Long-Term Operation – Draft Environmental Impact Statement

Appendix E – Draft Alternatives

July 2024

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Acronyms and Abbreviations

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ALPS-IP	Alternative Loss Pilot Study Implementation Plan
ARG	American River Group
ATSP	Automated Temperature Selection Procedure
Banks Pumping Plant	Harvey O. Banks Pumping Plant
BSPP	Barker Slough Pumping Plant
CCR	Sacramento River above Clear Creek gage
CCTT	Clear Creek Technical Team
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
Cfs	cubic feet per second
CLC	Clifton Court Forebay
COA	Coordinated Operation Agreement
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
D-	Decision
DCG	Delta Coordination Group
Delta	Sacramento–San Joaquin Delta
DMW	Delta Monitoring Workgroup
DO	Dissolved Oxygen
DRY	Drought Relief Year

DWR	California Department of Water Resources
EIS	environmental impact statement
EOA	end-of-April
EOD	end-of-December
EOS	end-of-September
ESA	Endangered Species Act
FCCL	Fish Conservation and Culture Laboratory
FNU	Formazin Nephelometric Units
FPT	Sacramento River at Freeport
FWOC	Fish and Water Operations Call
HOL	Holland Cut
Jones Pumping Plant	C. W. “Bill” Jones Pumping Plant
JPE	juvenile production estimate
Km	kilometers
LAR	Lower American River
M&I	Municipal and Industrial
MAF	million acre-feet
Mm	millimeters
MOU	Memorandum of Understanding
MRR	minimum release requirement
NBA	North Bay Aqueduct
NFH	National Fish Hatchery
NGO	nongovernmental organization
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Unit

OBI	Old River at Bacon Island
OH4	Old River at Highway 4
OMR	Old and Middle River
Ppt	parts per thousand
QWEST	net flow at Jersey Point
Reclamation	Bureau of Reclamation
RRDS	Roaring River Distribution System
SaMT	Salmon Monitoring Team
SFHA	Delta Smelt Summer and Fall Habitat Action
Shasta Management Plan	Plan for Shasta Reservoir Management
SHOT	Shasta Operations Team
Skinner Fish Facility	John E. Skinner Delta Fish Protective Facility
SMPA	Suisun Marsh Preservation Agreement
SMSCG	Suisun Marsh Salinity Control Gates
SMT	Smelt Monitoring Team
SRF	Stanislaus River Forum
SR-JPE	spring-run Chinook salmon juvenile production estimate
SR-LCM	spring-run Chinook salmon lifecycle model
SRP	Stepped Release Plan
SRS	Sacramento River Settlement
SRTTG	Sacramento River Temperature Task Group
SVI	Sacramento Valley Index
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TAF	thousand acre-feet

TCD	Temperature Control Device
TMP	Temperature Management Plan
Tracy Fish Facility	Tracy Fish Collection Facility
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USST	Upper Sacramento River Scheduling Team
VA	voluntary agreement
WIIN	Water Infrastructure Improvement for the Nation
WOMT	Water Operations Management Team
WRO	Water Rights Order

Appendix E Draft Alternatives

E.1 Introduction

The Bureau of Reclamation (Reclamation) formulated draft alternatives for the proposed Long-Term Operation of the Central Valley Project (CVP) and State Water Project (SWP) through the National Environmental Policy Act scoping process, coordination with public water agencies pursuant to the Water Infrastructure Improvement for the Nation (WIIN) Act, interagency coordination teams, outreach to interested parties, and Reclamation's decades of experience in operating the CVP. A Notice of Intent (87 Federal Register 11093–11095), published February 28, 2022, sought public comments. Reclamation requested comments by mail and by email and held 6 virtual public meetings identified geographically, but each open to virtual attendance by anyone:

1. Tuesday, March 8, 2022, 2 p.m. to 4 p.m., Sacramento, CA, virtual meeting.
2. Wednesday, March 9, 2022, 5:30 p.m. to 7:30 p.m., Red Bluff, CA, virtual meeting.
3. Thursday, March 10, 2022, 2 p.m. to 4 p.m., Fresno, CA, virtual meeting.
4. Tuesday, March 15, 2022, 5:306 p.m. to 7:30 p.m., Los Banos, CA, virtual meeting.
5. Wednesday, March 16, 2022, 2 p.m. to 4 p.m., Tracy, CA, virtual meeting.
6. Thursday, March 17, 2022, 2 p.m. to 4 p.m., Chico, CA, virtual meeting.

The subsequent scoping report includes the public comments received from the Notice of Intent and during scoping meetings (Bureau of Reclamation 2022a). Reclamation received 47 letters, emails, and verbal comments during the scoping period. Interest groups that provided comments included public water management agencies, tribes, local governments, farmers and producers, conservation organizations, commercial water developers, federal agencies, private citizens, and nongovernmental organizations (NGOs). An initial disposition of scoping comments related to alternatives and to the analysis of alternatives are described in the Initial Alternatives Report as Appendix V, *Screened Scoping Comments* (https://www.usbr.gov/mp/bdo/docs/lto-2021-initial-alt-2022-09-30-app-v.pdf).

An Initial Alternatives Report explored the bounds on different potential approaches (Bureau of Reclamation 2022b) and provided an initial screening of comments received during scoping based on identified screening criteria. Agencies are required to briefly discuss their reasons for eliminating alternatives from detailed study (40 CFR § 1502.14(a)). The use of these screening criteria supports Reclamation's clear and consistent description of its methodology for selecting which alternatives to analyze in detail. The purpose of the screening criteria is to guide Reclamation to identify, early in the development of alternatives process, which alternatives may and may not be appropriate to analyze in detail. Under the NEPA regulations, "reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible, and meet the purpose and need for the proposed action." (40 CFR § 1508.1(z)). If an alternative is flagged as inconsistent with this definition it should not be analyzed in detail.

1. **Purpose and Need:** how well each component would meet the purpose and need.
2. **Completeness:** whether sufficient information is available and can be analyzed through quantitative or qualitative means.
3. **Technically and Economically Feasible:** capable of being provided: (a) through technology that is readily available and has been demonstrated in actual operating conditions (not simply through tests or experiments) to operate in a workable manner; and (b) in a manner that does not require relatively large financial investments for relatively minor or unproven benefits.
4. **Value Added:** alternatives or components that may be considered unnecessary because similar or better performance in terms of resulting impacts is likely from a different or simpler configuration.

Previous consultations with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) identified measures to protect fish species listed under the Endangered Species Act (ESA) and those measures primarily differentiate alternative approaches. Exploratory modeling simulated potential water operations under layers of operational objectives with results informing potential modifications and limitations on the seasonal operation of the CVP and SWP. Mitigation measures may avoid, minimize, or compensate for adverse effects. The seasonal water operations and the conservation measures anticipated for inclusion in each alternative were identified as common components where the lack of unresolved conflict did not deem necessary the consideration of different approaches.

Reclamation held monthly status meetings with water agencies and separate monthly meetings with environmental NGOs on alternative formulation. A second parallel series of monthly meetings reviewed and developed modeling. Reclamation held quarterly WIIN Act meetings to discuss various topics, starting with scoping under the Notice of Intent in March, the Scoping Report on June 14, 2022, the Initial Alternatives Report on September 13, 2022, lines of evidence for analyses on December 13, 2022, the Affected Environment on March 14, 2023, and the Proposed Action and alternatives on June 13, 2023. Reclamation developed the following potential alternatives to the No Action Alternative described below. Reclamation must consider potentially reasonable alternatives beyond its own jurisdiction and consider the jurisdictions of other agencies (Federal and otherwise) when determining what reasonable alternatives should be considered.

1. **Water Quality Control Plan (Decision [D-]1641, Water Rights Order [WRO] 90-5, etc.):** operation to water right terms and conditions implementing the CVP and SWP contributions and obligations for state water quality control plan objectives for the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta), CVP tributaries, and other Water Quality Control Plan settlements. This alternative additionally includes habitat restoration, hatchery intervention, and other non-flow measures.
2. **Multi-Agency Consensus:** actions developed with agency coordination to harmonize, as appropriate, operations of the CVP with California Endangered Species Act (CESA) requirements for the SWP.

a. Reclamation met with the California Department of Fish and Wildlife (CDFW), California Department of Water Resources (DWR), NMFS, California State Water Resources Control Board (SWRCB), and USFWS weekly. Ultimately, 65 small groups of agency representatives were tasked to review the 2019 Long-Term Operation Proposed Action and 2020 Incidental Take Permit Action to identify substantial physical and biological science disagreements and to reconcile, as appropriate, operating criteria for the State and the Federal projects. Senior agency management and directors developed the actions necessary for a consensus alternative.

3. **Modified Natural Hydrograph:** actions developed with the environmental non-government organizations (NGO) through discussions with Reclamation to increase Delta outflow to meet certain targets with up to 65% of unimpaired Delta outflow and with carryover storage requirements to protect coldwater pool in upstream reservoirs.

    a. Reclamation met with several environmental NGOs approximately monthly for the development of this alternative.

4. **Risk Informed Operations:** modifications to the 2019 Proposed Action to incorporate new science and tools to consider population-level effects to listed species and respond to conditions in weekly "real-time" groups.

Refinements from the options in the Initial Alternatives Report to Public Draft Environmental Impact Statement (EIS) Alternatives included:

- Exclusion of most non-flow conservation measures to focus Alternative 2 on operational actions and to not specify actions for Reclamation, DWR and other federal and state programs in the environmental baseline.
- Reformulated Shasta Reservoir Coldwater Pool options into alternatives with consideration of additional options.
- Reformulated Old and Middle River (OMR) Flow Management options into alternatives
- Refined Spring Pulses and Delta Outflow options into alternatives under winter and spring flows.
- Development of New Melones Reservoir Stepped Release Plan (SRP) alternatives
- Incorporation of the installation of a Non-Physical Barrier at Georgiana Slough within the existing environment.
- Screened the Head of Old River Barrier. This action was proposed for inclusion; however, it did not meet screening criteria. Specifically:
    - It did not meet the purpose and need criterion for the operation of the CVP and SWP because it is not a CVP nor SWP facility and did not contribute to the operation of a facility;

- It did not meet the technical and economic feasibility criterion due to relatively minor and unproven benefits despite large financial investments and changes in Delta hydrodynamics; and
- It did not meet the value added criterion due to equivocal changes in survival and an increased need for OMR constraints. Appendix R of the Initial Alternatives Report describes the analysis.

