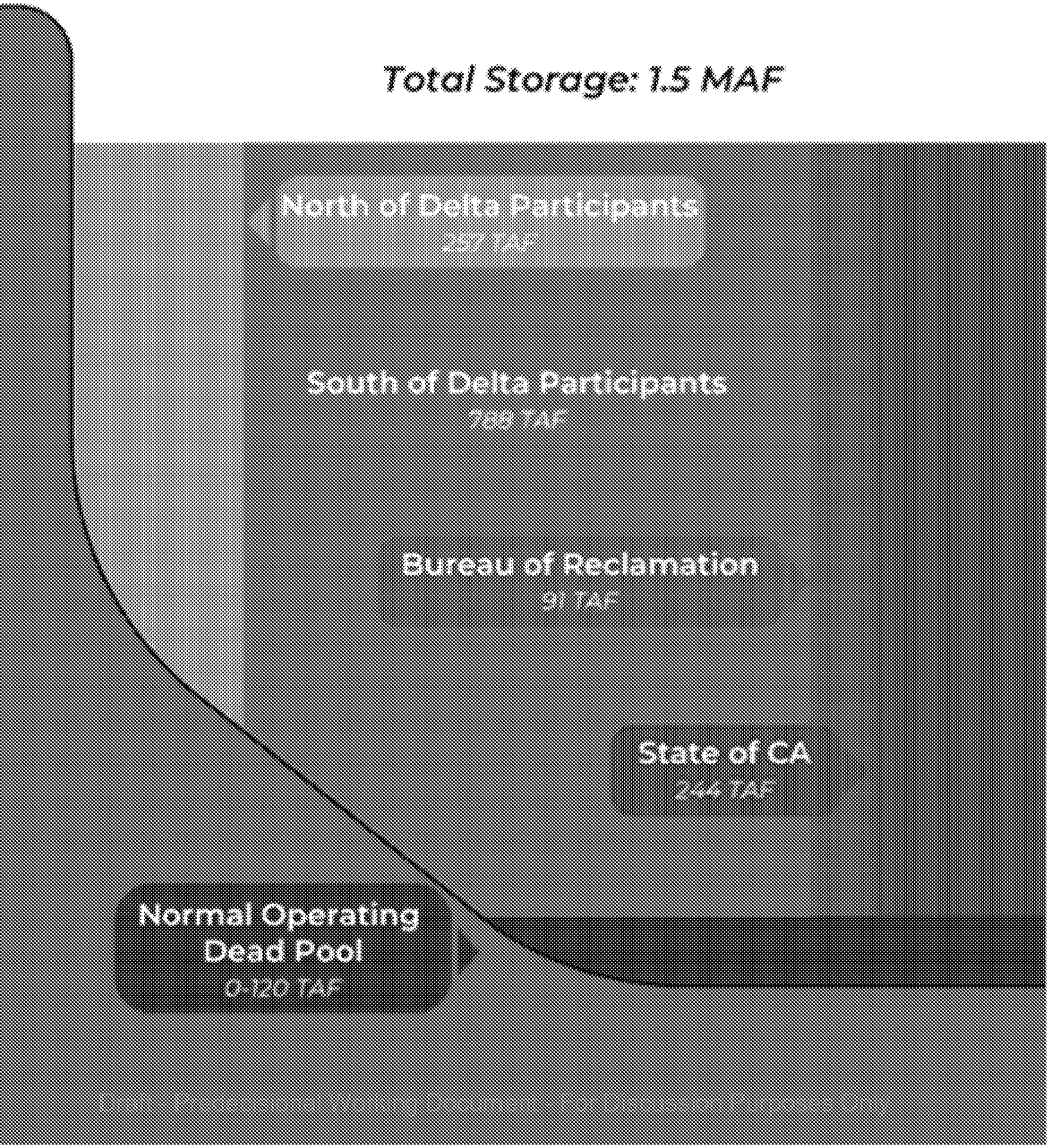
Background

- In April 2021, the Sites Board approved the "Principles for the Storage, Delivery, and Sale of Sites Reservoir Project Water"
- Forms the basis for uses of the project assets
- Identifies the "rules" and opportunities for use of Sites water
- Establishes that each participant in the Sites project is allocated a storage account in the reservoir

Overview of Storage Principles

- Reclamation and the State are considered “Storage Partners” along with other local water agencies
- All Storage Partners are treated equally in the operation of their portion of storage and receive a share of diversions proportionate to their level of storage/investment
- Release constraints result in releases proportionate to level of storage/investment
- Losses are allocated to each Partner proportionately
- Each Partner has autonomy over their storage space, may not be encroached on unless they agree
- The reservoir is operated to prioritize water supply benefits (versus recreation or power generation)

Storage Allocation

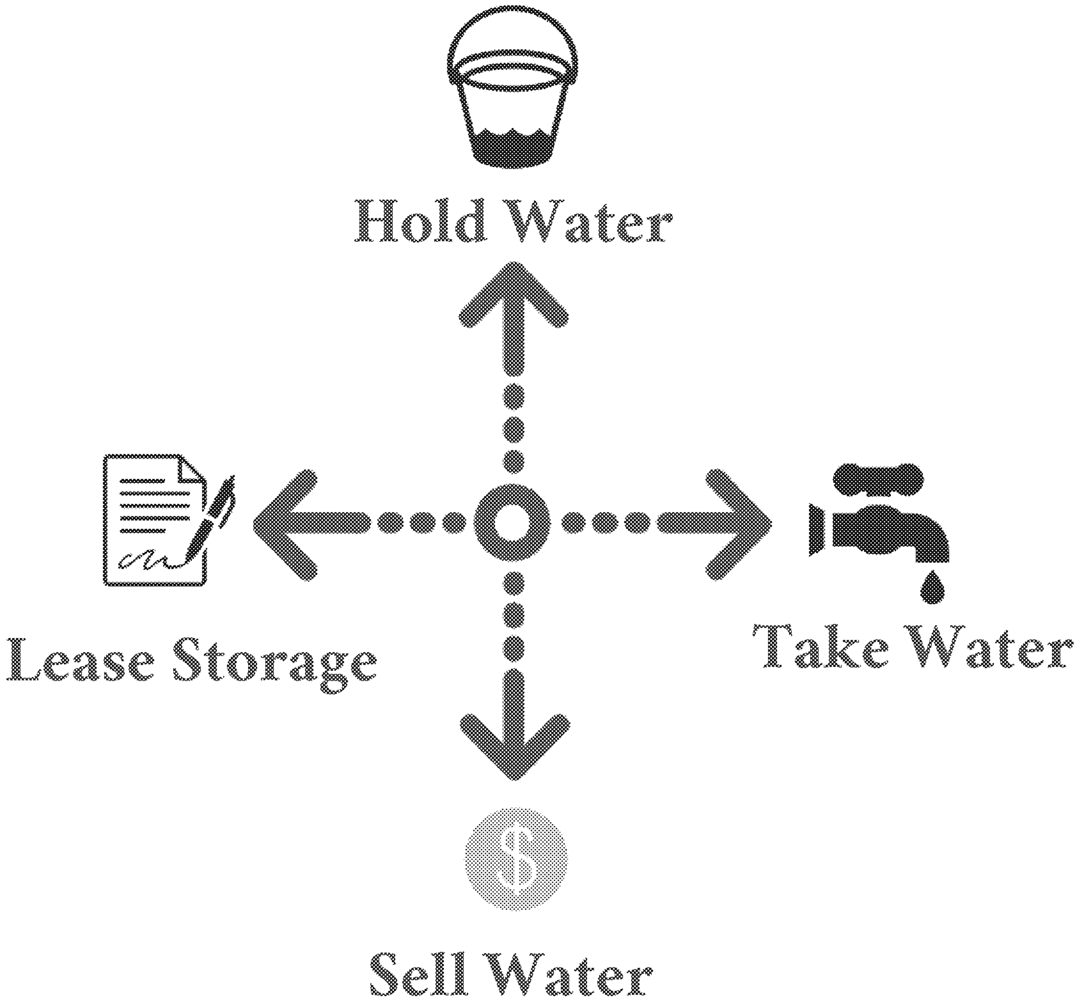


Diversions to storage divided based on storage allocation

E.g., State has 17% of active storage and receives 17% of diverted water

Possible Uses for Sites Storage/Supply

In any given year, Storage Partners have options for their Sites water and storage account



Hold Water

Lease Storage

Take Water

Sell Water

Potential Concepts

Group

Sites

Potential Concepts

- Other uses of water/benefits
- Location of water use
  - Fewer losses north of Delta or in Delta
- Other?

Next Steps

Group

Sites

Thank you!

Sites

Sites

JACOBS

Memorandum

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Project Name	Sites Reservoir Project	
Subject	Model Results to Support the 2022 Biological Assessment: No Action Alternative at 2035CT, Alternative 3A at 2035CT, and Alternative 3B at 2035CT – Sites Reservoir Temperature and Temperature Blending	
Attention	Ali Forsythe/Sites Project Authority	Monique Briard/ICF
	Erin Heydinger/HDR	Mike Hendrick /ICF
From	Robert Leaf/JACOBS	Steve Micko/JACOBS
	Reed Thayer/JACOBS	Chad Whittington/JACOBS
	Samaneh Saadat/JACOBS	
Date	May 23, 2022	

1. Introduction

The Sites Reservoir Project team has developed model simulations to support quantitative analysis of Sites long-term operations as part of developing a Biological Assessment, for completion in 2022.

The results of these model simulations are provided for informational and review purposes. If there are any questions regarding the results of these simulations, please contact the modeling team.

2. Modeled Scenarios

Model results are provided for the alternatives tabulated below.

Model Name	**Label Name (as seen in spreadsheet)**	**Description**
No Action Alternative 041122 2035CT	NAA 041122 2035CT	Baseline simulation (Reclamation 2021 Benchmark at 2035CT and 15 cm of sea level rise)
Alternative 3A 041122 2035CT	ALT3A 041122 2035CT	1.5 MAF Reservoir with 360 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise

Model Name	**Label Name (as seen in spreadsheet)**	**Description**
Alternative 3B 041122 2035CT	ALT 3B 041122 2035CT	1.5 MAF Reservoir with 230 TAF of Reclamation Investment at 2035CT and 15 cm of sea level rise

The Sites Reservoir temperature and release temperature blending results were developed for the Sites RDEIR/SDEIS. Please review Appendix 6D of the Sites Reservoir Project RDEIR/SDEIS. These results are useful so long as the results are interpreted consistent with the model limitations.

3. Model Simulations for Modeled Scenarios

3.1 Sites Reservoir Temperature and Release Temperature Blending

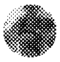
The following results are provided:

- SPJPA_Sites_CEQUAL_SitesReservoir_051722_ALT3A_041122_2035CT_ALT3B_041122_2035CT.xlsx, and
- SPJPA_Sites_ReservoirReleaseTemperatureBlending_rev10_20220519_2035CT.pdf.

Factors affecting spatiotemporal variation in survival of endangered winter-run Chinook Salmon outmigrating from the Sacramento River

Article *in* North American Journal of Fisheries Management · January 2022

DOI: 10.1002/nafm.10748



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North American Journal of Fisheries Management
© 2022 American Fisheries Society
ISSN: 0275-5947 print / 1548-8675 online
DOI: 10.1002/nafm.10748

ARTICLE

Factors Affecting Spatiotemporal Variation in Survival of Endangered Winter-Run Chinook Salmon Out-migrating from the Sacramento River

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Abstract

Among four extant and declining runs of Chinook Salmon *Oncorhynchus tshawytscha* in California's Central Valley, none has declined as precipitously as the Sacramento River winter run. Migratory winter-run Chinook Salmon employ a life history strategy to reside and feed in stopover habitats on their way from freshwaters to the ocean. Migratory winter run, on their way from freshwaters to the ocean, employ a life history strategy to reside and feed in stopover habitats that have been affected by anthropogenic disturbance. Using acoustic telemetry, we examined conditions that influenced reach-specific movement and survival of out-migrating juveniles during a prolonged, multi-year drought from 2013 to 2016, followed by one of the wettest years on record (2017). We modeled how time-varying individual riverine covariates and reach-specific habitat features influenced smolt survival. Model selection favored a model with mean annual flow, intra-annual deviations from the mean flow at the reach scale, reach-specific channel characteristics, and travel time. Mean annual flow had the strongest positive effect on survival. A negative interaction between mean annual flow and intra-annual reach flow indicated that within-year deviations at the reach scale from annual mean flow had larger effects on survival in low-flow years. These factors resulted in higher survival during years with pulse flows or high flows. Changes in movement behavior in response to small-scale changes in velocity were negatively associated with survival. Covariates of revetment and wooded bank habitat were positively associated with survival, but the effect of these fixed habitat features changed depending on whether they were situated in the upper or lower part of the river. Fish exhibited density-dependent stopover behavior, with slowed downstream migration in the upper river in the wet years and extending to the lower river in the most critically dry year. This paper contributes two key findings for natural resource managers interested in flow management and targeted habitat restoration. The first is new insight into how the magnitude of pulse flows in dry and wet years affects survival of winter-run fish. The second is that density dependence influences where stopover habitat is used. Despite this, we identified an area of the river where fish consistently exhibited stopover behavior in all years.

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Received August 3, 2021; accepted January 19, 2022

Migration is a fundamentally important ecological process for animals that reproduce and forage in different places. Environmental decision making is challenging in application to migrating species because management approaches must span a vast range of distant and distinct habitats (Runge et al. 2014). Stopover behavior is an important component of migration for animals that must refuel along the migration path before continuing toward their ultimate destination. Studies of birds have found that migrants will select stopover habitats that allow refueling with maximum efficiency to remain on schedule (Alerstam and Lindström 1992). Loss of even a small amount of stopover habitat can have disproportionately large impacts on migratory populations (Iwamura et al. 2014). Effective management of migratory species therefore depends on accurate characterization of habitat use.

In diadromous fishes, migration can be long and complex (Thorstad et al. 2012), but little is known about how stopover habitats vary in quality and how they are used. The Chinook Salmon *Oncorhynchus tshawytscha* is a suitable species in which to examine this behavior because the juveniles migrate through entire watersheds from inland freshwater streams where they are born to productive coastal estuaries (Moore et al. 2016). Accordingly, rivers function as a migratory corridor during the smolt migration phase, which is considered one of the most vulnerable periods in their anadromous life history (Quinn 2005). Alternatively, juvenile salmon may stop over during transit to capitalize on foraging opportunities, seek refuge from predators, or simply rest. Quantifying how juvenile salmon allocate their time across the riverscape is foundational to understanding the relative importance of different riverine habitats (Thorpe 1994; Moore et al. 2016).

California's Central Valley represents the southern extent of the range for Chinook Salmon, where they are confronted with a number of stressors (Fisher 1994; Yoshiyama et al. 1998). Mild winters with a receding snowpack and dry summers frequently result in a hydrologic system where water availability and demand are mismatched (Berg and Hall 2017). Dams on the major rivers block access to historical habitat, and water storage and managed releases to meet human demands throughout the year result in a flattened hydrograph relative to natural flows (Kondolf and Batalla 2005). Muted peak flows in winter and increased summer flows can mask cues that salmon use to initiate migration (Bunn and Arthington 2002). Finally, climate change projections of rising temperatures in the Sacramento River (Cloern et al. 2011) show an increased likelihood and duration of drought conditions, which have been occurring in California with increasing frequency over the past two decades (Diffenbaugh et al. 2015).

All four populations of extant Chinook Salmon races in California's Central Valley have declined over the past decades and have experienced precipitous declines since the onset of the latest megadrought in the early 2000s (Johnson and Lindley 2016), which was the second-driest 20-year period since 800 CE (Williams et al. 2020). Sacramento River winter-run Chinook Salmon (hereafter, "winter run") are the most critically endangered of the four Chinook Salmon runs in the Central Valley. The spawning population crashed from 87,000 in the late 1960s to fewer than 200 in the early 1990s (Fisher 1994) and remains at risk of extinction (Lindley et al. 2009; Poytress et al. 2014).

Historically, the winter run adapted to California's dry and variable climate by holding in the coldest upper reaches of headwater tributaries of the Sacramento River during summer months, when temperatures in the Central Valley were unsuitable for spawning and rearing (Yoshiyama et al. 1998). Fry reared in thermal refuges of these tributaries throughout summer (5–10 months) and migrated as smolts during the first freshets of the following autumn (Williams 2006). For the past 75 years, access to historic spawning tributaries has been eliminated by construction of Shasta and Keswick dams, forcing three populations to mix and spawn as one in the main stem of the Sacramento River downstream of Keswick Dam (Williams 2006). In the post-dam era, otolith geochemistry provides some evidence that winter-run fish continue to rear in nonnatal tributaries extending as far downstream as the San Francisco estuary (Phillis et al. 2018).