- Development of monitoring and drought components.

An initial disposition of scoping comments related to alternatives and to the analysis of alternatives are described in the Initial Alternatives Report as Appendix V, *Screened Scoping Comments* (Reclamation 2022b). The following sections describe the No Action Alternative and the four potential Action Alternatives.

E.2 Common Components

Reclamation operates the CVP for the congressionally authorized purposes of: (1) river regulation, improvement of navigation, and flood control; (2) irrigation and domestic uses, and fish and wildlife mitigation, protection, and restoration; and (3) power, and fish and wildlife enhancement. DWR operates the SWP to provide flood control and water for power generation, agricultural, municipal, industrial, recreational, and environmental purposes. Public Law 99-546 authorized the 1986 Coordinated Operation Agreement (COA, as amended in 2018), which sets procedures for Reclamation and DWR to share joint responsibilities for meeting Delta standards and other legal uses of water. Operation of the CVP and SWP also provide recreation and water quality benefits.

The alternatives cover CVP service areas and the operation of CVP dams, power plants, diversions, canals, gates, and related Federal facilities located on the watersheds of Clear Creek; the Sacramento, American, Stanislaus, and San Joaquin rivers; and CVP and SWP facilities in the Sacramento–San Joaquin Delta (Delta) and Suisun Marsh (Figure E-1).

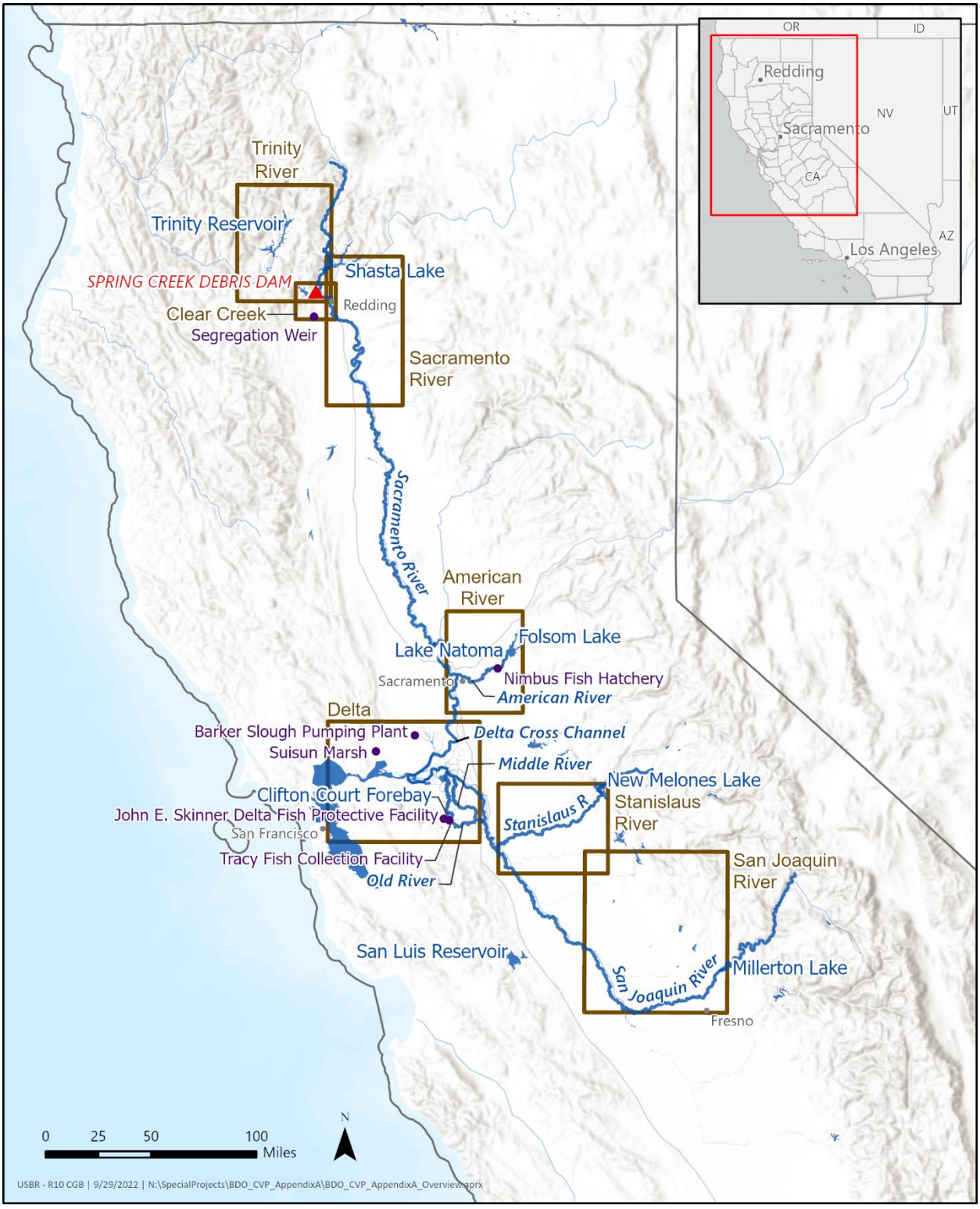


Figure E-1. Overview of the Facilities Operated in the Proposed Action.

Reclamation plans the operation of the CVP by projecting monthly, on a 12-month lookahead cycle, an "operations outlook" for how available water resources can best meet regulatory

requirements and water supply purposes, including considerations for public health and safety, wildlife refuges, senior water rights, water quality, fishery needs, other environmental requirements, and water service or repayment contracts. In most years, the combination of storage and runoff into CVP reservoirs and the Central Valley, after meeting statutory requirements, is not enough to fully meet CVP water service contractor demands and shortages occur. The water available for delivery to CVP water service contractors is determined by an administrative process, referred to as "allocations," that considers storage, forecasted inflow, system accretions and depletions, facility limitations, and project requirements under the operations outlook. The estimate of available water supply in the north of Delta system, along with the anticipated quantity of water needed to meet requirements throughout the year (such as D-1641), determine the north of Delta allocations. The estimate of water supply upstream, previously stored water south of the Delta (in San Luis Reservoir), and the potential conveyance capability through the Delta determine south-of-Delta allocations. The Municipal and Industrial (M&I) Water Shortage Policy determines the quantity of water during shortages for M&I and agricultural uses, for those water service and repayment contractors that reference the policy.

No later than February 15, Reclamation makes "Critical Year" determinations for Central Valley Project Improvement Act (CVPIA) wildlife refuges under Refuge Water Supply Agreements and senior water right holders under Sacramento River Settlement (SRS) Contracts, the San Joaquin River Exchange Contract, and San Joaquin River Settlement Contracts, as described by those contracts and agreements. Depending upon hydrologic conditions, the determination may be updated.

On or about February 20 of each year, Reclamation provides an initial declaration of the water made available under water service contracts, an "Initial Allocation." Water service contracts generally run from March through February. Beginning in February, Reclamation prepares forecasts of water year runoff using precipitation to date, runoff to date, and snow water content accumulation. These forecasts are based on the 90% exceedance inflow forecast from DWR. With the 90% exceedance forecast, there is a 10 percent chance that hydrology will be drier in the CVP than assumed in the forecast. The initial allocations allow the water contractors to make early planning decisions about the growing season. The forecast is developed by modifying release assumptions to first meet non-discretionary requirements and then determining the ability to meet discretionary objectives. Reclamation typically updates forecasts of runoff and operations plans at least monthly through May. If the water initially anticipated to be available is no longer likely to be available because additional releases are needed to maintain balanced conditions in the delta as defined in the COA, Reclamation provides a reduced allocation and notifies the water service contractors that less water will be available for delivery. These additional releases are used for purposes such as water quality, tributary-specific minimum flows, or flood control requirements. This approach is generally based on a 90% forecast and is intended to minimize the frequency of drier or warmer conditions than forecasted and avoid situations where a previous allocation for fisheries and agriculture cannot be supported. The 50% exceedance forecast is also used in the process, and they have historically been in agreement (meaning they are both under or both over 3.2 MAF). However, that was not the case in March, April, and May of 2020, thereby presenting significant uncertainty as to whether or not the final determination would be critical or non-critical.

DWR similarly plans the operations of the SWP by projecting monthly on a 12-month look-ahead cycle. The initial allocation for SWP deliveries is made by December 1 of each year with a conservative assumption of future precipitation to avoid over-allocating water before the hydrologic conditions are well defined for the year. As the water year unfolds, Central Valley hydrology and water supply delivery estimates (Table A Deliveries) are updated using known information and conservative forecasts of future hydrology. DWR may deliver water that is surplus to Table A Deliveries (Article 21 water). Article 21 water delivered early in the calendar year may be reclassified as Table A later in the year depending on final allocations, hydrology, and contractor requests. Reclassification does not affect the amount of water carried over in San Luis Reservoir, nor does it alter pumping volumes or schedules. Feather River Service Area contracts provide the terms for DWR to avoid interference with claimed senior water rights on the Feather River.

The Fish and Wildlife Coordination Act and the CVPIA, among others, authorize Reclamation to operate, in part, for fish and wildlife project purposes, undertake projects for habitat restoration and facility improvements, and to improve scientific understanding through developing models and supporting data. Following the 1995 Bay-Delta Accord, Reclamation and DWR operate the CVP and SWP to meet certain water quality control plan requirements for Delta outflow and salinity under D-1641. The responsibilities of DWR and Reclamation for senior water rights on the Sacramento River, Feather River, and in the Delta, as well as other regulatory requirements are allocated by the 2018 amended COA.