Hatchery releases of juvenile winter-run "pre-smolts" into the river are timed to maximize survival and occur during storm events when high instream flows can facilitate rapid emigration. However, the mechanism for how survival per unit time is related to flows is not well understood. On one hand, high flows could move fish rapidly through hazardous habitat. Alternatively, if fish move in response to density-dependent habitat availability, high flows could reduce pressure to move by creating more stopover habitat. Furthermore, it is unknown whether flows affect survival the same way across all reaches. Understanding which mechanisms most influence survival and identifying the reaches in which juvenile salmon experience particularly high or low mortality can therefore help managers find ways to focus on specific, targeted actions to improve survival.

Without this information, the National Marine Fisheries Service has had to rely on out-migration information from larger, yearling hatchery late-fall-run fish as surrogates to fill data gaps in their winter-run recovery plans (Johnson and Lindley 2016; Johnson et al. 2017). However, a growing body of scientific literature cautions against inferring too much from surrogates because they often do not respond in the same way as the targeted taxa to similar environmental conditions (Caro and O'Doherty 1999; Andelman and Fagan 2000). Even within a Chinook

Salmon run, the responses of hatchery and wild fish to environmental conditions may differ, resulting in differences in mortality during out-migration (Buchanan et al. 2010).

Nevertheless, research using acoustic telemetry primarily on late-fall Chinook Salmon has yielded some important insights into some of the immediate challenges confronted by migrating salmon smolts in general, such as disorienting structures with magnetic fields that influence seaward orientation (Klimley et al. 2017), predation dynamics (Sabal et al. 2016, 2021), entrainment into the south Sacramento–San Joaquin Delta (hereafter, "Delta"; Perry et al. 2015), and loss of habitat and limited food resources (Donaldson et al. 2014). This study builds upon earlier work on flow-mediated survival relationships that are gaining prominence in the field. Flow-mediated survival during the out-migration phase of the life cycle has been shown to have a greater effect on smolt-to-adult returns than marine survival (Michel 2019). The magnitude of bidirectional, tidally influenced flows has also been recognized as an important determinant of migration routing and survival in the Delta (Perry et al. 2018; Singer et al. 2020), and intra- and interannual reach flow has a greater impact on late-fall-run survival than other riverine and predation-related covariates (Henderson et al. 2019).

This study was designed to evaluate the effects of flow on winter-run survival at multiple scales and in the presence of other habitat covariates by directly evaluating the survival of hatchery-origin winter-run out-migrants using the Juvenile Salmon Acoustic Telemetry System (JSATS). Due to their scarcity, it was not feasible to obtain natural-origin winter-run fish (i.e., offspring of adults spawned in the river); therefore, extrapolation of our findings to natural-origin fish should be considered with caution (Buchanan et al. 2010). Furthermore, because our study used smolt-sized fish released in the upper river, our understanding of movement rates will be skewed to fish that would have reared in natal habitat and then initiated their smolt out-migration rather than rearing downstream. Evidence of downstream rearing is therefore likely to be conservative.

Within this framework, we developed a suite of mark–recapture models following the approach developed for the late-fall run by Henderson et al. (2019). We examined how individual features of the fish themselves (i.e., fish size); temporal, reach-constant riparian habitat features; and spatial, time-varying hydrologic conditions affected survival of out-migrating, hatchery-origin, winter-run juveniles. The study was carried out during a 5-year period under extremely variable climate conditions: a prolonged, multi-year drought (2013–2016) followed by one of the wettest years on record (2017). Although only one wet year was represented in our study, it allowed us to contrast movement behavior and survival outside of the drought conditions that characterized all other years in this study. To quantify relationships between covariates and survival, we used mark–recapture models and information-theoretic model selection criteria to rank alternative models. Our goals were to (1) examine spatial and temporal patterns in out-migration movement and survival in the river and (2) identify which combination of environmental covariates had the greatest influence on survival.

METHODS

Study site.— The Sacramento River is the largest river in California, flowing south from Mount Shasta for 410 km before reaching the Delta. Mean daily discharge from the Sacramento River in 1955–2019 was 656 m^3/s (California Department of Water Resources, Dayflow database), draining about 68,635 km^2 of the Central Valley. Keswick Dam (river kilometer [rkm] 557 from the Golden Gate Bridge [rkm 0]) is the upper limit to anadromy on the Sacramento River. For this study, we focused on movement and survival in the Sacramento River, ending 387 rkm downstream at the city of Sacramento, prior to entering the branching Delta and tidal estuary (Figure 1).

Acoustic-tagged fish.— The acoustic tags used with the JSATS in this study were manufactured by Advanced Telemetry Systems (ATS, Isanti, Minnesota). The model used in 2013 weighed 430 mg, with dimensions of 11.9 × 5.3 × 3.8 mm and a pulse rate interval (PRI) of 7 s, while the model used in 2014–2017 weighed 310 mg, with dimensions of 10.8 × 5.3 × 3.0 mm and a PRI of 10 s. Each year, 5% of tags were randomly sampled and used to verify tag life, which ranged from 43 to 90 d, with an average of 70 d. This satisfied the assumption of closure in the mark–recapture models because the longest duration travel times occurred early in the upper to middle river and did not exceed this value over the course of migrating through the study area.

At Livingston Stone National Fish Hatchery (U.S. Fish and Wildlife Service, Shasta Lake, California), fish that were selected for acoustic tagging were taken from tanks that contained the largest fish (one to eight tanks depending on the year) to keep individual tag burden below 5.9% (Brown et al. 2010). Prior to tag implantation, each fish was anesthetized to stage IV (i.e., fish were observed to have lost equilibrium and exhibited minimal response to touch; average time to stage IV was 141 s). Anesthetized fish were weighed to the nearest 0.1 g, and FL was measured to the nearest millimeter. Fish were placed ventral side up on a V-shaped, foam surgery cradle. Anesthesia was maintained during surgery with dilute anesthetic solution pumped through a small plastic tube leading into the mouth. An incision about 7 mm long was made between

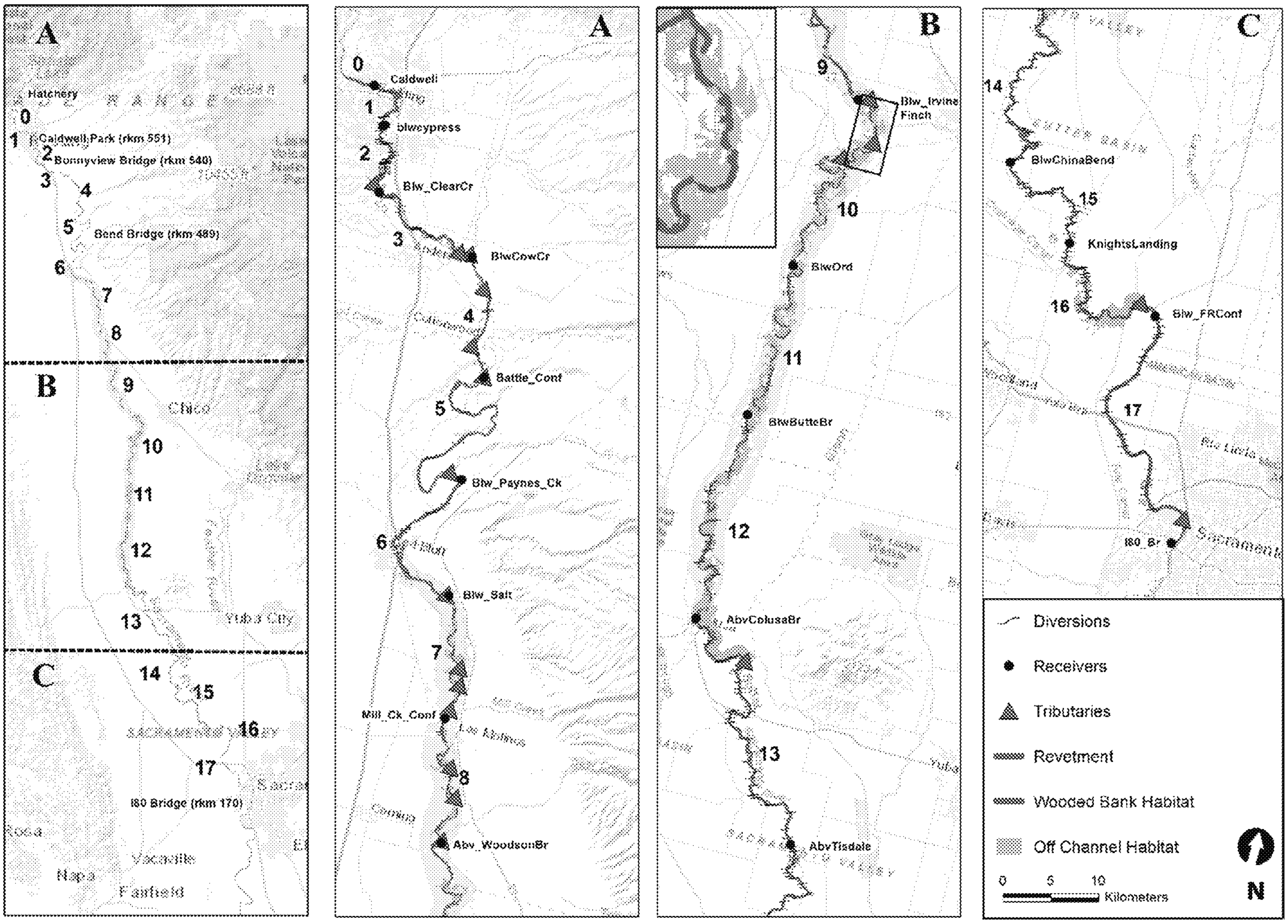

FIGURE 1. Extent of the study area from Redding to Sacramento (left panel). River reaches are numbered between acoustic receiver sites. Time-constant habitat features are mapped over the study area for the (**A**) upper, (**B**) middle, and (**C**) lower sections of the river. The inset map magnifies wooded bank habitat, revetment, and off-channel habitat that was connected within 1 km of the main-stem Sacramento River in the wet year. World topographic base map source: Esri, DeLorme, TomTom, Intermap, GeoTechnologies, General Bathymetric Chart of the Oceans, U.S. Geological Survey, Food and Agriculture Organization of the United Nations, National Park Service, Natural Resources Canada, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, Ministry of Economy, Trade and Industry (Japan), Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community.

the pelvic and pectoral fins approximately 3 mm off the ventral midline using a 3-mm scalpel (Sharpoint 15° stab knife). A disinfected acoustic tag was inserted battery first into the coelom through the incision, and the incision was closed with one or two sutures of absorbable monofilament (6/0 Monoswift). Surgery time averaged 142 s. Fish were observed to resume normal swimming behavior after an average of 236 s. Mean tag burden (tag weight expressed as a percentage of fish weight) by year ranged from 3.2% to 4.3%.

Following surgery, tagged fish were returned to tanks and held for 1–3 d until the hatchery production fish were loaded into transport trucks. Acoustic-tagged fish were transferred into portable PVC/mesh holding pens and placed within the tank of a transport truck. Transport time from the hatchery to release into the Sacramento River at Caldwell Park (Redding) was approximately 45 min; in 2016, fish were released at Bonnyview Bridge (Redding), and transport time for those fish was approximately 60 min. Acoustic-tagged fish were released simultaneously with the other hatchery-origin fish, which were released after sunset. In 2015, when hatchery fish were released over three consecutive days, acoustic-tagged fish were released on the first and third days. The number of acoustic-tagged individuals and the number of hatchery fish released varied substantially among the 5 years of this study; in particular, hatchery releases were much higher in 2014 and 2015 to compensate for anticipated severe losses of naturally produced fish due to drought, with elevated river temperatures and associated critically dry conditions (Table 1).

Acoustic receivers.— As part of the California Fish Tracking Consortium, we tracked fish by using an array of acoustic receivers beginning 3 km below the release location in Redding; extending down the Sacramento River, Delta, and San Francisco Bay; and ending at a dual line of receivers at the Golden Gate Bridge. However, for this study we were interested in examining riverine survival using outputs from the River Assessment for Forecasting Temperature (RAFT) model, which terminates at the tidal Delta, so we restricted this analysis to only receiver locations in the Sacramento River, ending at the city of Sacramento, to estimate survival and movement over 379 km (Figure 1). Receivers positioned downstream in the Delta to the point of ocean entry at the Golden Gate Bridge were therefore pooled into a single site and used to improve estimates of detection probability and survival for all reaches upstream of the final line.

Three different types of JSATS receivers were used in this study: ATS Model SR3000; Lotek Wireless (Newmarket, Ontario, Canada) Model WHS4000; and Teknologic Engineering (Edmonds, Washington) Model LER. Detection range varied from 50 to 300 m depending on river conditions (A. J. Ammann, unpublished data), with an 85% probability of recording at least four valid transmissions from a distance of 135 m (Ammann 2020). We deployed 40 receivers at 18 locations demarcating 17 river reaches (Figure 1). At most of the receiver locations, two receivers were deployed across the river to improve cross-sectional detection coverage. Receivers were held in position with a bottom anchor that was either attached to a shore cable or suspended from a bridge structure.

Postprocessing.— All receiver files contain some amount of invalid or false positive detections. These must be distinguished from true detections and removed to prevent biased interpretation of fish movement and survival (Beeman and Perry 2012). Therefore, each raw receiver file was processed using a set of algorithms to remove false detections (Deng et al. 2017) and to add location information and a unique fish identifier. The filtering algorithm was customized for each of the three receiver models. Briefly, the filtering algorithm used criteria that included the following constraints: (1) the detection code had to match that of a released fish; (2) detection time had to occur after the release time and before the tag was expected to expire; (3) detections that occurred less than 0.3 s after the previous detection (multipath) were removed; and (4) detections had to have occurred within a time window and within the tag's PRI that was specified depending on receiver make. Lotek receivers required a minimum of four detections within 16.6 times the PRI, and the observed PRIs among these detections had to be within 20% of the nominal PRI. Additionally, the SD of these PRIs had to be less than 0.025. Teknologic receivers required at least two detections within four times the PRI, the observed PRI had to be within 10% of the nominal PRI, and the difference in frequency of the two detections had to be less than 55 kHz. The ATS receivers required at least two detections within four times the PRI, the observed PRI had to be within 10% of the nominal PRI, frequencies of the two detections had to be between 416.30 and 418.75 kHz, and the difference in frequency of the two detections had to be less than 0.505 kHz. Separate receiver files were then compiled into a single table. Plots of the time of detection versus rkm were created for each fish and visually inspected for detections that were not spatially and temporally congruent with the remaining detections. We considered any upstream movements as those of predators having ingested a tagged fish. Where predation was inferred, we ended the fish's detection history at the furthest downstream detection.

Mark–recapture analysis.— We used a Cormack–Jolly–Seber survival model (Cormack 1964; Jolly 1965; Seber 1965) to analyze capture histories and estimate the effects of covariates on survival (ϕ) and detection (p). The

TABLE 1. Number and size (mean ± SD) of acoustic-tagged winter-run Chinook Salmon juveniles released each year. Fish were reared at Livingston Stone National Fish Hatchery and released at Caldwell Park (Redding, California; rkm 551) except in 2016, when the release location was Bonnyview Bridge (Redding; rkm 540). Tag burden was calculated as 100 × (tag weight/fish weight). Flow at Bend Bridge was calculated from the date of release to the date on which the last fish was detected at Tower Bridge in Sacramento.

Release date	Number of fish acoustic tagged	Weight (g)	FL (mm)	Tag burden (%; mean, range)	Hatchery winter-run fish released	Flow (m^3/s) at Bend Bridge[a] (mean, range)
Feb 7, 2013	148	10.3 ± 1.7	98 ± 5.0	4.3 (2.5–5.4)	166,967	168 (127–289)
Feb 14, 2014	358	9.4 ± 2.4	95 ± 7.7	3.9 (2.0–5.8)	190,905	187 (108–790)
Feb 4 and 6, 2015	249; 318	10.5 ± 2.0	100 ± 6.1	3.2 (2.0–5.9)	590,623	197 (105–1,453)
Feb 17 and 18, 2016	285; 285	9.3 ± 1.6	96 ± 5.1	3.6 (2.3–5.3)	415,865	432 (151–1,603)
Feb 2, 2017	569	9.1 ± 2.4	93 ± 7.5	3.7 (1.7–5.7)	141,388	1,315 (385–2,832)

[a] U.S. Geological Survey/U.S. Bureau of Reclamation (Bend Bridge hydrologic station [40.28849°, −122.186661°; rkm 489.4]; https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630).

Cormack–Jolly–Seber model was adapted from its original intended function to estimate survival over time into a spatial form of the model that could be used for animals that migrate unidirectionally (Burham et al. 1987) and could be “recaptured” in the form of acoustic detections along the migratory corridor. River reaches were bounded by receivers positioned at approximately 7–38-km intervals along the Sacramento River to the beginning of the Delta at the I-80/I-50 Bridge. In three locations where receiver positions were adjusted slightly among years (Butte City, Knights Landing, and Tower Bridge), the receivers were moved 6, 2, and 2 rkm from their original locations, respectively. For this analysis, these sites were assigned the rkm of the upstream-most receiver at each location. A capture history for each fish was created by assigning a “1” (detected) or a “0” (not detected) at each receiver location.

Survival was modeled in program MARK (White and Burnham 1999) through the RMark package (Laake 2013) within R (R Core Team 2020). By substituting space for time, we modeled reach-specific survival (S) as a logistic function using a linear structure,

$$\text{logit}(S_{i,j}) = \sum_{k=0}^{K} \beta_{j,k} x_{i,j,k}, \tag{1}$$

where logit() is the logit link function, $S_{i,j}$ is the survival probability for the ith individual in the jth reach, and $\beta_{j,k}$ is the slope coefficient of the kth covariate, $x_{i,j,k}$.

This model structure allowed for a mixture of spatially and time-varying covariates (e.g., water temperature), spatially and time-constant individual covariates (e.g., FL), spatially varying but time-constant covariates (e.g., reach length), and time-varying but spatially constant covariates (e.g., mean annual river flow). Each of the covariates we included in the analysis had an a priori hypothesized effect on smolt survival (Table 2). Fish size, as measured by FL, was the only covariate that was unique to each individual but constant across reaches and time. The time-varying, reach-constant covariate was annual mean flow at Bend Bridge, confined to the period spanning from the date of fish release to the date on which the last fish was detected in the river. Bend Bridge was chosen because it was upstream of major tributaries and diversions and therefore representative of flow in the Sacramento River watershed.

For each of the reaches, we derived spatially varying, time-constant covariates to define habitat features, many of which did not change between years and represented the best available approximation of reach-specific physical habitat for the Sacramento River (Figure 1). Each of the habitat features was mapped using ArcGIS version 10.4.1 (Esri, Redlands, California). River area and off-channel habitat were calculated as area per reach. Off-channel habitat was summarized as an annual mean from Landsat scenes corresponding to January–April, when fish were in the river. Median travel time was calculated from all observed travel times on a per-reach basis for each year. All other habitat features did not vary temporally across the study period. Shaded riverine aquatic cover (wooded bank) was defined as the nearshore aquatic area at the interface of the river and adjacent woody riparian habitat. This measure does not quantify instream cover. Specifically, to be designated as shaded riverine cover, the adjacent bank had to be composed of natural, eroding substrates supporting riparian vegetation that overhung or protruded into the water, with the water containing variable amounts of woody debris, such as leaves, logs, branches, and roots. Wooded bank and revetment were summarized as percentages of the length of the riverbank per reach. Remaining riverbank that was not classified as revetment or shaded was designated as bare bank. Other reach-specific covariates included the number of diversions, number of tributaries, and river sinuosity (Table 2).

A time-varying individual covariate was defined as the mean of the daily covariate (e.g., water flow, velocity, or temperature) over an individual’s travel time through a reach. For the purposes of defining covariate values for each fish, individuals that were undetected at a given receiver location but subsequently detected at a location further downstream had that missing arrival time imputed by using the observed arrival time at the upstream location, the observed arrival time at the next downstream location, the distance between these two locations, and the reach length between the upstream location and the missed location,

$$A_{(missed)} = A_{(upstream)} + \frac{\text{RL}_{(upstream \rightarrow missed)} \times \left[A_{(downstream)} - A_{(upstream)}\right]}{\text{RL}_{(upstream \rightarrow downstream)}}, \tag{2}$$

where A is arrival time and RL is reach length (km) between locations.

There were many more reaches defined by acoustic receivers than there were flow stations in the river. Therefore, to more closely match fish presence with environmental covariates, we used the RAFT model (Pike et al. 2013), which is a one-dimensional physical hydrodynamic model that estimates laterally and vertically averaged channel water temperature, flow, depth, and velocity every 10 min at a 2-km spatial resolution. We included temperature because metabolic rates and predation rates increase at higher temperatures (Vigg et al. 1991; Killen et al. 2010).

We considered flow at the reach scale and at the watershed scale because flow dynamics have been shown to be important for survival (Michel 2018; Perry et al. 2018;

TABLE 2. Hypothesized effects of covariates on winter-run Chinook Salmon survival for covariates included in the top mark–recapture survival model.

Category	Covariate	Definition	Prediction	Hypothesis
Individual	Length[a]	FL	Positive	Larger fish have higher survival due to improved predator avoidance and gape limitation
Temporal	Annual flow[b]	Mean flow at Bend Bridge (Jan–Apr)	Positive	Higher flows produce more habitat, facilitate downstream migration, and increase turbidity, which reduces predator exposure
Spatial	Reach length	Distance between upstream and downstream receivers	Negative	Longer migration distance increases exposure to predators
	Off-channel habitat[c]	Connected wetted area per reach within 1 km of river edge	Positive	Increased off-channel habitat produces more refuge and forage habitat
	Travel time	Median travel time	Negative	Longer travel time will decrease survival because of increased exposure to predators
	Sinuosity[d]	Deviation of reach length from shortest path	Positive	Increased sinuosity creates more instream habitat
	Revetment[e]	Percent revetment	Negative	Increased revetment reduces habitat refugia
	Diversions[f]	Number of diversions per kilometer for each reach	Negative	Increased habitat structure for predators
	Tributaries[g]	Number of tributaries per kilometer exceeding a Strahler stream order of 3	Positive	Increased access to nonnatal habitat
	Wooded bank habitat[h]	Percentage of nonriprapped bank with adjacent woody vegetation	Positive	Increased cover produces more refuge habitat
	Width : depth ratio[i]	Mean ratio of wetted channel width to depth	Positive	Wider, shallow channels increase refuge habitat
	Slope[i]	Mean elevation gradient of a reach	Positive	Steeper gradients will decrease travel time

TABLE 2. Continued.

Category	Covariate	Definition	Prediction	Hypothesis
Time-varying individual[i]	Temperature	Mean river temperature per reach	Negative	Increased temperature increases predator activity and reduces aerobic scope, potentially impacting locomotion
	Depth	Mean river depth per reach	Positive	Favors avoidance of bottom-oriented predators (catfish) and surface-oriented predators (birds)
	Interannual reach flow	Mean river flow per reach	Positive	Higher flows within a reach produce more habitat in that reach
	Intra-annual reach flow	Mean river flow per reach and year	Positive	Higher flows will be associated with increased turbidity and refugia
	Reach velocity	Mean river velocity per reach	Positive	Higher velocities will shorten travel time and reduce predator exposure

[a] Measured at tagging.

[b] U.S. Geological Survey data inventory page for site 11377100–Sacramento River above Bend Bridge, near Red Bluff, California: U.S. Geological Survey Web page, accessed January 20, 2022, at https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630.

[c] Normalized difference water index using 2-week conglomerates in Landsat (https://landsatlook.usgs.gov; April 9–23, 2013; February 21–March 18, 2014; February 24–March 5, 2015; March 23–30, 2016; and February 22–March 1, 2017).

[d] Sinuosity toolbox in ArcGIS.

[e] California Department of Water Resources.

[f] California Department of Fish and Wildlife (Passage Assessment Database) and the National Oceanic and Atmospheric Administration Southwest Fisheries Science Center.

[g] National Hydrography Dataset Plus (U.S. Environmental Protection Agency) with a Strahler stream order of 3.

[h] California Department of Water Resources and Google Earth imagery.

[i] Produced by the authors using the River Assessment for Forecasting Temperature (RAFT) model (Pike et al. 2013).

Henderson et al. 2019). In addition to mean annual flow at Bend Bridge, we included flow variables that measured variation from each reach's mean flow and variation relative to the mean flow in each year. We refer to these covariates as "interannual reach flow" and "intra-annual reach flow," respectively, following the methods of Henderson et al. (2019). Interannual reach flow was calculated by standardizing flow to each reach's mean flow:

$$z_{\text{inter},d,y,k} = \frac{Q_{d,y,k} - \mu_k}{\sigma_k}, \tag{3}$$

whereas intra-annual flow was calculated by standardizing daily flow within each reach and year:

$$z_{\text{intra},d,y,k} = \frac{Q_{d,y,k} - \mu_{y,k}}{\sigma_{y,k}}, \tag{4}$$

where $z_{\text{inter},d,y,k}$ and $z_{\text{intra},d,y,k}$ are the inter- and intra-annual reach flows on day d in year y and reach k; $Q_{d,y,k}$ is discharge; μ_k and $\mu_{y,k}$ are the means of $Q_{d,y,k}$ for each reach and each reach and year, respectively; and σ_k and $\sigma_{y,k}$ are the SDs of $Q_{d,y,k}$ for each reach and each reach and year. Including intra-annual reach flow allowed us to examine whether large freshet events within a reach would increase survival relative to the mean flow for that year (Cavallo et al. 2013; Courter et al. 2016). We included intra-annual reach flow in models with mean annual flow at Bend Bridge because scaling intra-annual flow by both year and reach removes the effect of annual differences in intra-annual reach flow, thus eliminating correlation between these variables. We also included an interaction term between mean annual flow and intra-annual reach flow, which tests whether within-year deviations from the mean annual flow had a different effect in high- and low-flow years.

Before fitting mark–recapture models, we conducted pairwise comparisons of all covariates to evaluate collinearity. If the correlation coefficients between any two variables exceeded 0.70 (Dormann et al. 2012) or if the variance inflation factor exceeded 10 (Kutner et al. 2004), we retained only the covariate with a greater hypothesized effect on survival (Supplementary Material available in the online version of this article). All continuous variables were standardized to zero mean and unit SD so that changes in survival could be predicted by a 1-SD change in each covariate value.

Model selection.—We used Akaike's information criterion (AIC) to rank alternative models based on the best trade-off between improved fit and model complexity (Burnham and Anderson 2002). Models with lower AIC values are considered better-fitting models in the model set. Our model selection process consisted of first identifying the best-fitting model for detection probability, then assessing goodness of fit, and finally fitting alternative survival models using the best-fitting detection model. We evaluated goodness of fit by estimating the degree of overdispersion using two different parameters in program MARK: the median-$\hat{c}$ procedure and the bootstrap goodness-of-fit procedure. Goodness of fit was evaluated using a model that allowed both survival and detection to vary independently among reaches and years (i.e., a reach × year interaction). Estimates of $\hat{c}$ less than or equal to 4 indicate that variability in the data was greater than expected given the multinomial likelihood structure of the mark–recapture model. Values of $\hat{c}$ greater than 1 indicate overdispersion, with more variability in the data than expected given the multinomial structure of the mark–recapture model, while values much greater than 1 (e.g., $\hat{c} > 4$) indicate a fundamental lack of fit, whereby the model structure poorly describes variation in the data (Burnham and Anderson 2002). We estimated $\hat{c}$ to be 1.54, indicating that our model structure was appropriate but that our data were slightly overdispersed. We therefore used the quasi-AIC (QAIC_c), which adjusts the AIC value based on $\hat{c}$, to select the model that was most supported by the data and ranked with the lowest QAIC_c score. In addition, $\hat{c}$ was used to inflate the SEs of parameter estimates in the model selected for inference.

The relative importance of covariates in the selected model (lowest QAIC_c score) was evaluated graphically and by examining point estimates of β coefficients with 95% CIs. Covariates having β coefficients with large absolute values were interpreted to have a larger effect on survival. Covariates having β coefficients with 95% CIs that overlapped zero were interpreted as not being significantly different from zero (i.e., no detectable effect). Covariates that did not contribute significantly to explaining the data were still retained in the selected model because they were chosen a priori to be important for their potential effect on survival (Burnham et al. 2011).

To identify the most parsimonious detection model, we fitted a series of models with increasing complexity while holding the survival model structure fixed using the reach × year interaction model. Like survival, we modeled the effect of covariates on detection as linear on the logit scale (equation 1). The simplest model included only sampling occasion (i.e., receiver site) as a main effect on detection probability (Supplementary Material). Next, we added year as a categorical factor to the reach model. The third model added an interaction between year and receiver site because the number of receivers and/or receiver model used at each location varied among years. Finally, the mean reach-specific velocity for each individual was added to each of the three models above for a total of six models in the model set. We hypothesized that river velocity and the ambient noise associated with velocity impact the attenuation of acoustic signals in water, thereby affecting detection probability. For all models, detection probabilities were set to zero when receivers were not deployed below Paynes Creek (location 6) and at the Mill Creek confluence (location 8) in 2013, below Cypress (location 2) when fish were released downstream of this location in 2016, and below China Bend (location 15) in 2017. We found that the model with water velocity and a site × year interaction had the lowest $QAIC_c$, which was considerably lower than that of the second-best model, which included only a site × year interaction ($\Delta QAIC_c = 2{,}069$; Supplementary Material). Therefore, the model including water velocity and the site × year interaction was used for all survival models.

Using an approach similar to that described above for the detection models, we fitted a set of eight survival models (Table 3) of increasing complexity and we used the $QAIC_c$ model selection criterion to rank each model. Subsets of the more parameterized models were evaluated using the same model selection criteria. As a basis of comparison with more parameterized covariate models, the models with the fewest variables only estimated survival separately for each reach or for each reach and year. From there, we included a model to test the effect of reach length (i.e., travel distance) and travel time on survival, with an intercept offset for each year. This model tested whether reaches with longer travel times and reach lengths, which increase exposure to predators (Anderson et al. 2005), could better explain variation in survival among reaches and years. Third, we added the RAFT model's flow variables (e.g., flow and velocity) to models that included reach length and travel time to test whether river flows affected survival after accounting for effects of travel time and reach length. Fourth, we evaluated models that only included time-constant habitat covariates (e.g., wooded bank habitat, number of tributaries, etc.; see Table 2 for the full list) or time-varying covariates (e.g., temperature and depth) that excluded flow variables. Finally, the most complex models combined all covariates from the preceding models, fitting one full model with interannual reach flow and another with intra-annual reach flow.

RESULTS

Spatiotemporal Conditions

Water temperatures ranged from 8°C to 16°C throughout the study period and varied among years but always had an increasing trend from February to April, as measured at Bend Bridge (Figure 2). Drought years 2014 and 2015 had the warmest mean February–March whole-river temperatures (12.2°C and 13.6°C, respectively). Peak flows in the Sacramento River varied temporally between years in response to storm events: no pulses in 2013, a few weak pulses in 2014, a single large pulse in 2015, two moderate pulses in 2016, and many large pulses on top of extremely high sustained flows in 2017 (Figure 2).

Riparian channel features varied spatially across the study area, with a greater number of tributaries upstream and greater percentage of revetment, greater number of diversions, and a smaller width : depth ratio downstream (Figure 1). Bank type characteristics were distributed in distinct sections of the Sacramento River (Figure 3). The upper section (reaches 1–6) contained mostly wooded bank, with some bare bank and lesser amounts of revetment. The middle section (reaches 7–12) was predominantly bare bank, with some wooded bank and lesser amounts of revetment. The area with the highest proportion of bare bank was associated with off-channel habitat (Figure 1) in drought years ($r = 0.80$). The lower river section (reaches 13–17) was predominantly revetment, with some wooded bank and a lesser amount of bare bank.

Travel Time

The time it took fish to travel downstream varied by reach and across years with different flow, velocity, and temperature profiles (Figure 4). Fish slowed down through the upper and middle reaches of the river during the high-flow year, through the middle reaches during all years, and in the lower reaches during the most critically dry year (2013; Figure 5). Travel times were the longest in the wettest and driest years. In the wettest year (2017), median travel time in the upper Sacramento River (Figure 1) was 24 d, ranging up to 70 d, while in the critically dry year (2013), median travel time in the middle Sacramento River was 33 d, ranging up to 54 d (Table 4). The most consistent slow travel times occurred in the middle Sacramento River, within a 55-km stretch of the river between Woodson Bridge and Tisdale (reaches 9–13; Figures 1, 5). This part of the river coincides with the greatest extent of connected off-channel habitat that was visible during the wet year between Red Bluff and Colusa (Figure 1).

Reach-Specific Patterns in Survival

Reach-specific survival scaled by distance and time (per 10 km per day) was consistently high (98–100%) in the upper reaches (1–4) and lower reaches (13–17) of the Sacramento River (Figure 6A). Reach-specific survival was lowest (96%) at reach 7 and intermediate (97–98%) through reaches 8–12 between Red Bluff and Colusa.

Factors that Affect Survival

Survival models with flow and habitat covariates received more support than the models that included only reach or reach and year, indicating that we had identified features that were important for juvenile salmon survival. The top-ranked survival model based on $QAIC_c$ was the full intra-

TABLE 3. Covariates included in each of the candidate mark–recapture survival models.