Potential alternatives are organized as follows:

- **Watersheds:** basin-by-basin description of facilities and the proposed operation for fish and wildlife, water supply, and power generation including proposed conservation measures to promote the recovery and/or to minimize or compensate for adverse effects of operation on federally listed species.
- **Monitoring:** the long-term evaluation of performance to assess overall effectiveness over time. Although each watershed has unique requirements, Reclamation and DWR integrate monitoring across watersheds; therefore, monitoring is organized in a single section.
- **Special Studies:** science-based efforts to address uncertainties in the actions that affect a reasonable balance among competing demands for water, including the requirements of fish and wildlife, agricultural, municipal, and industrial uses of water, and power contractors to inform subsequent decision making.
- **Drought:** actions to recognize extreme dry conditions may occur during operations. The boom-and-bust nature of California hydrology and the resulting effect on species warrants special consideration for operation during droughts. Although each drought is unique, contingency planning can facilitate a response.
- **Governance:** ongoing engagement by Reclamation and DWR with USFWS, NMFS, CDFW following completion of Biological Opinions and a Record of Decision.
- **Adaptive Management:** science and decision analytic-based approach to evaluate and improve actions, with the aim to reduce uncertainty over time and increase the likelihood of achieving and maintaining a desired management objective.

The common components describe where interagency coordination, and a review of literature and scoping comments did not identify substantial disagreement with the physical and biological science defining those actions nor substantial disagreement with the potential resource tradeoffs. Variable components are included in potential action alternatives. The following sections describe information applicable to the No Action Alternative and the action alternatives.

E.2.1 Sacramento River

Reclamation operates and maintains the Shasta Division of the CVP for flood control and navigation, M&I and agricultural water supplies, fish and wildlife, hydroelectric power generation, Sacramento River water quality, and Delta water quality. Facilities include the Shasta Dam and Power Plant, Keswick Dam and Power Plant, and a Temperature Control Device (TCD) on the upstream face of Shasta Dam.

Major facilities in the Sacramento Division of the CVP include the Red Bluff Pumping Plant, Tehama-Colusa Canal, and Corning Canal. The Red Bluff Pumping Plant is the intake for the Tehama-Colusa Canal and the Corning Canal (Figure E-2). Agricultural deliveries provide for the irrigation of over 150,000 acres of land in Tehama, Glenn, Colusa, and Yolo Counties. The Red Bluff Pumping Plant is the intake for the Tehama-Colusa Canal and the Corning Canal. Water is diverted from the Sacramento River approximately 2 miles southeast of Red Bluff through the 2,500 cubic feet per second (cfs), screened Red Bluff Pumping Plant. In 2011, Reclamation permanently welded the Red Bluff Diversion Dam gates in the open position.

Imports from the Trinity River Basin (Trinity Division) are delivered to the Sacramento River for downstream needs via two pathways: (1) released from Whiskeytown Reservoir to Clear Creek and joining the Sacramento River at the mouth of Clear Creek south of Redding; or (2) delivered to Keswick Reservoir through the Spring Creek Tunnel and Power Plant where water mixes with releases from Shasta Reservoir and is released from Keswick Dam.

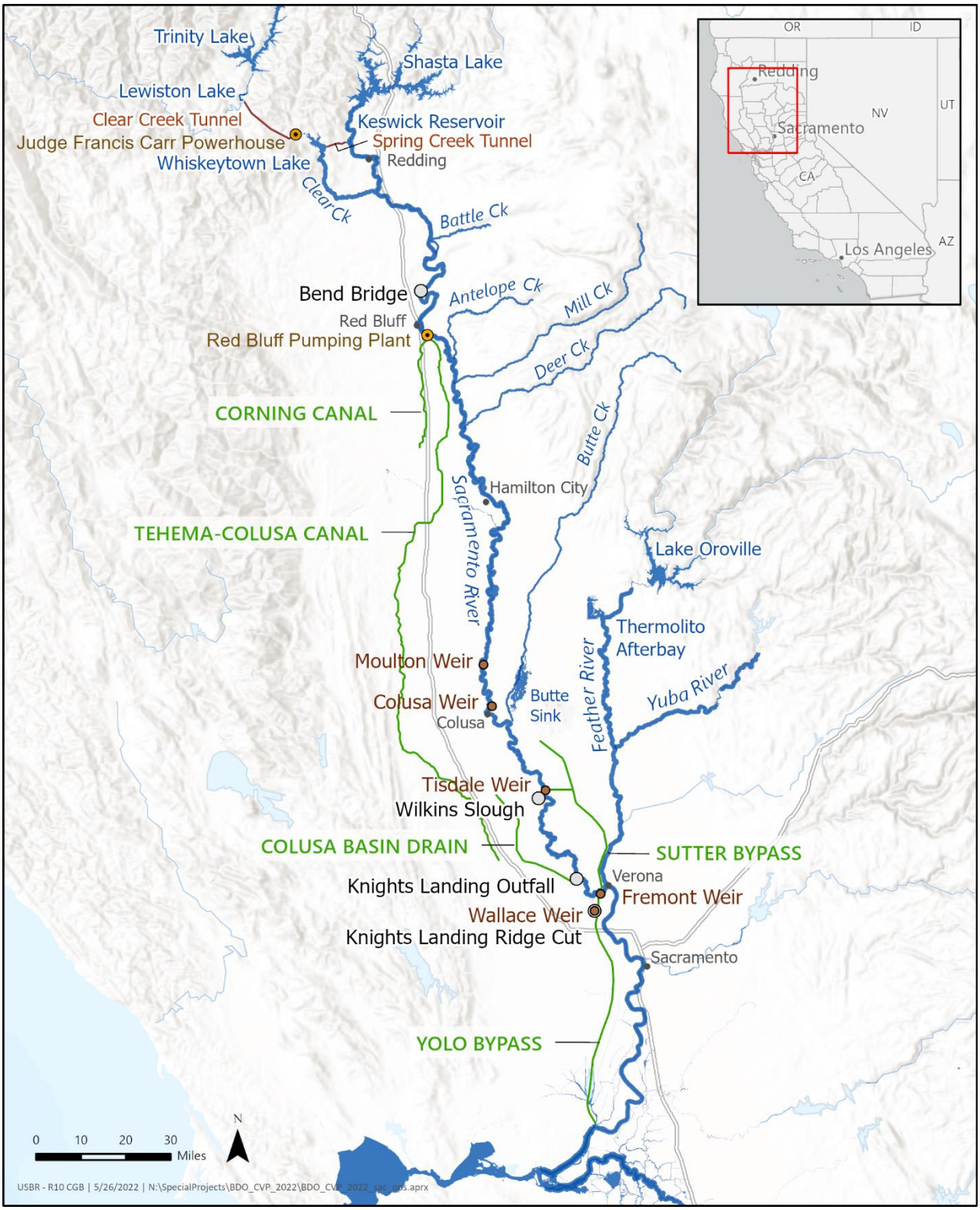


Figure E-2. Sacramento River Facilities in the Shasta and Sacramento Divisions of the CVP and Flood Control Weirs and Bypasses.

Statutory, Regulatory, and Contractual Requirements (see Appendix A of the Initial Alternatives Report for more details):

- Section 7 of the Flood Control Act of 1944
- Public Law 74-392 CVP Re-Authorization Act
- Public Law 81-839 Sacramento Valley Canals
- CVPIA
- SWRCB D-990
- SWRCB WRO 90-5
- SWRCB WRO 91-1
- SWRCB D-1641
- Settlement Contracts
- Exchange Contracts
- Water Service Contracts

E.2.1.1 Seasonal Operations

Reclamation operates Shasta Dam in the winter primarily for flood control and minimum flows in the Sacramento River and in the Delta. With flashboards installed on top of the drum gates that raise the elevation to 1,067 feet, the maximum capacity of Shasta Reservoir is 4.552 million acre-feet (MAF). For the flood season, the U.S. Army Corps of Engineers (USACE) provides a flood control diagram that specifies by date a top of conservation pool storage. Flood operational criteria target flow rates below 100,000 cfs at Bend Bridge for the protection of downstream populations; therefore, reservoir elevations may temporarily exceed the top of the conservation pool and encroach into flood space in order to limit downstream flows. In the winter, when not releasing for flood control, Reclamation seeks to store inflows to Shasta Reservoir and releases minimum flows necessary to meet downstream requirements. WRO 90-5 provides a target for minimum releases from Keswick Reservoir from September through February, the 1937 Act includes consideration for navigation at Wilkins Slough, and D-1641 provides flow standards in the Delta. Reclamation generally maintains flows of 5,000 cfs at Wilkins Slough year-round and these flows may be reduced in drought years. Reclamation may make releases above the minimum to maintain fall-run Chinook salmon redds in wetter hydrologic year types when storage levels are higher in Shasta Reservoir.

In the spring, when not operating for flood control, Reclamation seeks to maximize storage of inflow to optimize the filling of CVP reservoirs by the end of the flood control season (end of May). Higher storage improves the ability to meet downstream water temperature objectives and increases the ability to make releases later in the year for water supply. Accretions (runoff, return flows and flows from non-project creeks into the Sacramento River below Shasta Dam) also contribute to meeting both instream demands and Delta outflow requirements. Wetter years with high accretions may allow Reclamation to store more water in the spring and operate mostly for

flood control. Drier years with lower accretions may require Reclamation to make releases from Shasta Reservoir for downstream requirements throughout the spring season. Toward the middle to end of spring, instream diversion demands increase on the mainstem Sacramento River and require releases above minimums flows at Keswick Reservoir. Reclamation operates to flow objectives at Wilkins Slough to: (1) support diversion by SRS Contractors with a prior entitlement to water in the Sacramento River; (2) for deliveries to CVPIA wildlife refuges; and (3) for deliveries to CVP water service contractors at the Red Bluff Pumping Plant. The majority of these diversions typically occur mid-April through November with variations depending on hydrology.

Delta salinity and outflow requirements may necessitate additional releases from Shasta Reservoir. When system-wide demands require augmenting flows in the system, Reclamation coordinates imports from the Trinity Basin, releases by DWR from Oroville Reservoir, and releases from Folsom Reservoir. Each reservoir has factors to consider including instream requirements, amounts in storage, forecasted inflow, and refill potential. With several upstream reservoirs, Reclamation balances releases so that no one reservoir bears the full burden of meeting the downstream requirements. The 1986 COA and 2018 Addendum describe the CVP portion of Delta outflow requirements. Reclamation balances releases for the CVP portion of Delta outflow requirements between Shasta and Folsom reservoirs to maximize storage in each reservoir and minimize negative impacts between CVP tributaries. When increased releases are necessary to meet Delta needs, Reclamation generally first adjusts exports, then releases from Folsom Reservoir while releases from Shasta Reservoir travel down the Sacramento River. Once releases from Shasta Reservoir arrive in the Delta (about five days' travel time), releases from Folsom Reservoir can be reduced to balance the demands on each reservoir. When Reclamation can export water from the Delta during periods of excess flow, Reclamation can store more water in San Luis Reservoir south of the Delta. Maximizing exports in the spring reduces the reliance on stored water later in the year for meeting late season demands.