Covariate name	Reach	Distance–travel time	Interannual flow	Habitat	Intra-annual flow	Reach and year	Full interannual	Full intra-annual
Reach distance		x	x	x	x		x	x
Fish FL				x			x	x
Proportion of revetment				x			x	x
River sinuosity				x			x	x
Diversions per kilometer				x			x	x
Proportion of shaded riparian area				x			x	x
Tributaries per kilometer				x			x	x
Channel width : depth ratio				x			x	x
Mean slope of reach				x			x	x
Median travel time per reach		x	x	x	x		x	x
Reach	x					x		
Calendar year		x	x		x	x		
Reach × year interaction						x		
Flow standardized by reach			x				x	
Mean water temperature per reach							x	x
Mean water depth per reach							x	x
Mean water velocity per reach							x	x
Off-channel habitat per kilometer							x	x
Flow standardized by reach and year					x			x
Annual flow at Bend Bridge					x			x
Yearly reach flow × annual flow interaction								x

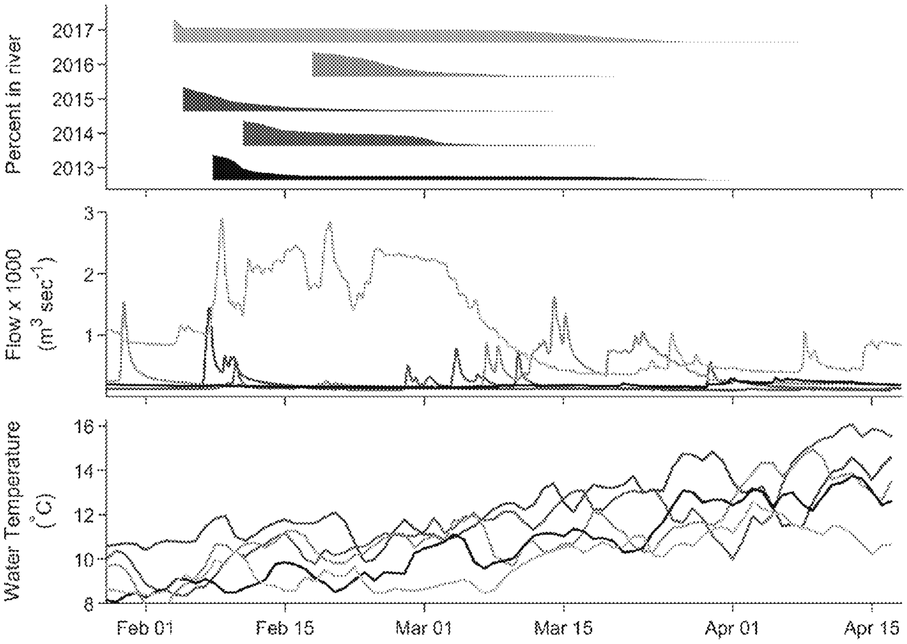

FIGURE 2. Percentage of acoustic-tagged winter-run Chinook Salmon juveniles in the Sacramento River from the date of release to the date on which the last fish was detected at Tower Bridge in the city of Sacramento for each year (upper panel). Flow (middle panel) and water temperature (lower panel) at Bend Bridge are also presented for each year (U.S. Geological Survey/U.S. Bureau of Reclamation hydrologic station [40.28849°, −122.186661°; rkm 489.4]; https://dashboard.waterdata.usgs.gov/api/gwis/2.0/service/site?agencyCode=USGS&siteNumber=11377100&open=15630).

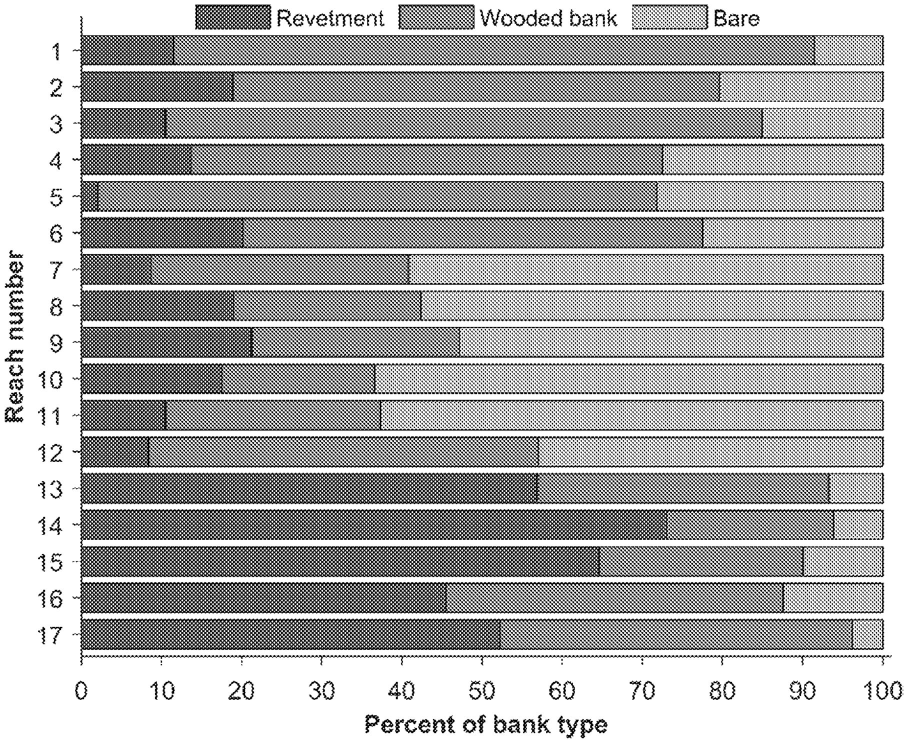

FIGURE 3. Percentages of revetment, wooded bank, and bare bank shoreline habitat types from upstream (reach 1) to downstream (reach 17) reaches of the Sacramento River. The area with the highest proportion of bare bank is associated with off-channel habitat (Figure 1) during drought years ($r = 0.80$).

annual reach flow and habitat model (Tables 3, 5), characterized by an interaction between mean annual flow and intra-annual reach flow and a combination of time-constant, reach-specific habitat features, reach water velocity, travel time, and fish length (Table 3). Among covariates with significant coefficients, as judged by 95% CIs that did not overlap zero, variation in annual flow had the strongest positive association with survival. These findings indicate that a 1-SD change in annual flow had a stronger effect on survival than a 1-SD change in any of the other covariates in the top-ranked model. However, the effect of annual flow was dampened by the negative effect of an intra-annual reach

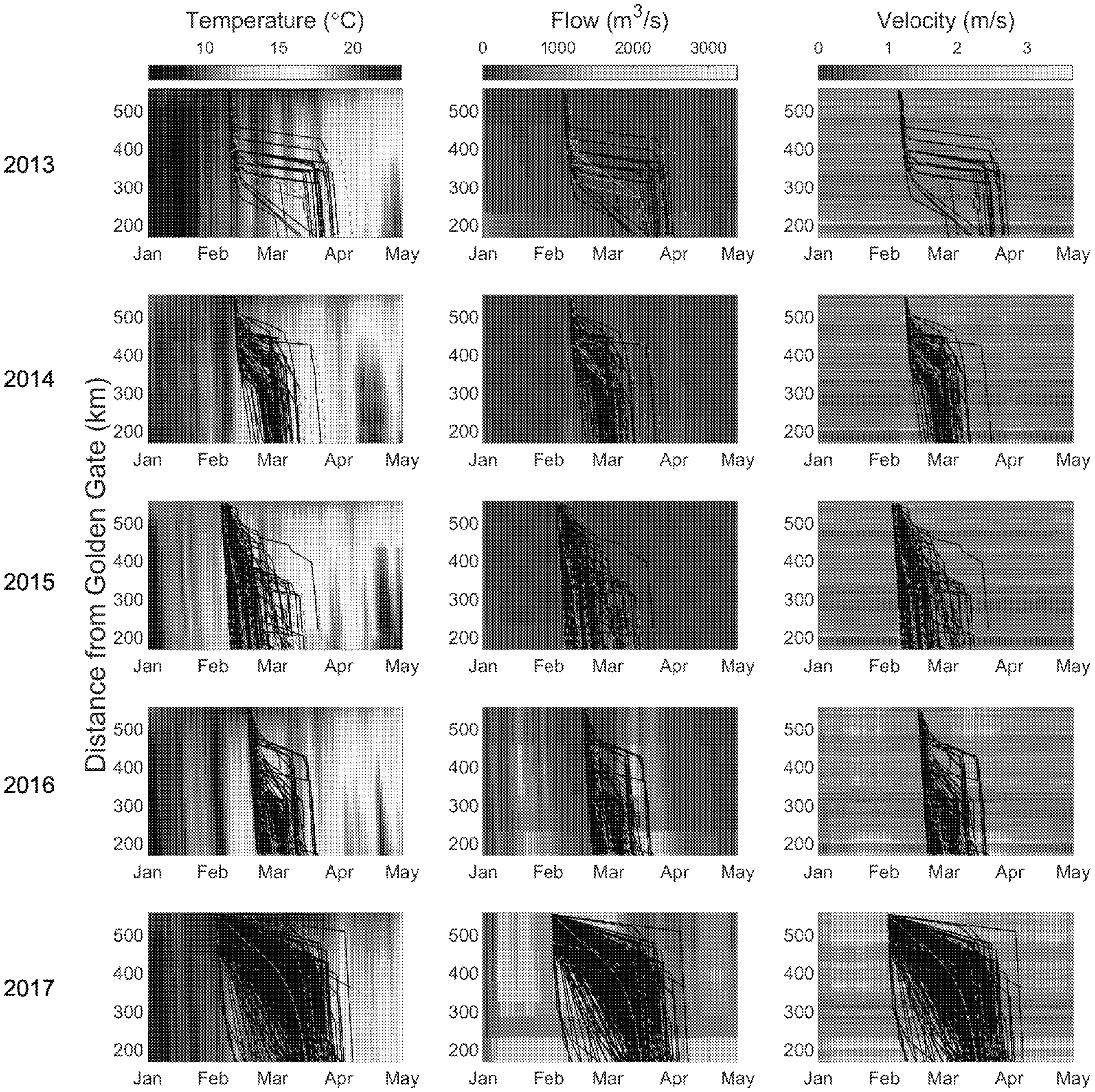

FIGURE 4. Downstream detections of juvenile winter-run Chinook Salmon (black lines) and interpolated tracks (gray dashed lines) in the Sacramento River from Redding to Sacramento, California. Detections overlay River Assessment for Forecasting Temperature (RAFT) model outputs for temperature (left column), flow (middle column), and velocity (right column) in water years 2013 (top row) to 2017 (bottom row).

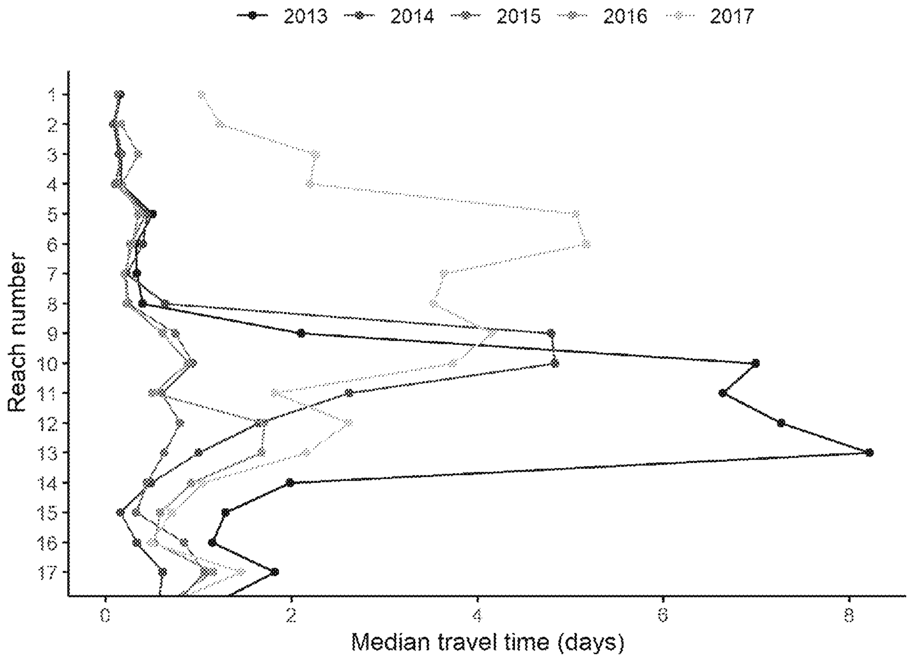

FIGURE 5. Travel time (d) by reach for juvenile winter-run Chinook Salmon migrating down the Sacramento River in each year. Each point represents the median number of days it took tagged fish to transit through a reach bounded upstream and downstream by acoustic receivers.

TABLE 4. Yearly variation in median travel time (d) of juvenile winter-run Chinook Salmon (Count) moving down the Sacramento River, with minimum (Min) and maximum (Max) values for the upper, middle, and lower sections (Figure 1) of the river.

Year	Section	Count	Median	Min	Max
2013	Upper	118	3	1	44
	Middle	23	33	4	54
	Lower	22	14	2	35
2014	Upper	288	3	1	36
	Middle	146	17	2	36
	Lower	135	3	2	13
2015	Upper	446	2	1	31
	Middle	310	5	1	36
	Lower	233	3	1	32
2016	Upper	531	2	1	28
	Middle	362	6	2	28
	Lower	285	5	1	28
2017	Upper	335	24	1	70
	Middle	293	18	2	44
	Lower	234	6	2	39

flow × annual flow interaction term. Other covariates with a significant positive effect on survival (i.e., 95% CIs that did not overlap zero) included percentages of revetment and wooded bank, fish length, and reach-specific intra-annual flow (Figure 7). Channel width : depth ratio, reach-specific velocity, depth, and reach length all had negative associations with survival, along with travel time, river temperature, and the intra-annual reach flow × annual flow interaction term. River sinuosity, diversion density, off-channel habitat, slope, and number of tributaries had negligible effects on survival, indicating that the covariates included in the selected model sufficiently explained differences in survival among years and reaches. Time-constant covariates, including river sinuosity, slope, and percent wooded bank, acted to increase estimates of survival in the upper reaches but decreased estimates of survival in the lower reaches relative to mean covariate values (Figure 6B). In contrast, the width : depth ratio decreased estimates of survival through the middle river (reaches 7 and 8) and increased estimates of survival relative to mean covariate values from reach 13 downstream, where the river becomes more channelized with revetment along the bank.

Mean annual flow, intra-annual reach flow, and their interaction had contrasting effects on predicted survival (Figure 8). Predicted survival per 10 km per day increased as a function of mean annual flow, with intra-annual reach flow and all other covariates set to mean values (Figure 8A). Due to the negative interaction between annual and intra-annual reach flow, the slope coefficient for intra-annual reach flow declined with annual flow such that reach effects were more positively associated with survival in low-flow years (Figure 8B). The combined effect of mean annual flow and intra-annual reach flow led to a positive relationship in low-flow years but a flat relationship in the high-flow year (Figure 8C). These findings

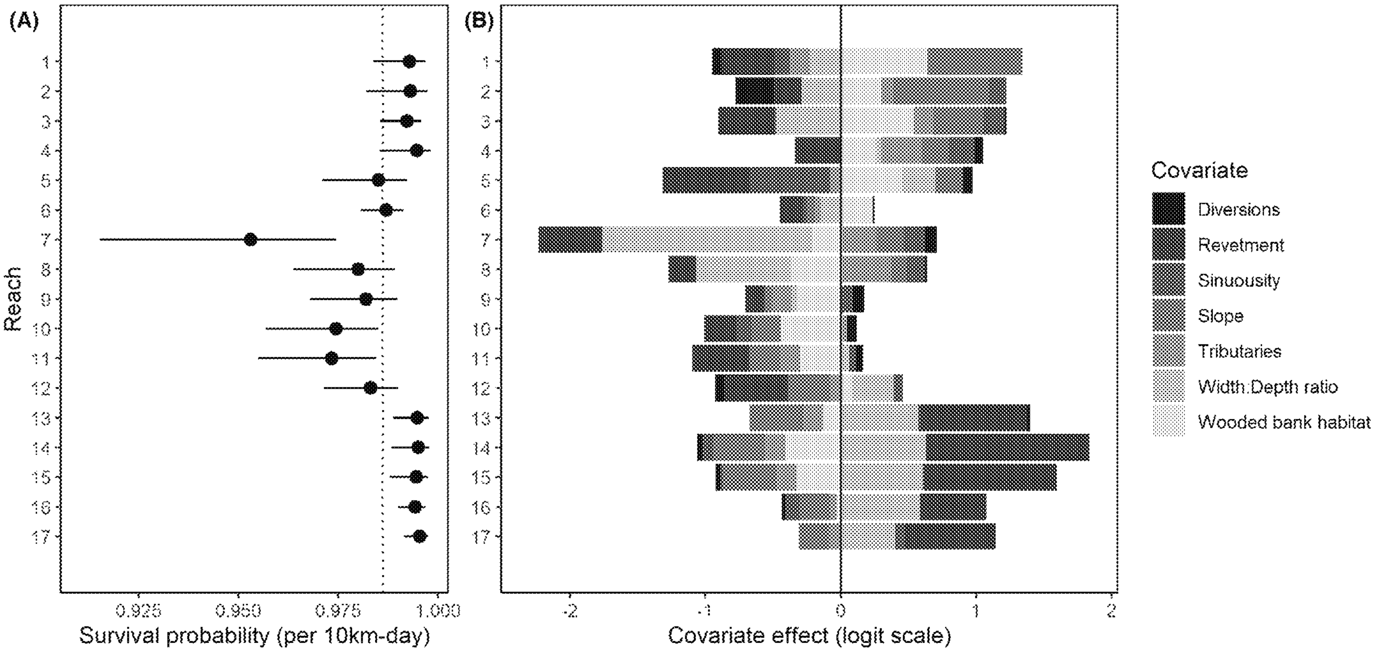

FIGURE 6. Effect of time-constant, reach-specific covariates on survival of juvenile winter-run Chinook Salmon: **(A)** predicted survival per 10 km per day (with 95% CIs) when all covariates are set to mean values except the reach-specific covariates shown in panel B (dashed line shows the mean survival over all reaches); and **(B)** the effect of each reach-specific covariate on the linear predictor (see equation 1). Covariate effects (represented as stacked bars) were calculated as the product of the standardized covariate and its corresponding slope coefficient (i.e., β). Habitat features associated with the riverbank also varied across the migration corridor (see Figure 3).

suggest that variation in daily reach-specific flows affect survival more in years when mean annual flow is low than in high-flow years.