Summer operational considerations include releases for temperature control, instream diversion demands, Delta outflows, Delta salinity, and exports. In-river temperatures downstream of Keswick Dam can be controlled via two methods. The first is thermal mass, by changing release volume or shifting releases between Trinity Basin imports and Shasta Reservoir, and the second is selective withdrawal of colder water through the TCD. Determination of which method to use is made daily as operators balance releases from multiple reservoirs to meet downstream needs. Releases in the summer meet water temperature objectives, support essential features of critical habitat and support water supply deliveries. Releases from Shasta Reservoir typically begin increasing in April as storm frequency decreases, air temperatures increase and system-wide demands increase. Peak releases from Shasta Reservoir typically occur June through August and begin to decrease from the peak sometime in August or September. Occasionally, in very wet years, high storage levels through the summer may result in a need to release higher than normal flows in early fall to meet flood control requirements for the next year. Consideration of fall conditions may also warrant measures for drought protection and rebalancing of storage between reservoirs.

In the fall, Reclamation's objective is to reduce Keswick Dam releases and rebuild storage in Shasta Reservoir. Reclamation balances fall operations based on highly variable conditions, including water temperature control (dependent on winter-run Chinook salmon emergence

timing), maintenance of winter-run Chinook salmon redds (dependent on spawning depths), instream diversion demands on the mainstem of the Sacramento River upstream and downstream of Wilkins Slough (dependent on seasonal planting and wildlife refuges), fall-run Chinook salmon redd dewatering minimization (dependent on late-summer flows and fall spawning timing), and releases stabilization through fall-run Chinook salmon egg and alevin incubation. The remaining coldwater pool in Shasta Reservoir is usually limited in the fall at the end of the temperature management season. Release reductions from Shasta Reservoir early in the fall considerations include winter-run Chinook salmon eggs and alevin incubation, significant instream diversion demands (e.g., rice decomposition) remain on the mainstem of the Sacramento River between Keswick Dam and Wilkins Slough, Delta smelt habitat and, depending on conditions, Delta requirements may require upstream reservoir releases for Delta outflow under requirements from the SWRCB. If early fall flows drop substantially after fall-run Chinook salmon spawn at high river stages, their redds may be dewatered when flows are later reduced to rebuild storage.

E.2.1.2 Rice Decomposition Smoothing

Rice decomposition smoothing could minimize impacts to fall-run Chinook salmon by minimizing fry stranding and redd dewatering as flows drop in the winter. Reclamation will release flows based on Sacramento Valley Water Service Contractors demand and SRS Contractors coordinated rice decomposition smoothing diversion schedule. SRS Contractors and CVP Water Service Contractors will synchronize their diversions to lower peak rice decomposition demand. Starting in August, Reclamation and the SRS Contractors, through Governance, will develop a diversion schedule based on dewatering risk for winter-run Chinook salmon redd locations. The diversion schedule will be updated as conditions warrant.

E.2.2 Clear Creek

As a component of the Trinity Division of the CVP, Reclamation operates and maintains Whiskeytown Dam on Clear Creek, with a capacity of 241,100 acre-feet, for irrigation and other beneficial uses, hydroelectric power generation, fish and wildlife, recreation, and upper Sacramento River temperature control and water rights requirements. Whiskeytown Lake provides reregulation of trans-basin imports from the Trinity River. Diversions from Lewiston Lake on the Trinity River through the Judge Francis Carr Powerhouse and the runoff from the Clear Creek drainage area flow into Whiskeytown Lake. Water from Whiskeytown Lake is released into Clear Creek, diverted through the Muletown Conduit, or diverted through the Spring Creek Tunnel and Spring Creek Powerplant into Keswick Reservoir. Whiskeytown Lake has two temperature curtains to pass cold water through the bottom layer and limit warming from Judge Francis Carr Powerhouse to the Spring Creek Powerplant.

Reclamation operates and maintains Spring Creek Debris Dam on Spring Creek, with a capacity of 5,870 acre-feet, for hydroelectric power generation and upper Sacramento River temperature control and water rights requirements. Spring Creek Debris Dam controls debris and contaminated runoff resulting from old mine tailings on Spring Creek, which would otherwise enter the Spring Creek Powerplant tailrace. Water from Spring Creek Debris Dam and Spring Creek Powerplant discharges into Keswick Reservoir.

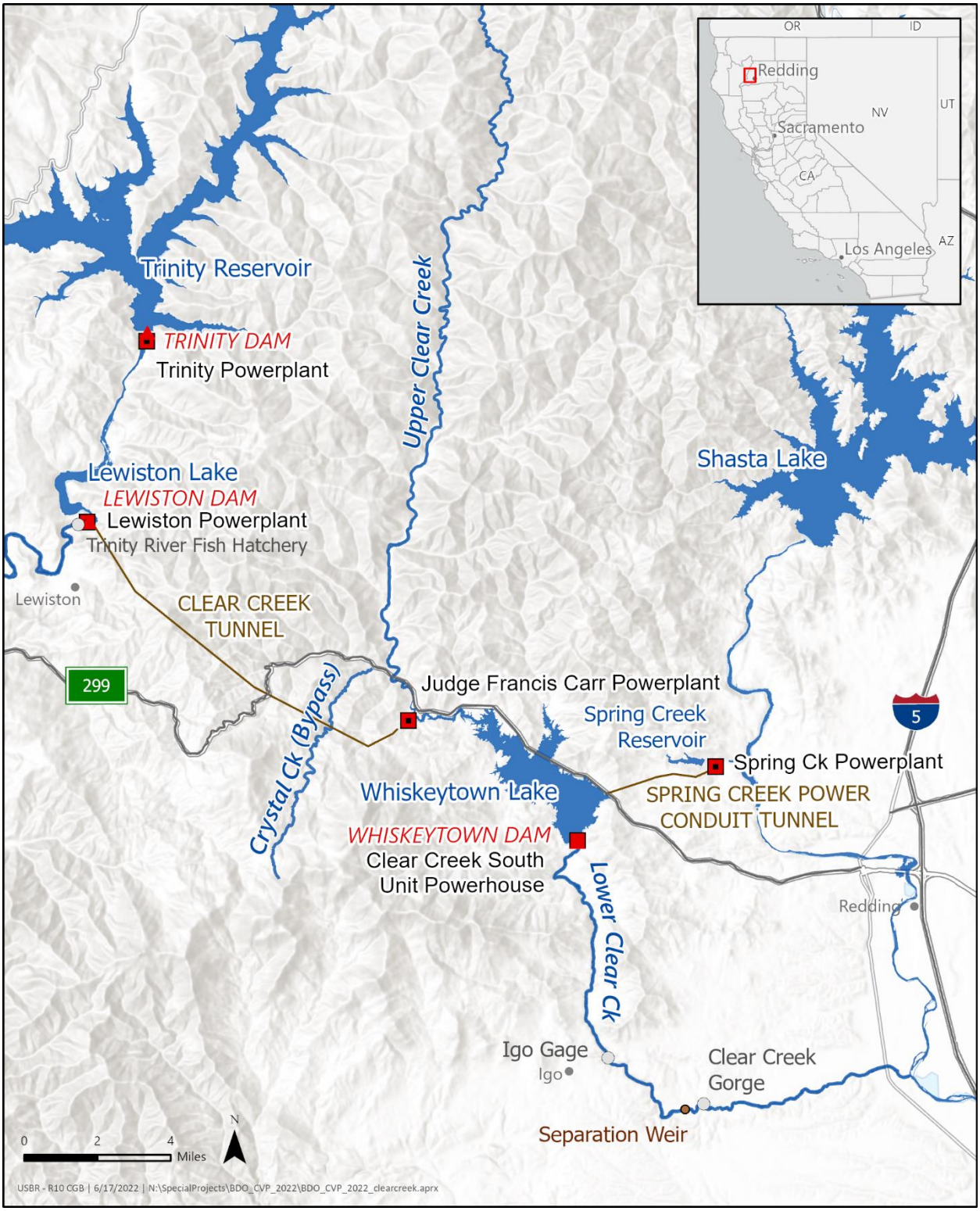


Figure E-3. Clear Creek Facilities in the Trinity Division of the CVP.

Statutory, Regulatory, and Contractual Requirements (see Appendix C, *Facility Descriptions* for more details):

- Public Law 84-386 Trinity River Division
- Section 3406(b)(12) of CVPIA
- Instream Flow Preservation Agreement 2000 (Contract No. 00-WC-1719-B8)
- April 15, 2002 SWRCB permit, minimum flows
- 1980 Memorandum of Understanding (MOU) with CDFW and SWRCB (Spring Creek Debris Dam)

E.2.2.1 Seasonal Operations

In the winter and spring, Whiskeytown Lake is operated to regulate flows for flood management. Starting in November, Reclamation will draw down Whiskeytown Lake by approximately 35 thousand acre-feet (TAF) to create flood management space, generally refilling in April or May. USACE does not regulate Whiskeytown Lake for flood control. Operations at Whiskeytown Lake during flood conditions are complicated by its operational relationship with the Trinity River, Sacramento River, and upper Clear Creek. On occasion, imports of Trinity River water to Whiskeytown Lake may be suspended to avoid aggravating high flow conditions in the Sacramento Basin. Heavy rainfall events occasionally result in uncontrolled Gloryhole Spillway discharges to Clear Creek, through the Whiskeytown Gloryhole.

During the summer and early fall, Reclamation operates to provide lake elevations as full as practical for recreation. Whiskeytown Lake is a major recreational destination with recreational facilities administered by the National Park Service. Summer and fall imports help maintain Whiskeytown Lake elevations, provide cold water for releases to Clear Creek for water temperature, decrease residence time in Lewiston Lake for Trinity River temperature control, and help maintain water temperature objectives in the Sacramento River by supplying water to Keswick Reservoir.

E.2.2.2 Ramping Rates

Reclamation will limit down ramping rates to no lower than 25 cfs per hour due to operational limitation of Whiskeytown Dam infrastructure. Reclamation may vary from these ramping requirements during flood control or develop a faster ramping rate on a case-by-case basis.

E.2.2.3 Segregation Weir

Reclamation proposes to ensure placement of a segregation weir on Clear Creek typically installed between the Clear Creek Gorge Cascade and Clear Creek Road Bridge in late August and remaining in place through early November. Placement of the weir would occur before fall run Chinook salmon enter Clear Creek to minimize hybridization with spawning spring-run Chinook Salmon and redd superimposition (redds constructed on top of redds constructed earlier by another salmon). Removal of the weir would occur after the peak of fall-run Chinook Salmon spawning when the risk of redd superimposition is very low.

Reclamation, through the Clear Creek Technical Team (CCTT), will select the location based on channel cross-section suitability for weir placement and the distribution of adult spring-run Chinook salmon holding locations. Previous placements have occurred at river mile 8.2 or 7.5. An additional location is being prepared at river mile 7.25. The weir location and timing protect

most of the spring-run Chinook Salmon utilizing Clear Creek, while minimizing effects to other salmonids.

E.2.3 American River

Reclamation operates and maintains the American River Division of the CVP for flood control, M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and Delta water quality. Facilities include Folsom Dam, its reservoir (977 TAF capacity), power plant, temperature control shutters on the power plant, and the Joint Federal Project auxiliary spillway, as well as the Nimbus Dam, Lake Natoma, Nimbus Power Plant, and Folsom South Canal. The CVP additionally delivers water to the Freeport Regional Water Project Intake. Releases from Folsom Dam are re-regulated approximately seven miles downstream by Nimbus Dam. Nimbus Dam creates Lake Natoma, which serves as a forebay for diversions to the Folsom South Canal and the Nimbus Fish Hatchery. Water diverted to the fish hatchery returns to the American River through four outfalls approximately 0.5 mile downstream of Nimbus Dam. Releases from Nimbus Dam to the American River pass through the Nimbus Power Plant, or the spillway gates at flows in excess of 5,000 cfs.

Folsom Reservoir is the main storage and flood control reservoir on the American River. Numerous other smaller non-CVP and SWP reservoirs in the upper basin provide hydroelectric generation and water supply without specific flood control responsibilities. The total upstream reservoir storage above Folsom Reservoir is approximately 820 TAF, and these reservoirs are operated primarily for hydropower production. Ninety percent of this upstream storage is contained by five reservoirs: French Meadows (136 TAF); Hell Hole (208 TAF); Loon Lake (76 TAF); Union Valley (271 TAF); and Ice House (46 TAF). Reclamation coordinates with the operators of these non-CVP and SWP reservoirs to aid in planning for Folsom Reservoir operations.

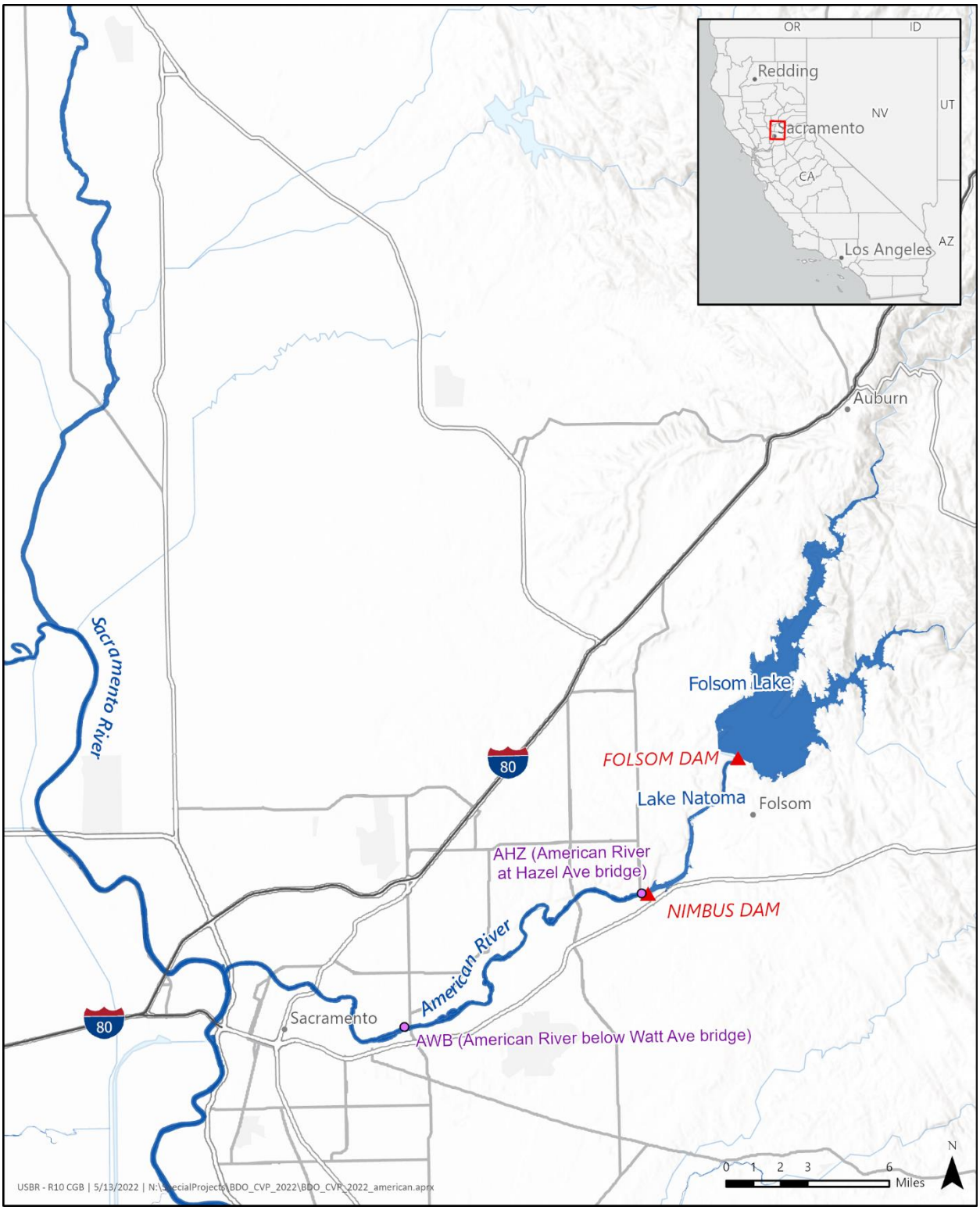


Figure E-4. Facilities in the American River Division of the CVP.

Statutory, Regulatory, and Contractual Requirements (see Appendix C, *Facilities Descriptions*):

- Public Law 81-356 American River Development Act of October 14, 1949, Ch. 690, 63 Stat. 852
- Public Law 89-161 Auburn-Folsom South Unit Act of September 2, 1965, 79 Stat. 615
- Freeport Regional Water Authority Intake
- SWRCB D-893
- SWRCB D-1641
- Water Control Manual for Folsom Dam and Lake (June 12, 2019) and its October 16, 2018, NMFS Biological Opinion
- Water Forum MOU March 29, 2021

Independent related activities to highlight:

- Nimbus Hatchery Genetics Management Plan
- Temperature Modeling Platform
- Spawning and Rearing Habitat Restoration
- Folsom Dam Raise and Temperature Control Shutters

E.2.3.1 Seasonal Operations

Reclamation operates Folsom Reservoir in the winter primarily for flood control and minimum flows in the lower American River and Delta. Flood control may drive operations in wetter years. The USACE 2019 *Water Control Manual: Folsom Dam and Lake* provides operational rules for dam safety and flood risk management. Flood operation criteria target flow rates below downstream channel capacities. During non-flood control operations, Reclamation stores Folsom Reservoir inflows that exceed releases for minimum instream flows and Delta water quality requirements. Reclamation seeks consistent steady releases to minimize potential redd dewatering, redd scouring, and juvenile stranding for steelhead and fall-run Chinook salmon, but Delta outflow requirements may require varying releases.

In the spring, when not operating to flood control requirements, Reclamation seeks to maximize capture of the spring runoff to fill as close to full as possible, while also considering conditions in the lower American River for fisheries needs. The American River Minimum Flow Standard includes both minimum releases and, in some years, a pulse flow to cue juvenile salmonids to emigrate. Reclamation also operates for water supply and Delta outflow requirements. As the closest reservoir to the Delta, increased releases from Folsom Lake are frequently called on to address Delta water quality requirements under D-1641. When releases from upstream CVP and SWP reservoirs meet Delta outflow requirements, Folsom Dam releases can be reduced and system-wide reservoirs balanced.

Reclamation is implementing a pilot program that considers an end-of-December (EOD) planning minimum of 300 TAF (Water Forum Memorandum of Understanding, March 2021). When developing the operational forecast, Reclamation would consider an end-of-December (EOD) Folsom Reservoir storage of at least 300 TAF. In some years, operational constraints may result in an EOD storage of less than 300 TAF. If, based on the May forecast, Reclamation does not anticipate meeting 300 TAF at EOD, it will be reported at the May American River Group (ARG) meeting. In those instances, Reclamation and the American River Parties will develop a list of potential actions that may be taken to either improve forecasted storage or decrease demand on Folsom Reservoir. The objective of considering storage in the forecasting process is to provide releases of salmonid-suitable temperatures to the Lower American River and reliable deliveries to American River water agencies dependent on deliveries or releases from Folsom Reservoir. In September, storage is typically at its lowest after releases and diversions for summer demands. When planning in the spring for temperature management later in the year, meteorological forecasts of precipitation events are uncertain for October through December. Assuming higher precipitation events than may materialize may present a higher risk of the reservoir not having sufficient carryover storage by EOD.

In the summer, Reclamation typically releases flows above the minimum instream flow requirements for instream temperature control, Delta outflow, and water supply. Reclamation manages water temperatures through the volume of water released and shutter elevations, in consideration of projected meteorological conditions. Reclamation balances the need to access Folsom Reservoir coldwater pool for instream temperature control during the summer for steelhead and the need to preserve cold water for fall-run Chinook salmon.