DISCUSSION

The Sacramento River is the main source of California's water conveyance system and acts as a key migration corridor for anadromous fish moving from freshwater to ocean environments. Therefore, the management of reservoir releases directly affects the conditions encountered by juvenile salmon as they migrate to the ocean as smolts. Because of their small size, smolts are vulnerable to how these conditions affect exposure to predators during the downstream emigration phase of their life history (Sabal et al. 2021). Additionally, they may be vulnerable to delayed mortality in the ocean from associated migration duress (Michel 2018).

The decline of the winter run, as the most critically imperiled Chinook Salmon run, remains one of the most important issues confronting water management in the Sacramento River. In this study, we observed that mean annual flow over the time during which fish were in the river had the most positive effect on their survival out of all the modeled covariates. Moreover, we observed that higher flow at the reach scale had a more positive effect on survival in dry years with low flow than it did in wet years with high flow. Although the interaction between annual flow and intra-annual reach flow occurs with one high-flow year observed in 2017 (Figure 5), similar observations have been made in previous work on late-fall-run Chinook Salmon (Courter et al. 2016; Perry et al. 2018; Henderson et al. 2019). Anomalous wet years like 2017 are important to consider because California remains in a state of extended drought, and obtaining data for years like this is likely to be difficult given their importance for fish survival. It has long been known that freshwater flow is connected to variation in survival of juvenile salmon migrating to the sea (Kjelson and Brandes 1989; Newman and Rice 2002; Michel 2018; Notch et al. 2020); however, our findings suggest that although it may not be possible to create wet-year flow conditions like those in 2017, increasing flow through managed flow pulses can benefit salmon survival. Our results also improve current understanding of how annual changes in flow can affect survival rates and spatially varying changes in habitat features known to be important for rearing (Zeug et al. 2019; Zeug and Winemiller 2008) with time-varying features of the river (i.e., reach flow, temperature, and depth; Henderson et al. 2019). Considering these factors together in a novel framework that scales survival by the amount of time fish are spending in a given part of the river provides a clearer way to examine spatial variation in migration survival.

TABLE 5. Survival (ϕ) model selection based on quasi-Akaike's information criterion ($QAIC_c$) ranks with a $\hat{c}$ of 1.54. Models are shown with the number of parameters (npar), the calculated value of $QAIC_c$, the difference in $QAIC_c$ value between the given model and the top model ($\Delta QAIC_c$), and the deviance value (QDeviance).

Survival model	npar	$QAIC_c$	$\Delta QAIC_c$	QDeviance
Full intra-annual	108	13,320.53	0.00	13,103.37
Full interannual	106	13,415.67	95.15	13,202.56
Separate survival for reach and year	175	13,438.75	118.23	13,085.71
Intra-annual reach flow	100	13,488.73	168.20	13,287.73
Habitat	102	13,508.79	188.26	13,303.76
Interannual reach flow	98	13,544.11	223.58	13,347.15
Distance–travel time model	97	13,547.31	226.78	13,352.37
Reach	107	13,576.39	255.86	13,361.25

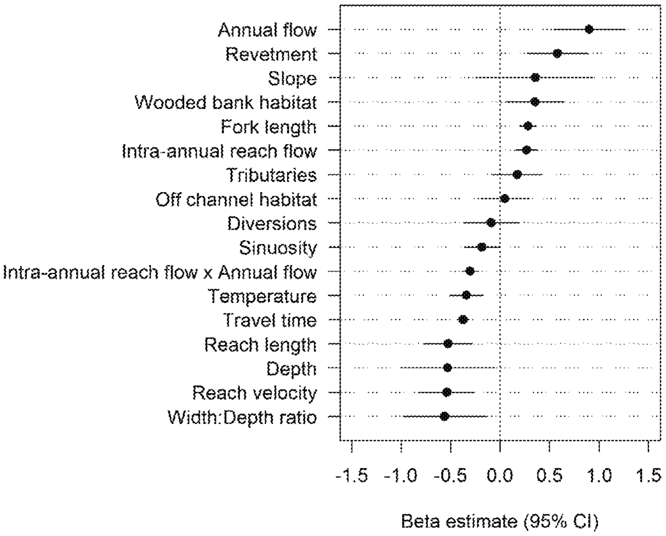

FIGURE 7. Parameter estimates (±95% CI) of slope coefficients (i.e., β estimates) for each covariate in the selected model. The CIs that overlap zero indicate no significant effect.

In some ways, our results differed from those of previous studies on the late-fall run (Perry et al. 2010; Michel et al. 2015; Henderson et al. 2019) and spring run (Cordoleani et al. 2018; Notch et al. 2020) of Chinook Salmon. We observed stopover behavior in all years, but the region of the river in which stopover behavior occurred appeared to depend on density-dependent habitat availability, with fish exhibiting stopover behavior higher in the river during the wettest year and lower in the river during the driest year (Figure 5). During dry years with lower flow, salmon

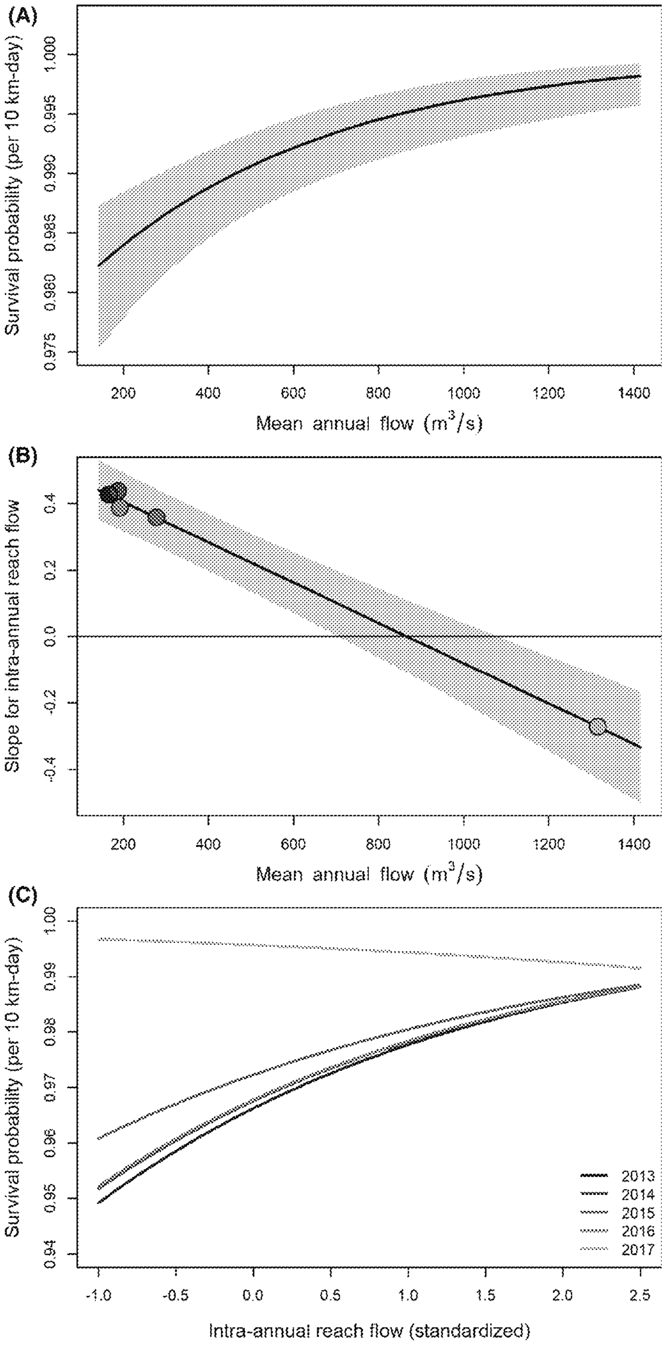

FIGURE 8. Effects of mean annual flow, interannual reach flow, and their interaction on predicted survival of juvenile winter-run Chinook Salmon: **(A)** predicted survival per 10 km per day as a function of mean annual flow, with intra-annual reach flow and the other covariates set to mean values, except for travel time (set to 1 d) and reach length (set to 10 km); **(B)** effect of the interaction between mean annual flow and intra-annual reach flow, showing the slope coefficient for intra-annual reach flow as a function of mean annual flow (symbols represent the slope for intra-annual reach flow for each value of mean annual flow; symbols are slightly jittered vertically to reduce overlap); and **(C)** combined effect of mean annual flow and interannual reach flow on predicted survival per 10 km per day. Shaded regions in panels A and B show the 95% CIs.

that delay migration tend to experience higher mortality (Sturrock et al. 2020). In 2013, a year that was characterized by low flows and a nearly flat hydrograph (Figure 2), the stopover behavior low in the river and the corresponding low survival suggest that fish may not initiate downstream migration without an appropriate migration cue, which usually arrives as a pulse in flow (del Rosario et al. 2013) or, ultimately, as warming temperatures (Figure 4). Salmon are known to avoid high temperatures by timing their migration to occur before or after peak river temperatures (Hodgson and Quinn 2002). Therefore, we might expect that fish migrating in response to high temperatures could suffer indirect effects, such as a reduction in aerobic scope (Eliason and Farrell 2016).

The trade-off between increased exposure to predators and access to good foraging habitat is indirectly supported with a positive association between annual flow and survival (Michel et al. 2015; Perry et al. 2018; Henderson et al. 2019; Zeug et al. 2020). High flows can benefit survival by increasing water turbidity, thus providing cover for juveniles to evade predators (Gregory and Levings 1998), and by offering access to a greater diversity of foraging and refuge habitat that allows fish to slow down higher in the watershed. A positive association of body size with survival is consistent with previous work on other runs (Cordoleani et al. 2018; Henderson et al. 2019; Notch et al. 2020), which suggests that a fish's size can reduce predation as individuals grow beyond the gape limitation of some predators (Nowlin et al. 2006). A caveat is that the increased tag burden of fish in the smaller size range could disproportionately affect the survival of acoustic-tagged fish (Brown et al. 2010; Liss et al. 2016). Although we did not detect a fish size effect for tag shedding or survival rates in the portion of tagged fish that were held and monitored for 60 d, tag burden will disproportionally affect the performance of smaller fish and may contribute to the observed higher survival for larger fish.

Some relationships between other covariates and survival ran counter to our working hypotheses and revealed interesting patterns upon further investigation. First, increased survival was associated with a higher proportion of revetment along the riverbank (Figure 7). However, the positive effect of revetment was only observed where it was predominant along the riverbank in the last five reaches (Figure 6B, reaches 13–17), which had similar habitat and morphology (e.g., deep, narrow, low-gradient channels; Supplementary Material) and downstream of reaches where fish were observed exhibiting slow travel. Fish surviving to these lower reaches are likely larger because of longer feeding durations or upstream size-selective mortality that removed smaller fish. Moreover, fish holding upstream that survived to these lower reaches are more likely to be actively out-migrating, which decreases travel time (Figure 5) and exposure to predators. Future work that compares the spatial survival of other runs that emigrate at other times may shed some light on the role of revetment, predation, and survival in this part of the river.

Second, while more rapid downstream movement may appear to result in better in-river survival for out-migrating smolts, the negative association between reach velocity and survival suggests that volitional downstream movement may be compromised. Inflection points that indicate a change to downstream migration behavior appear to correspond to sudden changes in the velocity profile of the river (Figure 4). As instream rearing is known to occur for winter-run fish in the main-stem Sacramento River (Freeman et al. 2001) and tributaries (Phillis et al. 2018), we may be observing a switch from resting and feeding to migration behavior in which vulnerability to mortality is higher, at least initially. During the wet year of 2017, when water velocities were high throughout the main channel, better access to low-velocity off-channel and ephemeral tributary habitat throughout the upper and middle Sacramento River may have been key for fish to improve foraging opportunities on prey (e.g., drift) that would otherwise have been advected in the main stem throughout the largest pulse flow periods.

Limitations of observational studies on hatchery-raised salmon in the field can make it difficult to infer how variables might affect wild fish, which initiate their smolt migration earlier in the fall. Natural-origin winter-run fish initiate their downstream migration beginning in July and into autumn, around the time when the first storms of the year arrive in California, following several months of summer conditions characterized by low flows and warm temperatures. These early storms create unique conditions, known colloquially as a "first flush," when accumulated debris and sediment are carried downstream, creating turbid conditions and cover that wild fish could use as refugia from predators. In contrast, our study fish were released during the peak of winter in a single synchronized event with the entire hatchery production of winter run to provide a swamping effect and improve survival. A study on Sockeye Salmon *O. nerka* using a combination of PIT and acoustic tags demonstrated that the estimated survival probability for smolts increased from 50% when migrating with 2,000 conspecifics to 95% when migrating with 350,000 conspecifics (Furey et al. 2016). Because density dependence spreads fish out as they migrate downriver through rearing habitat along channel margins, a predator swamping effect will attenuate at an unknown rate and will likely have different characteristics than natural-origin fish experience. In addition, if density-dependent habitat availability is indeed the primary mechanism that predicts where fish will slow down, natural-origin fish that are not confronted with as many conspecifics at a given time are more likely to exhibit slower travel times in the upper reaches of the river than that of our study fish. Future studies that release similar numbers of fish at different locations along the river may be able to control for a swamping effect and more closely approximate how natural-origin fish behave.

Management Implications

Flow management is often used as a primary tool for mitigating impacts to fish. When high flows are not available, maintaining functional flows through flow pulses offers managers another way to improve survival under low-flow conditions (Michel et al. 2021). Figure 8B describes how the slope of the intra-annual reach flow–survival relationship changes with mean annual flow. This relationship can be used by managers to determine, at a given level of annual flow, whether a flow pulse is likely to produce a measurable effect on survival. For example, when flow is less than about 700 m^3/s, given the confidence interval, pulse flows will have a high probability of having a positive effect on survival. The relationship also indicates what the magnitude of the effect may be. For example, when mean annual flow is 600 m^3/s, a pulse flow is going to have half the effect of a pulse event than when mean annual flow is 200 m^3/s. Of course, there are no observations between 300 and 1,300 m^3/s, and collecting these data in a targeted way is recommended to determine whether the relationship at higher flows is nonlinear.

As climate change induces more variability and a higher frequency of hot and dry conditions, facilitating migration with pulse flows is likely to become harder to achieve due to water scarcity and a lack of habitat diversity throughout the watershed (Lindley et al. 2007). This means that the resilience of declining salmon populations will increasingly depend on habitat restoration (Herbold et al. 2018). While habitat restoration can take months or years to achieve, depending on the scale of the activity, more information is needed to understand which characteristics of holding habitat cause fish to alter emigration. Some of the ways that winter-run fish interacted with spatial covariates appeared to change as they moved downstream, possibly because of selection, given that hatcheries release naïve juveniles into the upper river, or because of switching from holding to out-migration behavior. It is therefore important for resource managers to consider that how fish perceive the value of habitat variables can change in response to density-dependent effects and as the fish develop and mature, exhibiting behavioral and physiological plasticity as they undergo smoltification.

In this study, off-channel habitat was inaccessible during all years except 2017, which is likely why we were unable to detect an effect of access to off-channel habitat on survival. Natural-origin winter-run fish, which begin to rear and out-migrate during late fall and winter, when natural flows are more variable, may have better access to ephemeral off-channel habitat (Bellido-Leiva et al. 2021). We detected low survival and slow travel times in a middle section of the river with a large extent of potential off-channel habitat (Figure 1) where bare banks predominated (Figure 3), suggesting a location where juveniles may be responsive to targeted restoration efforts (around reaches 7–12), such as connecting off-channel habitat at lower flow thresholds.

The positive effect of wooded bank habitat on survival throughout the study area suggests that restoration activities that increase cover and bank complexity along the shoreline of the main-stem river could improve foraging and resting habitat (Zajanc et al. 2013). Indeed, vegetation has been shown to have the largest effect on smolt movement rates in the Sacramento River, with fish slowing down in areas having increased cover (Zajanc et al. 2013; McNair 2015). Wooded bank habitat on the Sacramento River has been lost over the past 50 years, primarily due to bank protection projects like the Sacramento Riverbank Protection Project. Since 1961, over 225 km (140 mi) of revetment (riprap) have been constructed on the riverbank, with only 7% of shaded riparian cover remaining in the lower Sacramento River (USFWS 2004). In our study, fish moved quickly through areas with heavy revetment and they exhibited slower movement in areas with wooded habitat. Moving slowly allows the fish time to rest and feed on their journey to sea.

In conclusion, out-migration survival of winter-run juveniles on the Sacramento River was best described by an intra-annual flow model with a mix of time-varying spatial covariates, reach-specific habitat features, and individual effects. Years with higher flow showed a strong association with increased survival, and years with lower flow showed a more positive flow–survival relationship at the reach scale. Wooded bank habitat had a positive association with survival, despite having been replaced by revetment along more than 90% of the riverbank in the Sacramento River. Evidence for instream holding behavior, which is known to be an important life history trait in juvenile winter-run fish, was indicated by slow travel times that appeared to respond to density-dependent habitat availability. Consistent slow travel times were observed in a section of the river between Red Bluff and Colusa, which coincided with the greatest extent of potential off-channel habitat that was connected during the high flows of 2017. Other habitat features did not have a consistent effect on survival across the migration corridor, as they displayed either a positive association with survival in the upper river and a negative association with survival in the lower part of the river or vice versa, indicating a dynamic relationship between the fish's physiological/behavioral developmental characteristics and their environment. With increased variability in drought and flood severity associated with climate change, it will become more important to disentangle the behavioral factors that affect out-migration timing (Munsch et al. 2019) and survival (Johnson et al. 2017), particularly as demands for freshwater put additional pressure on native fishes like Central Valley Chinook Salmon at the southern extent of their range.

ACKNOWLEDGMENTS

Funding for this study was provided by the State and Federal Contractors Water Agency, the Sites Authority, an Ecosystem Restoration Grant from the California Department of Fish and Wildlife, and the U.S. Bureau of Reclamation. J.L.H. was supported by a postdoctoral fellowship provided by the Delta Science Program to initiate the study. We are grateful to many field biologists at the National Oceanic and Atmospheric Administration's Southwest Fisheries Science Center for helping to collect the data upon which our analysis was based. Special thanks to Bob Null, Kevin Niemela, and John Rueth (U.S. Fish and Wildlife Service and Livingston Stone National Fish Hatchery) for tagging and logistical support. All experiments were performed upon approval by the Institutional Animal Care and Use Committee at the University of California at Santa Cruz. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government. There is no conflict of interest declared in this article.

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SUPPORTING INFORMATION

Additional supplemental material may be found online in the Supporting Information section at the end of the article.

IEP Winter-Run Project Work Team Meeting

Friday, June 3, 2022 – 1:00-3:00 pm

Web Meeting Info: Click here to join the meeting

Or call in (audio only): 916- 535-0984 Conference ID: 911 828 878#

1:00 – 1:05 **Welcome**

- i. Introductions – Please introduce yourself in the chat
    1. Name, Title, Affiliation
    2. Brief statement of your interest in or projects related to winter-run Chinook Salmon (optional)
- ii. Modify/Adopt Agenda

1:05 – 2:05 **Updates for the PWT (<5 min each)**

- i. Fish Monitoring Updates
    1. Adults (Doug Killam) Weekly Update File under "Data Access"
    2. Redds and stranding (Doug Killam) Stranding Locations
    3. Juveniles at RBDD (Bill Poytress) Biweekly Reports SacPAS
    4. GCID Fish Passage Monitoring Update (Keith Marine) GCID Fish Study Data
    5. Tagging/Survival Studies (Arnold Amman, Cyril Michel) CalFishTrack
    6. Lower River Juvenile Monitoring Catch Data Access
        - a. Tisdale (Drew Huneycutt)
        - b. Knights Landing(Jeanine Phillips)
        - c. Lower Sacramento River (Rebecca Stark)
    7. Colusa Basin and Wallace Weir (Shig Kubo) Project Info and Data Access
    8. Fremont/Sacramento/Sutter Weir Rescues (Chris McKibbin)
    9. Delta Monitoring (Adam Nanninga) Delta Juvenile Monitoring Website
    10. Ocean Salmon (Kandice Morgenstern, Audrey Dean)
- ii. Habitat/Side Channels (Mike Memeo) Project Information
- iii. Battle Creek Jumpstart (Laurie Earley, Bob Null)
- iv. Upper Sacramento Scheduling Team and Temperature Task Group Updates (???)
- v. Livingston Stone Hatchery Update (Taylor Lipscomb)
    1. BY 2021 release update
    2. BY 2022 actions and planned activities
- vi. Thiamine Monitoring Update (Rachel Johnson, Taylor Lipscomb)
- vii. Genetics Updates (Scott Blankenship, Carlos Garza)
- viii. Drought Actions Updates (Mike Harris?)

2:05 – 2:30 **"Factors affecting spatiotemporal variation in survival of endangered winter-run Chinook Salmon outmigrating from the Sacramento River"** (Journal Article)
Jason Hassrick, PhD, ICF Fish and Aquatics Science Team

2:30 – 2:55 **Iron Mountain Mine Superfund Site**
Lily Tavassoli, U.S. Environmental Protection Agency or Tom Wallis, Jacobs
EPA Superfund Site; Environmental Info (USGS)

2:55 – 3:00 **Final Items, Assignments, and Scheduling for Next Meeting**

Winter-run in the News: SacBee

ADJOURN

Sites Reservoir Project CWA 404/401 Permit Packages: Comments from Integration/Reclamation/Authority Requiring Additional Guidance from EIR/S Team*

**Note that text is generally sourced from the DREIR/DSEIS (December 2021) but figures references are specific to the 404/401 permit applications. Please review comments, revise text (track changes), and provide brief response as needed.*

Section/Topic: Project Description

Corresponding Text and Comment: United States (U.S.) Department of the Interior, Bureau of Reclamation (Reclamation) owns the RBPP, the TC Canal, and Funks Reservoir. GCID owns the GCID Main Canal and GCID's Hamilton City Pumping Plant. The Authority would own and operate all new facilities, except for the TC Canal and Funks Reservoir, which would continue to be operated by the Tehama-Colusa Canal Authority.

Commented [HD1]: New facilities within this permit, not new facilities built for Sites wheeling. Correct?

Commented [WN2R1]: I have no information on this. You'll have to get the Authority to confirm/deny.

Commented [AJ3R1]: JP

Response:

Section/Topic: Project Description

Corresponding Text and Comment: The Project would involve the construction and operation of an offstream surface water reservoir to provide direct and real benefits to instream flows, the Delta ecosystem, and water supply reliability. The reservoir inundation area would be in rural, unincorporated areas of Glenn and Colusa Counties, and other related Project components would be located in Tehama, Glenn, Colusa, and Yolo Counties (Figures 1 through 5 in Appendix A). The Project would use existing infrastructure to divert unregulated and unappropriated flow from the Sacramento River at Red Bluff and Hamilton City and convey the water to a new reservoir west of the community of Maxwell. New and existing facilities would move water into and out of the reservoir, with ultimate release back to the Sacramento River system via existing canals and a new pipeline located near the town of Dunnigan. Water released from Sites Reservoir would be used to benefit local, State, and federal water use needs, including public water agencies, anadromous fish species in the Sacramento River watershed, wildlife refuges and habitats, and the Yolo Bypass to help supply food for delta smelt (*Hypomesus transpacificus*). At the time of submission of this application package there are 23 Storage Partners representing local and regional water delivery agencies that serve over 24.5 million people and over 500,000 acres of farmland. The State of California and Reclamation are also expected to commit to participation considering participating in the Project as Storage Partners.

Commented [SJ4]: Is this in the current EIR/S PD? If so, fine, if not then let's rephrase as it seems a bit wishy-washy

Commented [MJ5R4]: Confirmed not sourced from EIR/S PD. Revised text to more defined commitment, but could also substitute with "Additional Storage Partners could include the State of California and the federal government" or "Additional Storage Partners could include the State of California and Reclamation," which is more consistent with the EIR/S PD.

Response:

A word search was done regarding "considering participating" in Chapter 2, Project Description and Alternatives, and could not find this phrase.

This could be rephrased to acknowledge both Reclamation and the State of California participation in the Project.

Chapter 2, Project Description and Alternatives, of the RDEIR/SDEIS has the following about storage partners: The Storage Partners consist of the governmental agencies, water organizations, and other entities who are funding the Project and who are receiving a storage allocation in Sites Reservoir and the resulting water supply or water supply-related environmental benefits from the Project. Storage Partners could include local agencies, the State of California, and the federal government. https://sitesproject.org/participants/

Section/Topic: TRR

Corresponding Text and Comment: TRR East or TRR West would encompass approximately 100 acres and have a storage capacity of approximately 600 AF. Earthen embankments would be installed along the perimeter of the TRR. The bottom of the reservoir would consist of compacted earth fill graded to the proper elevation. An impermeable lining consisting of a geomembrane would be placed over the compacted earth (Figures TRR-4 and TRR-5). The liner would include a pressure relief valve and appropriately spaced ballasts to mitigate uplifting pressure resulting from fluctuating water table and winds. The TRR would be hydraulically connected to the GCID Main Canal to allow water to be conveyed to and from the Sites Reservoir and constructed via primarily mass excavation. This connection would occur through the I/O canal facilities located adjacent to the GCID Main Canal. The I/O canal would facilitate flow through several check structures into the main and extension reservoirs to the west (Figures TRR-6 and TRR-7). The TRR would accommodate inflows of up to 1,800 cfs. The GCID Main Canal would be the conveyance source of water for the TRR and its PGP to pump water to Sites Reservoir. The canal would also be the primary conveyance for releases of water from the TRR and its PGP from Sites Reservoir.

Response: The TRR is the regulating reservoir that allows water from GCID system into and out of Sites Reservoir. GCID can receive water directly from Sites Reservoir through the use of the TRR if they desire. In other words, some amount of water can go directly to GCID as a result of operating the reservoir. The operational scenario should show some amount of water delivered to GCID as a result of operating the TRR/Sites Reservoir. The commenter is correct that all other storage partners would receive water via conveyance through Funks Reservoir, TCCA Canal, Dunnigan Pipeline and Colusa Basin Drain.

Section/Topic: TRR

Corresponding Text and Comment: The TRR East and TRR West facilities are within a designated Federal Emergency Management Agency (FEMA) Special Flood Hazard Area, Zone A, Without Based Flood Elevation. Site drainage would be conveyed off site to the existing GCID Main Canal or directly into the TRR through shallow swales or overland flow.

Response: This is just identifying that when it rains, water would likely go into GCID Main Canal or the TRR. I don't think there is an assumption associated with this.

Section/Topic: Dunnigan Pipeline

Corresponding Text and Comment: Water from Sites Reservoir would be released into the existing TC Canal via Funks Reservoir facilities and into the GCID Main Canal via the TRR facilities. Approximately 40 miles south of Sites Reservoir in Yolo County, water would be diverted from the TC Canal into a newly constructed 1,000 cfs pipeline (Dunnigan Pipeline) and outlet, which would convey Project flows into

Commented [HD6]: GCID is mainly a wheeler of water TO Sites not very much FROM Sites. It is my understanding that operational scenarios show only GCID water would be delivered from Sites into GCID facilities. This is different that releasing water into the TC for wheeling to others. Please correct me if I have that wrong.

Commented [WN7R6]: You may want to get Authority/Integration operations to confirm the response I drafted (Heydinger, Erin <erin.heydinger@hdrinc.com>)

Commented [HE8R6]: Correct with the exception of a small amount of refuge water. Water being released from Sites into TRR and GCID would be for GCID or wildlife refuges north of the Delta (Sacramento National Wildlife Refuge). Please note that Sites' water right is only for diversion to storage, so water will not be directly delivered to GCID under Sites' water right, but will first go to storage and then be delivered to GCID.

Formatted: Highlight

Commented [HD9]: I'd like to understand this assumption more.

Commented [WN10R9]: You might want to check with Henry Luu of Authority/Integration associated with this.

Commented [AJ11R9]: Henry – please review response and/or provide input

Commented [HD12]: This characterization is confusing to me. My understanding is that TC will be operated to utilize the Dunnigan Pipeline. GCID, to my knowledge is not part of this delivery system.

Commented [AJ13R12]: I think this goes back to Erin's response earlier.... Water being released from Sites into TRR and GCID would be for GCID or wildlife refuges north of the Delta (Sacramento National Wildlife Refuge)

Henry can you review/buy off?

CBD, which drains into the Sacramento River. The proposed Dunnigan Pipeline and related facilities are described in detail below (Figure DP-1).

Response: Water can be released from Sites into the TRR for direct release into the GCID system for GCID use. The TC Canal will be connected to the Dunnigan Pipeline. The first sentence is just saying there are two ways to release water: Funks to TC Canal and TRR to GCID Canal. The 40 miles south is referring to the TC Canal.

Section/Topic: TRR

Corresponding Text and Comment: Pumping from the GCID Main Canal to Sites Reservoir would require construction of the TRR facilities. There would be four primary facilities: the TRR, TRR PGP, an electrical substation, and TRR pipelines. The TRR facilities would be in Colusa County ~~north~~ west of the GCID Main Canal and west of McDermott Road. Aquatic resources would be directly filled to construct the TRR facility embankments and access roads, or excavated to construct the TRR pipelines. A temporary cofferdam would be installed in Funks Reservoir to isolate the TRR pipeline trenching work from the reservoir.

Commented [HD14]: West?

Commented [AJ15R14]: West

Commented [HD16]: On Google Maps there are 2 McDermott Rd which might be confusing. West of GCID and South of Delevan Rd?

Commented [AJ17R16]: South of Lenahan Road if helpful to response.

Response: The location information above is for TRR-East, which is "north" of the canal and "west of McDermott Road and was evaluated as part of Alternatives 1 and 3 in the RDEIR/SDEIS. This text needs to be revised to reflect TRR-West and should read as follows: The TRR would be located in Colusa County west of the GCID Main Canal and east of Funks Reservoir (this text can be found which is in the Alternative 2 discussion in section 2.7.2 TRR West Facilities). TRR-West should be described in the RDEIR/SDEIS, the location should be changed as described above.

Section/Topic: Mitigation Measure VEG-3.2

Corresponding Text and Comment: For unavoidable temporary and permanent impacts on wetlands, the Authority would compensate for the loss by creation or acquisition and permanent protection of suitable wetland habitat to ensure no net loss of wetland habitat functions and values. Compensation would be provided for all permanent impacts and temporary impacts on wetlands that last longer than 1 year, and mitigation would be implemented immediately following temporary impacts and concurrent with or in advance of permanent impacts. Final compensation acreages would be based on the verified aquatic resources delineation and through the CWA Section 404 and 401 permitting process. Mitigation for temporary impacts would occur on site, if feasible. Compensation would also be in compliance with the *Regional Compensatory Mitigation and Monitoring Guidelines for South Pacific Division* (U.S. Army Corps of Engineers 2015). Any permanent impact on wetlands would be mitigated by creating or preserving wetlands at a minimum 1:1 ratio (i.e., 1 acre restored or created for every 1 acre filled), but the final compensation ratios may include additional compensation and would be based on site-specific information and determined through coordination with state and federal agencies (SWRCB, Corps) during permit processing. Where wetland impacts overlap with listed species impacts, mitigation would be coordinated for both resources and would not be duplicated.

Commented [DMD18]: I understand this is proposed as a minimum, but using a 1:1 mitigation ratio to estimate cost will likely result in significant underestimation of cost. I haven't seen any recent 404s with a 1:1 mitigation ratio.