In the fall, operations focus on water temperature control management. Limited coldwater pool and limited storage require balancing releases and shutter operations to maximize the ability to maintain suitable water temperatures for steelhead rearing and fall-run Chinook salmon spawning. If reservoir inflows are greater than the release needs, Reclamation stores the surplus water. Reclamation will ramp down to the revised minimum flows from Folsom Reservoir as soon as possible in the fall and maintain these flows through fall-run Chinook salmon spawning and egg emergence, where possible, to minimize redd dewatering and juvenile stranding.

E.2.3.2 Ramping Rates

Reclamation will ramp down releases in the American River below Nimbus Dam as shown in Table E-1 and at night, if possible.

Table E-1. Lower American River Ramping Rates.

Daily Rate of Change (cfs)	Amount of Decrease in 24 Hours (cfs)	Maximum Change per Step (cfs)
20,000 to 16,000	4,000	1,350
16,000 to 13,000	3,000	1,000
13,000 to 11,000	2,000	700
11,000 to 9,500	1,500	500
9,500 to 8,300	1,200	400
8,300 to 7,300	1,000	350
7,300 to 6,400	900	300
6,400 to 5,650	750	250
5,650 to 5,000	650	250
<5,000	500	100

cfs = cubic feet per second.

Reclamation may vary from these ramping requirements during flood control. Reclamation, through ARG, may develop a faster down ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs.

E.2.4 Delta

Reclamation operates and maintains the Delta Division of the CVP for M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and Delta water quality. The major CVP features are the Delta Cross Channel, Contra Costa Canal and Rock Slough Intake facilities, Tracy Fish Collection Facility (Tracy Fish Facility) and C. W. "Bill" Jones Pumping Plant (Jones Pumping Plant), and Delta-Mendota Canal. The Jones Pumping Plant, located about five miles north of Tracy, has six fixed-speed pumps with a diversion capacity of 4,600 cfs. The Jones Pumping Plant discharges into the head of the Delta-Mendota Canal.

Reclamation operates and maintains the San Luis Unit of the West San Joaquin Division for M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and water quality. The major joint CVP and SWP features are the O'Neill Forebay, San Luis Reservoir, Bernice Frederic Sisk Dam, O'Neill Pumping-Generating Plant, William R. Gianelli Pumping-Generating Plant, San Luis Canal, Dos Amigos Pumping Plant, and Los Banos and Little Panoche detention dams and reservoirs. The major CVP-only facilities include the Coalinga Canal and Pleasant Valley Pumping Plant.

Reclamation operates the San Felipe Division for M&I and agricultural water supplies, fish and wildlife protection, and recreation. The major CVP features are the Pacheco Pumping Plant, Tunnel, and Conduit.

The main SWP Delta features are the Barker Slough Pumping Plant (BSPP), Suisun Marsh facilities (including the Suisun Marsh Salinity Control Gates [SMSCG] and Roaring River Distribution System [RRDS]), Morrow Island Distribution System, Goodyear Slough Outfall Gates), Clifton Court Forebay (CLC), John E. Skinner Delta Fish Protective Facility (Skinner Fish Facility), Harvey O. Banks Pumping Plant (Banks Pumping Plant) and California Aqueduct. The BSPP diverts water from Barker Slough into the North Bay Aqueduct (NBA) for delivery to the Solano County Water Agency and the Napa County Flood Control and Water Conservation District. The SMSCG are located on Montezuma Slough about two miles downstream from the confluence of the Sacramento and San Joaquin Rivers, near Collinsville. The purpose of SMSCG operation is to decrease the salinity of the water in the eastern portion of the Suisun Marsh. When operated tidally, the gates reduce salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and by retaining lower salinity Sacramento River water from the previous ebb tide. Operation of the gates in this fashion lowers salinity in eastern Suisun Marsh channels and results in a net movement of water from east to west through Suisun Marsh.

The SWP Banks Pumping Plant, located near the Jones Pumping Plant, has 11 pumps. Pumping is limited to a maximum permitted capacity of 10,300 cfs per day. The Banks Pumping Plant discharges into the California Aqueduct.

The Delta-Mendota Canal/California Aqueduct Intertie is used to move water between the California Aqueduct and the Delta-Mendota Canal. It can pump up to 700 cfs from the Delta-Mendota Canal to the California Aqueduct and convey up to 900 cfs from the California Aqueduct to the Delta-Mendota Canal. This structure was built to help both federal and state water projects more effectively move water from the Delta into the California Aqueduct, the Delta-Mendota Canal, the San Luis Reservoir.

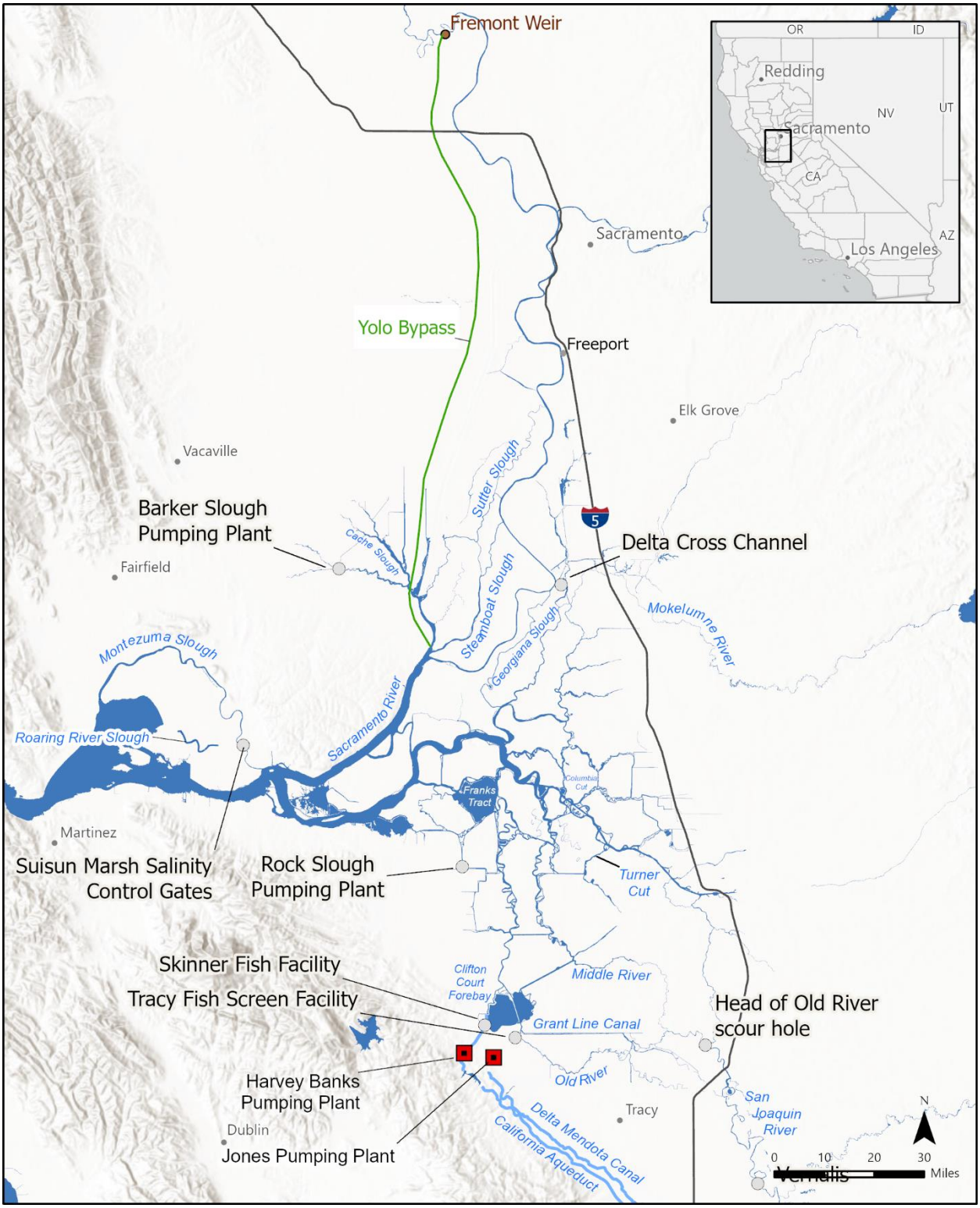


Figure E-5. Map of the Delta Division Facilities.

Statutory, Regulatory, and Contractual Requirements (see Appendix A of the Initial Alternatives Report for more details):

- Public Law 74-392 CVP Re-Authorization Act
- SWRCB D-1641
- 1986 COA and 2018 COA Addendum
- Public Law 99-546, Suisun Marsh Preservation Act
- 1986 Settlement Agreement with South Delta Water Agency (CLC gate operations)
- October 13, 1981, USACE Public Notice No. 5820A (Clifton Court inflow criteria)
- DWR's Division of Safety of Dams criteria (CLC storage)
- USACE Permit No. 199900715 (CLC additional 500 cfs)
- DWR/CDFW Agreement (Skinner Fish Facility)
- USACE Permit Nos. SPK-200100121, SPK-20000696 (Temporary Barriers)

Independent related activities to highlight:

- Agricultural Barrier Construction (DWR, USACE)
- BSPP Fish Screen (DWR)
- Contra Costa Los Vaqueros Expansion – Phase 1
- Contra Costa Rock Slough Fish Screen
- Delta Cross Channel Gate Improvements Study
- Georgiana Slough Non-Physical Barrier (DWR, USACE)
- Head of Old River – Scour Hole Predation Reduction Study
- Bernice Frederic Sisk Dam Raise and Reservoir Expansion Project Construction
- Suisun Marsh Habitat Management, Preservation, and Restoration Plan
- Tracy Fish Facility Improvement Program
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

E.2.4.1 Seasonal Operations

In the winter and spring, Reclamation and DWR typically export excess water. Excess water conditions occur when releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in-basin uses and exports. Actions to minimize entrainment of listed fish into the south Delta and at the Jones and Banks pumping plants limit the export of excess water. Exports during the winter and spring reduce the reliance on conveying previously stored water in the summer and fall for south-of-Delta water supply needs. In dry conditions, Reclamation and

DWR may need to increase releases from upstream reservoirs beyond what is needed to meet minimum flow requirements in order to meet water quality or outflow requirements in the Delta.