Commented [WN19R18]: Lisa Webber or Harry Oaks?

Commented [MJ20R18]: See responses from Lisa and Harry in text.

Commented [AJ21R18]: Keep it as is and then we negotiate . This is straight from EIR. Discussed with group on 5/24 that we may end up saying" comment noted, etc."

Sites Reservoir Project CWA 404/401 Permit Packages: Comments from Integration/Reclamation/Authority Requiring Additional Guidance from EIR/S Team*

Wetland mitigation would consist of replacement habitat that may be a combination of the following ~~two~~ options, in-lieu fee credits, purchase of mitigation bank credits and permittee-responsible mitigation.

Commented [DMD22]: Does Sites want to consider the use of In-Lieu Fee credits? The mitigation ratio would be higher than 2:1, but the "work" would be done by someone else, Sites wouldn't be responsible for monitoring to ensure success, etc.

Sacramento District California In-Lieu Fee Program | NFWF

eCFR :: 33 CFR Part 332 -- Compensatory Mitigation for Losses of Aquatic Resources

Commented [AJ23R22]: see edits/changes. Reminder to check what is in the EIR/EIS too for consistency .

Response:

Mitigation ratios in the REIR/SEIS are minimum ratios that will be implemented at an equivalent or greater requirement. As stated in this measure, the final ratio will be determined in coordination with state and federal agencies. The Authority is coordinating regulatory agencies regarding permitting conditions, terms, requirements, and mitigation and will continue to coordinate with regulatory agencies to obtain the permits required to construct and operate the project. Mitigation ratios required under the permits may differ from the CEQA/NEPA minimum mitigation ratios and could stay at the minimum or increase, depending on the final project design and permitting requirements.

Offsite compensatory wetland mitigation for the Project may include the purchase of agency-approved mitigation/conservation bank credits, the establishment of third party-responsible "turn-key" mitigation/conservation bank projects, preservation of biological resources through conservation easements with private landowners, payments to in-lieu fee programs, or the establishment of Authority (permittee)-responsible offsite mitigation sites.

Section/Topic: Mitigation Measure VEG-3.3

Corresponding Text and Comment: For unavoidable temporary and permanently affected streams and ponds, the Authority would compensate for the loss by creation or acquisition and permanent protection of suitable open-water habitat to ensure no net loss of stream or pond habitat functions and values. Compensation would be provided for all permanent impacts and temporary impacts on non-wetland waters that last longer than 1 year, and mitigation would be implemented immediately following temporary impacts and concurrent with or in advance of permanent impacts. Final compensation acreages would be based on the verified aquatic resources delineation and through the CWA Section 404 and 401 permitting process. Mitigation for temporary impacts would occur on site, if feasible. Compensation would also be in compliance with the *Regional Compensatory Mitigation and Monitoring Guidelines for South Pacific Division* (U.S. Army Corps of Engineers 2015). Any permanent effect on open-water habitat would be mitigated by creating or preserving habitat at a 1:1 ratio (i.e., 1 acre restored or created for every 1 acre filled), or by an equivalent or greater requirement as determined through coordination with state and federal agencies (SWRCB, Corps) during permit processing. Compensation would be provided for all permanent impacts and temporary impacts on non-wetland waters that last longer than 1 year, and mitigation would be implemented concurrent with or in advance of construction-related impacts. Final compensation acreages would be based on the verified aquatic resources delineation and through the CWA Section 404 and 401 permitting process. Where stream or pond impacts overlap with listed species impacts, mitigation would be coordinated for both resources and not be duplicated.

Commented [DMD24]: We will have to account for all wetland and species impacts and then mitigate at the ratios required by the resource agencies. Is the intent of this language to say that to the extent feasible, we will "stack" our credits? If so, I think this is fine. If we purchase wetlands credits that are also valid mitigation for listed species for which we also have mitigation requirements, then we can document that and provide it to the agencies requiring mitigation.

Commented [AJ25R24]: Potentially a commented noted scenario

Response:

Yes, the intent of the language is to say that credits for the same impact location that is both an aquatic feature and an area of listed species habitat will count toward both the loss of aquatic resource and loss of listed species habitat.

The draft mitigation plan also states that mitigation credit bundling approach will be used. Mitigation credit bundling is the process through which a mitigation project provides different credit types for multiple resources for the same spatially overlapped unit of land. The Authority proposes to employee credit bundling where possible to maximize the credit potential per unit area (acre) where habitat and species mitigation goals overlap. Offsite mitigation areas will look to maximize the habitat value for multiple species to provide opportunities for credit bundling.

Section/Topic: Mitigation Type

Corresponding Text and Comment: Vernal Pool

Commented [SK26]: Are we leaving this blank until we know for sure whether we are impacting vernal pools or are we certain we can avoid? Not sure where we left off with vernal pool assessment.

Commented [AJ27R26]: See responses.

Response (Lisa Webber): The disconnect is that seasonal wetland is used in the current land cover mapping, and therefore the EIR/S mitigation, to also encompass vernal pool and alkali seasonal wetland, which couldn't be distinguished from the aerial photo interpretation mapping we have. It's likely we will find the three separate types (seasonal wetland, vernal pool, alkali seasonal wetland) when we do the on-the-ground surveys and then refine the map. Does the draft permit app need to make this distinction, or can it wait until the final version?

Section/Topic: Federal and State Permits, Approvals, Reviews, and Consultation Requirements

Corresponding Text and Comment: Prepare the Supplemental Draft EIS, Final EIS and issue the ROD as the NEPA lead agency within the Department of the Interior. Reclamation will also be responsible for compliance with the following laws, regulations, and executive orders, as applicable: Federal Water Pollution Control Act (CWA), Sections 303, 401, 402, and 404; Rivers and Harbors Act, Sections 9, 10, 14, and 408; Federal Safe Drinking Water Act; Wild and Scenic Rivers Act; Fish and Wildlife Coordination Act; Marine Mammal Protection Act; Migratory Bird Treaty Act; Federal Clean Air Act; National Historic Preservation Act of 1966, Sections 106 and 110; American Indian Religious Freedom Act; Native American Graves Protection and Repatriation Act; Executive Order 13186 (protection of migratory birds); Executive Order 11990 (protection of wetlands); Executive Order 12898 (environmental justice); Executive Order 11988 (floodplain management); Executive Order 13007 (protection of Indian Sacred Sites on federal land). Farmland Protection Policy Act.

Commented [DMD28]: Was this discussed in the sup draft? If not, we should add a line about this in the final.

Commented [MJ29R28]: John/Jelica - I am coordinating with our EIR/S bio leads to address this comment as well as the comments "Same" below. However, your feedback would be helpful.

Commented [SJ30R28]: It's in the REIR

Commented [DMD31]: Same.

Commented [SJ32R31]: Chapter 4

Commented [DMD33]: Same.

Commented [DMD34]: Same.

Commented [DMD35]: Same.

Commented [DMD36]: Same.

Response:

Section/Topic: State and federal listed species with potential to occur in the project area (401 Supplemental Pages, Table 11); i.e., ESA Section 7 coverage for all federally-listed species

Corresponding Text and Comment: Federal Biological Assessment

Commented [DMD37]: For terrestrial species this is fine, for aquatic species, my understanding is that this issue is not resolved.

Response:

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/24/2022 5:04:13 PM
To: maven@mavensnotebook.com
CC: 'Sarah Rossetto' [srossetto@katzandassociates.com]
Subject: RE: Sites Project Document
Attachments: Proposed Location_Sites Main Reservoir.jpg; Sites Valley Aerial.PNG; Proposed Location_Sites Dam.jpg

Absolutely! Attached are a few pictures for your use. We've tried to label the files as to what they are in case anyone asks.

And thanks again for making the change today on the document description. Much appreciated!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: maven@mavensnotebook.com <maven@mavensnotebook.com>
Sent: Tuesday, May 24, 2022 10:02 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: 'Sarah Rossetto' <srossetto@katzandassociates.com>
Subject: RE: Sites Project Document

Hi Alicia,

No problem. I probably should have looked a bit closer myself. In slower times, I probably would have, but the volume of drought stuff is just overwhelming.

Do you have a picture or two of the site that I could use when stories come up?

Regards,
Chris

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, May 24, 2022 9:56 AM
To: maven@mavensnotebook.com
Cc: Sarah Rossetto <srossetto@katzandassociates.com>
Subject: RE: Sites Project Document

Chris – Thank you again for your willingness to update the text. Below is revised text. We're just trying to make it clear that the EA/IS is for geotechnical activities – not for the whole project.

Please let me know if you have any questions or concerns. And thanks again!

Ali

The Bureau of Reclamation (Reclamation), as the Lead Agency pursuant to the National Environmental Policy Act (NEPA) and the Sites Project Authority (Authority), as the Lead Agency pursuant to the California Environmental Quality Act (CEQA) have prepared an Environmental Assessment/Initial Study (EA/IS) for the 2022-2024 Sites Reservoir Geologic, Geophysical, and Geotechnical Investigations.

Reclamation and the Authority are proposing to conduct geologic, geophysical, and geotechnical investigations in Glenn, Colusa, and Yolo Counties. The purpose of the activity is to conduct field investigations and surveys to obtain data and information needed to formulate and refine the engineering design and to assist in the preparation of permit applications for the proposed Sites Reservoir and associated facilities in western Sacramento Valley. The investigations include up to 70 pavement cores, 258 augers and borings, and 33 cone penetration tests at varying depths. In addition, approximately 70 piezometers would be installed at select auger or boring locations. Non-invasive geophysical surveys would occur at each investigation location. Non-invasive geologic surveys would also occur at various locations in the proposed Project Area.

A Proposed Mitigated Negative Declaration for the investigations is also available on the Sites Project Authority's website at sitesproject.org/environmental-review.

Public comment period extends through June 21, 2022.

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: maven@mavensnotebook.com <maven@mavensnotebook.com>
Sent: Tuesday, May 24, 2022 9:32 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: RE: Sites Project Document

Hi Alicia,

Certainly. I just pulled the paragraph from the page. Please feel free to suggest what should be there.

Regards,
Chris

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Tuesday, May 24, 2022 9:30 AM
To: Maven <maven@mavensnotebook.com>
Cc: Sarah Rossetto <srossetto@katzandassociates.com>
Subject: Sites Project Document

Hi Chris – Thanks for always helping us get the word out on the Sites Reservoir Project. I clicked on the link below and the description isn't really accurate and I am concerned that it might be really confusing for some folks. The description is for the overall Project – but the EA/IS is only for geotechnical activities.

NOW AVAILABLE: Draft EA-IS for Sites Reservoir now available for public comment – MAVEN'S NOTEBOOK | Water news (mavensnotebook.com)

Is there a way I can work with you to update the description?

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 |
aforsythe@sitesproject.org | www.SitesProject.org

From: Maven <maven@mavensnotebook.com>
Sent: Tuesday, May 24, 2022 9:05 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Subject: Newsom urges aggressive conservation; CA Senate proposes $2B program to balance water supply, water rights; Tracking water storage for Sierra Nevada

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- Tracking water storage for Sierra Nevada and Upper Colorado River Basins
- Reclamation announces public meeting regarding the 2021 Reinitiation of Consultation on the Long-Term Operation of the Central Valley Project and State Water Project
- Garamendi secures wins for Bay Area and Delta Infrastructure in Water Resources Development Act of 2022
- Full quantification of water rights not required for CEQA review, Second District declares
- Listen: The conservation case for emergency rules on groundwater in the Scott and Shasta basins
- Restoring Shasta River tributary to benefit wild salmon
- Sustaining steelhead populations in the Bay Area's backyard
- A water-stressed valley needs to curb development
- SoCal needs to keep vital trees alive despite unprecedented watering restrictions
- San Diego pays a lot for abundant water. Tijuana pays a different price for water scarcity.
- Dam of questions breaks around hydropower plan for one-of-a-kind canyon in western Colorado
- And more ...

Click here to read today's Daily Digest.

Also on Maven's Notebook today:

- **NOW AVAILABLE:** Draft EA-IS for Sites Reservoir now available for public comment
- **NOTICE** of Petition for Temporary Transfer/Exchange per Various Department of Water Resources and U.S. Bureau of Reclamation License and Permits
- **NOTICE:** Petitions for Temporary Transfer of Water under South Feather Water & Power Agency Permits 1267 and 2492

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Our mailing address is:
Maven's Notebook
P. O. Box 2342
Canyon Country, CA 91386

From: Alicia Forsythe [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=A6CDF06A7E904B65BAA21702A82AD329-AFORSYTHE]
Sent: 5/26/2022 7:59:59 AM
To: Arsenijevic, Jelica [Jelica.Arsenijevic@hdrinc.com]
CC: Kevin Spesert [kspesert@sitesproject.org]
Subject: RE: Sites - Discussion with Laverne Bill Today

Thanks Jelica. I did give them a general heads up on test pits and trenching. I didn't go into too much detail as I think we need to work with them more on this as these are more likely to uncover unknown resources. So I can see the tribe being more concerned with these.

I haven't had a chance to look at the potential scope issues for test pits for them. Can you schedule some time with Kevin and I to talk about scope amendments for Yocha Dehe for test pits. This can happen in late June. I don't think we want to broach changing their scope until we can talk more about the activity with them.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Sent: Tuesday, May 24, 2022 9:34 AM
To: Alicia Forsythe <aforsythe@sitesproject.org>
Cc: Kevin Spesert <kspesert@sitesproject.org>
Subject: RE: Sites - Discussion with Laverne Bill Today

Hi Ali
Apologies for late response.

Fantastic news from Laverne – we certainly enjoyed working with the monitors. Not sure if I shared, but ICF cultural folks had an existing relationship with one of the monitors – there was definite trust in our team due to ICF from the beginning!

Thanks for giving them a heads up for future work. I have met Eric as he was the tribal representative during the pre-siting survey for the TRR early evaluation work. We don't have a schedule yet for Priority 1 but I can certainly bring Eric up to speed.

As far as test pits/trenching, were they given a heads up on this effort? I sent email back regarding a need to amend our existing contract with them as its specific to TRR early evaluation work and Priority 1 (minus test pits/trenching activities).

Thanks again or heads up.

Jelica Arsenijevic
Environmental Project Manager

Due to COVID-19, I will be working from home. Please contact me via cell # listed below. Be safe out there!

HDR
2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, May 19, 2022 4:05 PM
To: Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>
Cc: Kevin Spesert <kspesert@sitesproject.org>
Subject: Sites - Discussion with Laverne Bill Today

Hi Jelica – We had our monthly meeting with Laverne Bill today from the Yocha Dehe tribe. I said we appreciated his team out there on the monitoring earlier this year. I asked if they had any suggestions for improvements and he thought the effort went really well. I mentioned the upcoming work – targeted to start around the August timeframe. He suggested that we work with Eric and Saguaro (spelling?) on his team to start to get things on the calendar. Are these folks that you know/have been coordinating with? Just thought I would share this discussion.

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 |
aforsythe@sitesproject.org | www.SitesProject.org

From: Laurie Warner Herson [laurie.warner.herson@phenixenv.com]
Sent: 5/26/2022 12:40:27 PM
To: Arsenijevic, Jelica [jelica.arsenijevic@hdrinc.com]
CC: Spranza, John [john.spranza@hdrinc.com]; Alicia Forsythe [aforsythe@sitesproject.org]; Risse, Danielle [Danielle.Risse@hdrinc.com]; Marcia Kivett [MKivett@sitesproject.org]
Subject: Re: Sites - Environmental Planning / Permitting Schedule to Construction

I'm good for the 20th

Sent from my iPhone

On May 26, 2022, at 12:25 PM, Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com> wrote:

Schedule is clear…the 11AM I am not required to go to ☺

Jelica Arsenijevic
Environmental Project Manager

Due to COVID-19, I will be working from home. Please contact me via cell # listed below. Be safe out there!

2379 Gateway Oaks Drive, Suite 200
Sacramento, CA 95833
D 916-679-8854
M 209-329-6897

Jelica.Arsenijevic@hdrinc.com

hdrinc.com/follow-us

From: Spranza, John <John.Spranza@hdrinc.com>
Sent: Thursday, May 26, 2022 12:19 PM
To: Alicia Forsythe <aforsythe@sitesproject.org>; Laurie Warner Herson <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <jelica.arsenijevic@hdrinc.com>; Risse, Danielle <danielle.risse@hdrinc.com>; Marcia Kivett <MKivett@sitesproject.org>
Subject: RE: Sites - Environmental Planning / Permitting Schedule to Construction

Schedule on Monday 6/20 is clear.

John Spranza

D 916.679.8858 M 818.640.2487

From: Alicia Forsythe <aforsythe@sitesproject.org>
Sent: Thursday, May 26, 2022 12:08 PM
To: Laurie Warner Herson <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>; Risse, Danielle <Danielle.Risse@hdrinc.com>; Marcia Kivett <MKivett@sitesproject.org>
Subject: RE: Sites - Environmental Planning / Permitting Schedule to Construction

Hi all – Based on the engineering scheduling efforts, I think we should try to get together on 6/20 or 6/24. Can you let Marcia know if you can generally clear your schedule on 6/20 after the agenda meeting (11 AM meeting)?

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

From: Alicia Forsythe
Sent: Thursday, May 26, 2022 9:59 AM
To: Laurie Warner Herson <laurie.warner.herson@phenixenv.com>; Arsenijevic, Jelica <Jelica.Arsenijevic@hdrinc.com>; Spranza, John <john.spranza@hdrinc.com>; Risse, Danielle <Danielle.Risse@hdrinc.com>
Subject: Sites - Environmental Planning / Permitting Schedule to Construction

Hi Team – I would like to schedule an all day workshop with the environmental group to chat about the steps to get us into construction. I'd like to do this by construction package. I think by mid to late June, the engineering team will have a good sense of the construction packages.

Laurie – prior to this meeting, can you pull together our list of EIR/EIS mitigation measures and commitments and then group/prioritize them in a way that identifies those that relate to construction and those that don't. For those that do relate to construction, then group/prioritize them by prior to/during/after construction? Something that helps us look at each of these and think quickly about timing as they relate to construction.

John and Jelica – Similar for our ESA/CESA/404/401 permits as above. Once we get a sense of the packages from Henry, I'd like to also have you all identify the ESA/CESA species and acres of wetlands in each package footprint. Please incorporate in the Bio requirements from the EIR/EIS also, but I think the focus should be more on the ESA/CESA species as there are follow on requirements (reconsultation, mitigation in place, etc) for these species.

Danielle – Similar for cultural. We'll need to make some assumptions on timelines and potential magnitude of efforts by package. So once we have the packages, if you could look at the cultural data to identify the number/magnitude of resources potentially affected, that would be helpful.

I will ask Marcia to schedule this. I realize that we will need input from Henry and Conner also, but I'd like for us to outline our key drivers first and then engage them.

Please feel free to invite others that should attend, but I would like to keep this meeting focused so we can get a rough framework and we can start to refine it from there.

Super excite for this and I think its time we start to frame this up!

Ali

Alicia Forsythe | Environmental Planning and Permitting Manager | Sites Project Authority | 916.880.0676 | aforsythe@sitesproject.org | www.SitesProject.org

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From: JP Robinette [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=F4D19AE1EBE142FBB3C5EF37126CEBC8-JROBINETTE]
Sent: 5/26/2022 1:51:59 PM
To: Luu, Henry [henry.luu@hdrinc.com]
CC: Cheyanne Harris [charris@brwncald.com]
Subject: Facilities Use Agreements - Internal Engineering Analysis Needed

Hi Henry,

There are a few items related to facilities use agreements that I need your help with. I have captured them below with rough timelines, but we can discuss the details:

1. We need to understand if it is possible for TCCA to take on the dredging of funks and understand our options for constructability. If possible, it would be best to have them, as the owner/operator, take on this effort. Can you please look into this and let me know any potential issues with them taking this on (i.e. cost of implementing an alternative approach to the coffer dam). I need to know this in 2 weeks and would like to see a <1 page summary of the analysis (internal memo).
2. What percentage of the TC conveyance capacity (pump station and canals) are we using during diversions? Same question for GCID? There have been questions on the availability of capacity for other future winter diversion projects, such as recharge projects, and the relative priority and capacity usage of Sites. I need to know this in the next 3 weeks, and would like a <1 page summary of the analysis (internal memo).
3.
4. We need to provide a very simple report on the water surface elevations along the Knights Landing Ridge Cut from the Colusa Basin Drain down to the Wallace Weir during our diversions. I need this to speak to landowners along the drain who are concerned with seepage in wet times and access to water in dry times, so the numbers need to be by month or similar (internal document). Please let me know what a reasonable timeline is on this, as I do recall there were some missing pieces of information for this analysis.

It strikes me that we may need to get on the phone with Pete soon to get some of this going and discuss that these are all internal analysis that will feed into our strategy on agreements and permitting, and possibly related to negoations.

Thanks,

JP Robinette, P.E.
Engineering and Construction Manager | Sites Reservoir Project
801-819-4306
www.sitesproject.org

From: JP Robinette [jrobinette@sitesproject.org]
Sent: 5/26/2022 1:53:27 PM
To: Jerry Brown [jbrown@sitesproject.org]; Alicia Forsythe [aforsythe@sitesproject.org]; Kevin Spesert [kspesert@sitesproject.org]
Subject: Fw: Facilities Use Agreements - Internal Engineering Analysis Needed

FYI, these have all come up in the past two weeks or so on the facilities use agreements.

JP

From: JP Robinette
Sent: Thursday, May 26, 2022 1:51 PM
To: Luu, Henry <henry.luu@hdrinc.com>
Cc: Cheyanne Harris <charris@brwncald.com>
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From: JP Robinette [jrobinette@sitesproject.org]
Sent: 5/26/2022 1:54:42 PM
To: Luu, Henry [henry.luu@hdrinc.com]
CC: Cheyanne Harris [charris@brwncald.com]
Subject: Re: Facilities Use Agreements - Internal Engineering Analysis Needed

As you probably would catch, item 3 should say "releases" rather than diversions. Fixed below.

JP

From: JP Robinette
Sent: Thursday, May 26, 2022 1:51 PM
To: Luu, Henry <henry.luu@hdrinc.com>
Cc: Cheyanne Harris <charris@brwncald.com>
Subject: Facilities Use Agreements - Internal Engineering Analysis Needed

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Bi-Weekly Sites-USBR Coordination Draft Agenda

Affordable Water, Sustainably Managed

Our Core Values – Safety, Trust and Integrity, Respect for Local Communities, Environmental Stewardship, Shared Responsibility and Shared Benefits, Accountability and Transparency, Proactive Innovation, Diversity and Inclusivity
Our Commitment – To live up to these values in everything we do

Meeting Participants:

Date: May 31, 2022 **Location:** Join Microsoft Teams Meeting

Start Time: 3:00 p.m. **Finish Time:** 4:00 p.m.

Purpose: Coordinate activities related to planning and permitting of the Sites Reservoir Project. This is a standing bi-weekly meeting.

Meeting Participants:

Jerry Brown, Sites	Henry Luu, Sites	Erin Heydinger, Sites	John Spranza, Sites
Ali Forsythe, Sites	Vanessa King, Bureau	Laurie Warner Herson, Sites	Michael Mosley, Bureau
Richard Welsh, Bureau	Gregory Mongano, Bureau	Jobaid Kabir, Bureau	Melissa Dekar, Bureau
Don Bader, Bureau	Darryl Good, Bureau	Stacey Leigh, Bureau	Susanne Manugian, Bureau
Natalie Taylor, Bureau	Levi Johnson, Bureau	Mark Carper, Bureau	Austin Olah, Bureau
Mark Morberg, Bureau	Luke Davis, Bureau	Shane Hunt, Bureau	Kevin Jacobs, Bureau

Discussion Topic	Topic Leader	Time
1. Introductions	All	
2. Follow-up on action items from the last meeting: a. None		1 min
3. EIR/EIS, Permitting, Operations		20 min
4. Financial Assistance		20 min
5. Other Activities		10 min
6. Review of Action Items		As time allows

Bi-Weekly Sites-USBR Coordination Draft Agenda

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Public Benefit Contracts – Refined Concepts for Common Terms as proposed by the Prop 1 Project Applicants
April 29, 2022

The Prop 1 applicants are discussing proposing common public benefit contract terms to be applied consistently across all Prop 1 projects. Concepts for discussion with CDFW are shown here in bold/italics within the applicable sections of the public benefit contract outline provided by CDFW via May 18, 2021 email to all Prop 1 applicants.

1. Recitals.
2. Definitions (consistent with § 6001 where appropriate).

(Note to Reviewers: There may terms that we wish to have defined consistently across all projects beyond those identified in the Regulations, Section 6001. For example, it may be useful to have consistent definitions for beneficiary pays, Project Operator, Project Operations Plan, etc)

3. Authority (Cal. Water Code § 79755(a)(3); Cal. Code of Regs., Title 23 (§ 6014(a)(2)).
4. Term.
5. Description of public benefit(s) (§ 6014(a)(2)(A)(2)).
    i. Identification of ecosystem improvements (§ 6001(a)(28)).

> *"Ecosystem improvements" means a public benefit that includes changing the timing of water diversions, improvement in flow conditions, temperature, or other public benefits that contribute to the restoration of aquatic ecosystems and native fish and wildlife, including those ecosystems and fish and wildlife in the Delta, per Water Code section 79753(a)(1). Ecosystems include both aquatic and terrestrial habitats and natural communities."*

Concept for discussion:

- ***The project is obligated to contribute to ecosystem improvement through physical actions (changing the timing of water diversions, improvement in flow conditions, temperature, or other public benefits). Many other factors, beyond the control or influence of the project, will determine the effectiveness of the contribution in restoring aquatic ecosystems and native fish and wildlife. While the project must deliver measurable physical actions, it is not reasonable to expect those physical actions to have any specific biological outcome or measurable effect on populations of native fish and wildlife. For example, a project may be responsible for the delivery of Incremental Level 4 Refuge water but cannot be ultimately responsible for ensuring an increase in use of the refuge/wetland area by waterfowl with ensuing improvements in waterfowl populations.***

   ii. Description of physical and biological benefit provided. (i.e., quantity, duration, timing etc., of ecosystem benefit, consistent with CDFW finding from application process).

Concept for discussion:

- ***Similar to above, the description of physical and biological benefit provided would consist of a description of the physical actions and expected biological benefit from the Project relative to baseline conditons, but would not include an obligation for the Project to provide specific biological outcomes or effect on populations of native fish and wildlife. In the same Incremental Level 4 Refuge water example, as an example for this section, the description would likely include a description of quantity or water (acre-feet), timing of deliveries (months of the year), and expected biological benefit relative to baseline conditions, but not a projection of ultimate biological outcomes or effects on populations of waterfowl.***

6. Quantification and finding of net public benefit.

   "The net public and non-public physical benefits shall be calculated using the physical, chemical, or biological change in each benefit resource condition that is created by or caused by the proposed project, less any negative impacts of similar physical units, location, and timing, created or caused by the proposed project as compared to the without-project conditions at the same reference point (i.e., 2030 future conditions, 2070 future conditions)." (§ 6004(a)).

   "The project applicant has entered into a contract pursuant to Water Code section 79755(a)(3) with CDFW, State Water Board, and the Department [of Water Resources], which administer public benefits of the project after the individual agency makes a finding that the public benefits of the project meet all of the requirements of Water Code sections 79750 et seq." (§ 6013(c)(2)).

7. Implementation of public benefit (e.g., operation agreements, conveyance agreements, and/or discussion of processes needed for benefit to occur).

Concepts for Discussion:

- ***The delivery of public benefits should not have a greater or lesser certainty than the delivery of non-public benefits. The certainty and priority of delivery of public benefits should be "on par" with the non-public benefits. Individual projects may voluntarily choose to provide a greater certainty for their specific Project, but this would be on a project-specific basis.***
- ***The delivery of public benefits has a number of risks that are beyond the control of the Project and there should be provisions to address the risks. These include such things as physical risks (i.e., delivery facility failures), regulatory risks (i.e., future BiOps, water right permit changes, ITPs make realizing or delivering the benefits infeasible), acts of god, and political risks (i.e., war, legislation changes).***

Reporting.

   i. Between CDFW and the project (§6014(a)(2)(A)(3)).
   ii. To CWC (§6014(a)(2)(A)(4)).

Concepts for Discussion:

- ***Reporting requirements for public benefits should be coordinated and consistent with the reporting requirements of non-public benefits.***

8. Adaptive Management Plan (§ 6014(a)(2)(A)(1)).
    - i. Public benefit monitoring metrics.
    - ii. Monitoring locations, frequency, and timing.
    - iii. Metric evaluation methodology and associated threshold or trigger levels based on best available science that initiate adaptive management actions.
    - iv. Decision making process including the administering agency role and the adaptive management actions that would be taken when a trigger is reached.
    - v. Funding sources and financial commitments to implement the adaptive management plan.
    - vi. Other items deemed necessary on a case-by-case basis by CDFW.

Concepts for Discussion:

- ***The adaptive management obligation of the project should be limited to modifying the physical actions provided by the project to improve biological outcomes. These modifications should be undertaken in consultation with CDFW and other project partners, in consideration of comprehensive monitoring of aquatic ecosystems and native fish and wildlife conducted by CDFW and/or utilizing existing monitoring to the extent possible.***
- ***Adaptive management obligations shall be limited to entities that have decision-making authority over actions, such as pulse flow releases from Lake Oroville. Pulse flow releases will be managed by CDFW and DWR, and so any adaptive management actions related to pulse flows should be undertaken by CDFW and DWR, and not the project proponent.***
- ***The adaptive management actions should not infringe on the ability or inhibit the ability of the Project to deliver non-public benefits or have any adverse impact on other project partners (e.g., SWP or CVP).***

9. Assurances regarding how the project will be operated, maintained, repaired, replaced and rehabilitated to achieve public benefit over the life of the contract (§6014(a)(2)(A)(5)).

Concept for Discussion:

- ***The term of the agreement should be specified.***
- ***Any assurances that funding sources will be provided to cover identified OM&R costs required to deliver public benefits.***

10. Right of entry (§ 6014(a)(2)(A)(6)).
11. Failure to comply with contract agreement (§ 6014(a)(2)(A)(7)).
12. Effect of contract agreement (§ 6014(a)(2)).
13. Breach of contract.
14. General terms and conditions.
15. Force majeure.
16. Process for amending or modifying contract.

Concept for Discussion for items 11 through 17:

- ***The State should have similar rights and obligations in these areas to the non-public beneficiaries.***

Additional Concepts for Discussion:

- ***There needs to be a common understanding with CDFW about what happens during non-routine and emergency conditions. Here's a couple of examples to discuss:***

a. Governor declared local, regional, or statewide emergency conditions
b. During times Project facilities are inoperable or have limited operating capacity due to circumstances beyond the Project operator's control

From: Marcia Kivett [MKivett@sitesproject.org]
Sent: 5/31/2022 8:41:20 AM
To: Jerry Brown [jbrown@sitesproject.org]
Subject: Fw: Sites - "Net" Salmon Effects
Attachments: Diversion Criteria Chronology_2022-0520[2].pdf; Sites2022SALMOD-04212022[1][3].pdf

I'm not sure if you have received a response to your request.

From: Jerry Brown <jbrown@sitesproject.org>
Sent: Friday, May 20, 2022 2:46 PM
To: Kevin Spesert <kspesert@sitesproject.org>; Sara M. Katz <skatz@katzandassociates.com>
Cc: Alicia Forsythe <aforsythe@sitesproject.org>; Heydinger, Erin <erin.heydinger@hdrinc.com>; Marcia Kivett <MKivett@sitesproject.org>
Subject: Sites - "Net" Salmon Effects

We still have an outstanding action item from the April Board meetings to create a communication piece that demonstrates the significant environmental "net" benefit improvement in the project since 2017. This would be specific to flows in the river for salmon. I think we've accumulated the technical information needed to support this piece as follows:

1. The attached table is a chronology of the progress since 2017 to improve and enhance the protections for aquatic species in the Sac River and Delta. The current conditions are expected to achieve a "no harm" condition for all of the Sites diversions from the river. The numbers won't mean much to most people but the level of protection is significantly improved and a "no harm" level of protection is huge.
2. Updated reductions in salmon mortality from exchange operations under Alt 3 (see attached table). With the increased flexibility in the exchange criteria, we've got significant salmon mortality improvement. This is not so much about comparing to 2017 as it is to show that what we're doing is to help the salmon with the reservoir in the months that they need it most. Erin/Ali might have other graphics to further illustrate this point. The Board commented to these tables that reduced mortality, while good, is confusing.
3. Sites takes water from the river (in a protective manner) in the periods when salmon need it least. Sites reserves this water and gives it back to the river and the salmon when help is needed most. This is smart storage. Sites works conjunctively within our developed system to create adaptation. This is exactly what PPIC and other experts recommend we need to be doing. Shasta was audacious, brute force, hubristic. Sites is humble, simple, attuned to the times, a friend to the salmon. Sites is judo and Shasta is karate.

Now we need to take this information (probably not #3) from technical to layman and make a clear and convincing rebuttal to "sites creates a net harm to salmon". Maybe we do this with another FAQ, maybe we create its own one pager.

Please come up with your best shot at something we can share with the public on this topic. Need a 1st draft by end of the month.

Thanks