During the summer, the CVP and SWP convey previously stored water through the Delta for export at the Jones Pumping Plant, Banks Pumping Plant, and other Delta facilities. Delta operations during the summer typically focus on maintaining salinity and meeting Delta outflow objectives while maximizing exports with the available water supply. In addition, the CVP and SWP make upstream reservoir releases for water temperature management and instream flows, which may be available for export after outflow, salinity, and in-Delta needs have been met.

In the fall, operations are adjusted to meet salinity objectives, Delta outflow requirements, and peak demands from CVPIA wildlife refuges. Upstream and in-Delta demands typically decrease and accretions within the system typically increase. When water is available and not required for salinity and Delta outflow requirements, late summer and fall provide an opportunity to export water and start filling San Luis Reservoir for the next water year. When conditions are dry, there is little opportunity for exports. Releases from upstream reservoirs generally decrease to conserve water in storage for the next year. On occasion, releases for flood conservation pool or redds protection may occur and result in additional flows into the Delta.

The Banks Pumping Plant pumps water directly from CLC. The CLC radial gates are closed during critical periods of the ebb and flood tidal cycle for water quality and water levels in the south Delta. During July through September, the maximum daily diversion limit from the Delta into the CLC is increased from 6,990 cfs to 7,490 cfs, and the maximum averaged diversion limit over any three days is increased from 6,680 cfs to 7,180 cfs. Except for Alternative 2b, from mid-December through mid-March, diversions into CLC may be increased by one-third of the San Joaquin River flow at Vernalis when those flows exceed 1,000 cfs. Further, the Banks Pumping Plant will pump up to 195,000 acre-feet for the CVP in accordance with the 2018 COA Addendum.

E.2.4.2 Delta Cross Channel Gate Closures

Reclamation operates the Delta Cross Channel (DCC) Gates in the open position to (1) improve the efficiency of conveying water from the Sacramento River to the export facilities at the Banks and Jones Pumping Plants; (2) improve water quality in the central and southern Delta; and (3) reduce salinity intrusion rates in the western Delta. During the late fall, winter, and spring, the gates would be periodically closed to protect out-migrating salmonids from entering the interior Delta and to facilitate meeting the D-1641 Rio Vista flow objectives for fish passage. In addition, whenever flows in the Sacramento River at Sacramento reach 20,000 to 25,000 cfs, the gates would be closed to reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates.

Reclamation operates the DCC Gates to reduce juvenile salmonid entrainment risk beyond actions described in D-1641, consistent with Delta water quality requirements in D-1641. From October 1 to November 30, Reclamation operates the Delta cross channel gates in the open position unless monitoring indicates a higher risk of fish presence, in which case the gates are closed. From December 1 to January 31, the DCC Gates are closed, except to prevent exceeding a D-1641 water quality threshold. During a DCC Gates opening between December 1 and January 31, the CVP and SWP would divert at Health and Safety pumping levels. From February

1 to May 20, the DCC Gates are closed, consistent with D-1641. From May 21 to June 15, Reclamation closes the DCC Gates for a total of 14 days, consistent with D-1641. Reclamation and DWR perform a risk assessment to determine the timing and duration of the gate closures.

E.2.4.3 Tracy Fish Collection Facility

Reclamation will operate the Tracy Fish Facility to screen fish from Jones Pumping Plant. The primary channel is a behavioral barrier with effectiveness that depends on the pumping Jones Pumping Plant. The secondary channel is a positive fish barrier. When south Delta hydraulic conditions allow and conditions are within the original design criteria for the Tracy Fish Facility, the secondary channel is operated to achieve water approach velocities for striped bass of approximately 1 to 2.5 feet per second (fps) from June 1 through October 31 and for salmon of approximately 3 fps from November 1 through May 31.

Salvage of fish at the Tracy Fish Facility occurs 24 hours per day, 365 days per year. Fish are salvaged in flow-through holding tanks, monitored by a 30-minute fish count every 120 minutes, and transported by truck to release sites near the confluence of the Sacramento and San Joaquin rivers. Larval smelt sampling commences upon detection of a spent female at the Tracy or Skinner fish facilities or when a water temperature trigger of 53.6°F (12°C) at nearby California Data Exchange Center (CDEC) stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m.

The CVP uses two release sites: (1) on the Sacramento River near Horseshoe Bend and (1) on the San Joaquin River immediately upstream of Antioch Bridge.

To seek additional improvements to the Tracy Fish Facility; Reclamation proposes to develop the Alternative Loss Pilot Study Implementation Plan (ALPS-IP) and implement the resulting pilot study, which would include consideration of additional salvage facility loss parameterization and study or further procedural modifications if identified and prioritized through the ALPS-IP Structured Decision Making results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

Maintenance and Repair

Reclamation will provide the fish agencies notification of salvage disruption (salvage outage) due to planned facility maintenance at least 24 hours in advance. To minimize and avoid salvage disruptions, Reclamation conducts most planned outages during shutdowns of the Jones Pumping Plant, typically in the spring and continuing into the summer and fall months. For unplanned facility maintenance, Reclamation will provide notice as soon as practicable and minimize the duration of the salvage outage. Reclamation, through technical assistance with the fishery agencies, will develop an appropriate loss factor for these outages.

Reclamation is required to maintain the Tracy Fish Facility and may not have discretion over when the maintenance must occur.

E.2.4.4 John E. Skinner Delta Fish Protective Facility

DWR will operate the facility to screen fish from Banks Pumping Plant. Salvage of fish occurs at the Skinner Fish Facility whenever Banks Pumping Plant is pumping. Fish are salvaged in flow-through holding tanks, monitored by a 30-minute fish count every 120 minutes, and transported

by truck to release sites near the confluence of the Sacramento and San Joaquin Rivers. Larval smelt sampling commences upon detection of a spent female at the Tracy or Skinner fish facilities or when a water temperature trigger of 53.6°F (12°C) at nearby CDEC stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m.

To seek additional improvements to the Skinner Fish Facility; DWR proposes to develop the ALPS-IP and implement the resulting pilot study, which would include consideration of additional salvage facility loss parameterization and study or further procedural modifications if identified and prioritized through the ALPS-IP SDM results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

Maintenance and Repair

DWR will provide Reclamation and the fish agencies notice of salvage disruptions due to planned facility maintenance (planned outages) at least 24 hours in advance. To minimize and avoid salvage disruptions, DWR conducts most planned outages during full shutdowns of Banks Pumping Plant, frequently in the spring. Further, the modular design of the Skinner Fish Facility in conjunction with total export capacity reductions is used to avoid salvage disruptions for maintenance and repair activities. For unplanned facility maintenance, notice will be provided as soon as practicable. In the event of an unplanned outage (e.g., power disruption) extending beyond one hour, DWR will stop pumping, but may continue to operate the CLC radial gates.

Fish Protection Facility Operations Manual

DWR proposes to develop and implement a revised written training curriculum as identified in Section IV: Fish Identification, of the 2021 DWR CDFW Interagency Agreement for Fish Facilities Operation. Additionally, DWR proposes to annually review and update the revised Skinner Fish Facility Operations Manual after Water Year 2023 as specified in the manual. The Skinner Fish Facility will have access to a staff biologist for consultation to support salvage staff, research studies, and special handling of tagged fish.

E.2.4.5 Water Transfers

Water transfers assist California urban areas, agricultural water users, and others in meeting their water needs. Reclamation and DWR will operate the CVP and SWP to facilitate transfers through providing water in streams for delivery to alternative diversion points, conveying water across the Delta for export, or storing water for delivery at a future time.

Seasonal operations describe deliveries up to contract totals. Included in this consultation is transfers of water, up to contract totals, between CVP contractors within counties, watersheds, or other areas of origin (e.g., Accelerated Water Transfers). In accordance with Section 3405(a)(1)(M) of the CVPIA, these transfers are deemed to have met the historic use and consumptive use/irretrievably lost to beneficial use requirements, CVPIA Sections 3405(a)(1)(A) and 3405(a)(1)(I), respectively.

Transfers not meeting these requirements, including out of basin transfers (e.g. North to South Water Transfers, Exchange Contractors Transfers, Warren Act Transfers), follow the *Draft Technical Information for Preparing Water Transfer Proposals, as updated in 2019* (Water Transfers White Paper). The actions taken by contractors to make water available for these water transfers (i.e., reducing consumptive use by crop idling and shifting, reservoir storage releases, or

groundwater substitution) have separate environmental compliance and are **not** a component of this EIS. However, the specific timing and operations associated with the movement of the water to be transferred **is** a component of all alternatives analyzed by this EIS. Updated in 2019, the paper provides detailed information on establishing water transfers and how to complete a particular transfer and document it in a way to prevent harm to other legal users of water.

Reclamation and DWR will provide a transfer window across the Delta from July 1 through November 30. When pumping capacity is needed for CVP or SWP purposes, Reclamation and DWR may restrict water transfers. Maximum transfers are shown in the table below.

Table E-2. Proposed Annual North to South (out of basin) Water Transfer Volume.

Water Year Type	Maximum Transfer Amount North to South (TAF)
Critical	Up to 600
Dry (following Critical)	Up to 600
Dry (following Dry)	Up to 600
All Other Years	Up to 360

TAF = thousand acre-feet.

Independent related activities to make transfer water available not included in this EIS as a common component include:

- Long Term Water Transfer Program (North to South Water Transfers)
- Long Term Exchange Contractor Transfers
- Non-Project Transfers (e.g., “Warren Act Transfers”)

Reclamation and DWR frequently transfer project and non-project water supplies through CVP and SWP facilities, including in-basin and out of basin transfers. The quantity and timing of a specific water transfer may or may not require operational changes to both CVP and SWP reservoir releases and CVP and SWP facilities pumping.

E.2.4.6 Agricultural Barriers

Agricultural barriers maintain water levels for south Delta agricultural diverters. DWR may install barriers as early as May 1 in Old River near Tracy 0.5 mile upstream of the Tracy Fish Facility; in Middle River 0.5 mile upstream of the junction with Victoria Canal; and in Grant Line Canal, about 400 feet upstream of the Tracy Boulevard Bridge. All barriers will be removed by November 30 each year.

Operation of the Agricultural Barriers is part of the long-term operation of the CVP and SWP. Upon completion of installation, DWR will allow the barriers to operated tidally depending on stage conditions, except for one culvert at each of the three agricultural barriers. These culverts will remain open beyond June 1 if water levels for diversion in the south Delta is not a concern and the mean daily water temperature at Mossdale is less than 71.6°F (22°C).

E.2.4.7 Clifton Court Forebay Weed Management

Aquatic weed management is needed year-round to prevent potential damage to SWP equipment through cavitation at the pumps and excessive weight on the fish protection louver array. Excessive weed mats entrained into the fish holding tanks and collection baskets in the Skinner Fish Facility reduce the efficiency of fish salvage, affect the ability of staff to conduct fish counts, and smother fish. Dense stands of aquatic weeds additionally provide cover for predators that prey on listed species within the CLC. Algal blooms degrade drinking water quality through production of taste and odor compounds or algal toxins.

DWR would continue to apply copper-based aquatic herbicides and algaecides to control aquatic weeds and algal blooms and use mechanical harvesters on an as-needed basis in CLC, but would also apply Aquathol® K aquatic herbicide and peroxygen-based algaecides (e.g., PAK 27) and extend the treatment window beyond July 1 to August 31. DWR could apply Aquathol K, a chelated copper herbicide (copper-ethylenediamine complex and copper sulfate pentahydrate), a copper carbonate compound, or other copper-based herbicides. Algaecides may include peroxygen-based algaecides (e.g., PAK 27). These products are used to control algal blooms that can degrade drinking water quality through production of taste and odor compounds of algal toxins and can cause excessive filter clogging at drinking water treatment plants. Treatment areas would typically be about 900 acres and no more than 50% of the 2,180 total surface acres.

Aquatic weed and algae treatments would occur on an as-needed basis depending upon the level of vegetation biomass, cyanotoxin concentration from the harmful algal blooms, or concentration of taste and odor compounds. Operational procedures would minimize impacts on listed species during aquatic herbicide treatment for application of Aquathol K and copper-based products and algaecide treatment for application of peroxide-based algaecides in CLC. The timing of application is an avoidance measure and is based on the life history of Chinook Salmon and steelhead in the Central Valley Delta region and of Delta smelt. Applications of aquatic herbicides and algaecides would be contained within CLC. The radial intake gates to CLC would be closed prior to, during, and following the application.

E.2.4.8 Suisun Marsh – Roaring River Distribution System Fall Flood-Up

There are existing consultations for a portion of the Suisun Marsh Preservation Agreement (SMPA) (*USFWS 2013 Biological Opinion File No. 0SESMF00-2012-F-0602 Biological Opinion on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California* and *NMFS 2013 Biological Opinion File No. 2012-02390 Suisun Marsh Long-Term Habitat Management, Preservation, and Restoration Plan*). These consultations are included in independent related activities that are part of the Environmental Baseline. If Reclamation and DWR reinitiate the consultations referenced above on the SMPA, based on any of the reinitiation triggers identified in 50 Code of Federal Regulations (CFR) Section 402.16 *Reinitiation of consultation*, operations of the Suisun Marsh Facilities prescribed in the SMPA would be included in their entirety under those consultation and no longer under the long-term operation of the CVP and SWP.

DWR will continue operation of the Suisun Marsh Facilities (SMSCG, RRDS, Morrow Island Distribution System, and Goodyear Slough Outfall Gates) in accordance with the SMPA, which contains provisions for DWR and Reclamation to mitigate the effects on Suisun Marsh channel

water salinity from SWP and CVP operations and other upstream diversions. The SMPA requires DWR and Reclamation to meet salinity standards in accordance with D-1641.

The SMSCG are operated on an as-needed basis to meet D-1641 and SMPA water quality standards in Suisun Marsh.

Roaring River Distribution System diversion rates have been controlled to maintain a maximum approach velocity of 0.2 fps at the intake fish screen except for a five-week contiguous period (five-week flood-up window) when Roaring River Distribution System diversion rate will be controlled to maintain a maximum approach velocity of 0.7 fps for fall flood-up operations. The dates of the five-week annual flood-up window may change annually due to waterfowl season dates changing each year and corresponding flood-up needs but will occur during the months of September through November.

E.2.5 Stanislaus River

Reclamation operates and maintains the Eastside Division of the CVP for flood control, M&I and agricultural water supplies, hydroelectric power generation, fish and wildlife protection, recreation, and water quality. Reclamation's facilities include the New Melones Dam, Reservoir (2.4 MAF capacity), and Powerplant.

The Tri-Dam Project, a partnership between the Oakdale Irrigation District and South San Joaquin Irrigation District, consists of Donnells and Beardsley Dams, located upstream of New Melones Reservoir on the middle fork Stanislaus River, and Tulloch Dam and Powerplant, located approximately six miles downstream of New Melones Dam on the mainstem Stanislaus River. Releases from Donnells and Beardsley Dams affect inflows to New Melones Reservoir. The main water diversion point on the Stanislaus River is Goodwin Dam, an impassable barrier for fish migration approximately two miles downstream of Tulloch Dam.

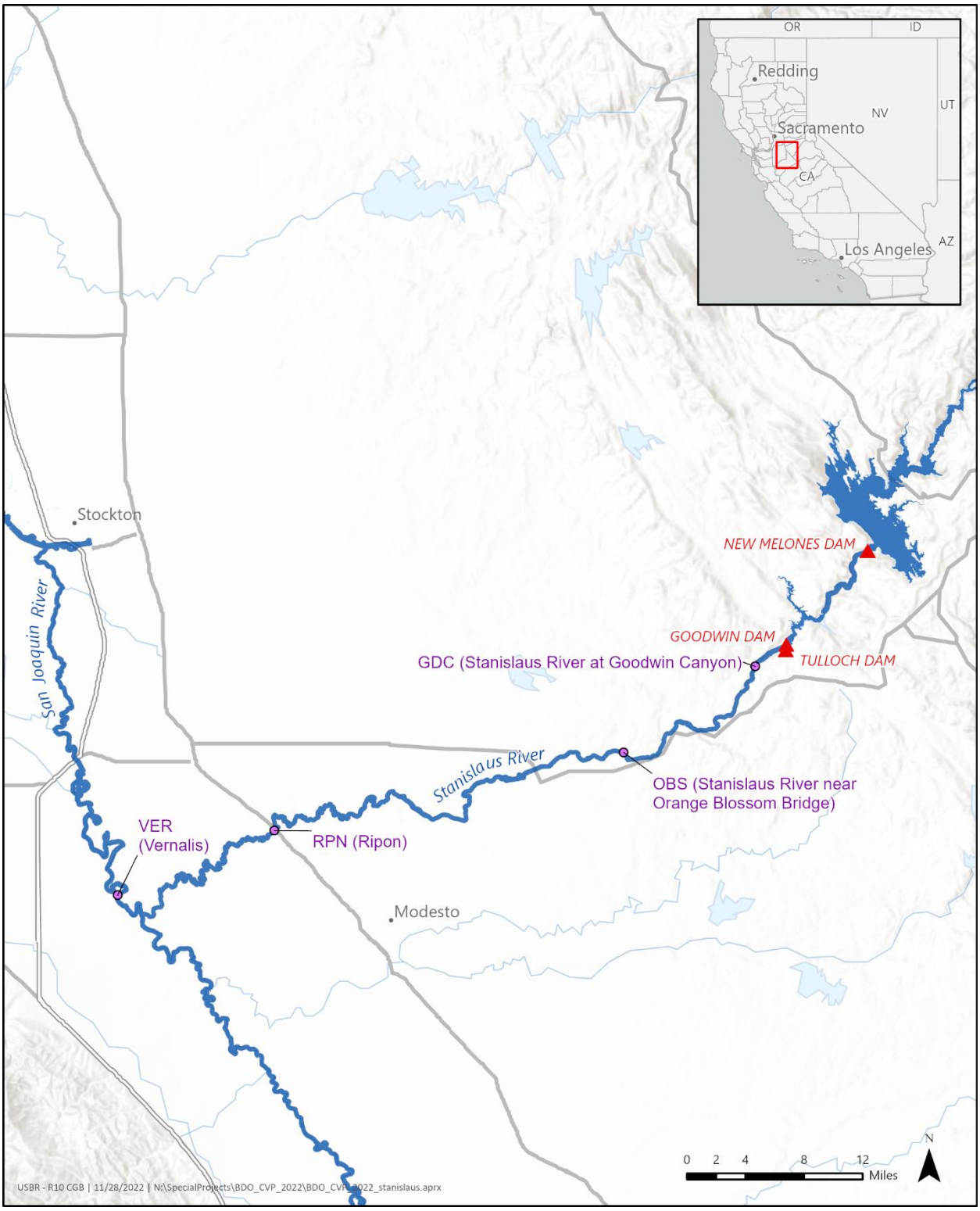


Figure E-6. Map of the Stanislaus River and Eastside Division.

Statutory and Regulatory Requirements, (see Appendix A of the Initial Alternatives Report for more details):

- USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959)
- Public Law 87-874 Flood Control Act of 1962
- Minimum flow standards below Goodwin Dam: "Interim Instream Flows and Fishery Studies in the Stanislaus River Below New Melones Reservoir" (1987 Agreement between Reclamation and the California Department of Fish and Game [now CDFW])
- Minimum Dissolved Oxygen (DO) standards: SWRCB D-1422
- SWRCB D-1641, D-1616, Bay-Delta Plan flow objectives and subsequent assignment of responsibility
- 1992 CVPIA 3406(b)(2)
- Agreements and Contracts
- 1988 Agreement and Stipulation with Oakdale Irrigation District and South San Joaquin Irrigation District
- Water Service Contracts
- Tri-Dam Agreement

Independent related activities to highlight:

- Temperature Modeling Platform

E.2.5.1 Seasonal Operations

In the winter and spring, Reclamation will operate to D-1641 and for flood control in accordance with the USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959). Operating to flood control constraints is relatively infrequent because New Melones Reservoir is a larger reservoir relative to its annual inflow. However, Tulloch Lake is subject to high local inflows, and may be in flood control operations for brief periods when New Melones Reservoir is not. During these periods, releases from Tulloch Lake may be used to meet flow objectives, schedules, or requirements on the lower Stanislaus River below Goodwin Dam but are generally of a short duration. Reclamation seeks to minimize potential redd dewatering, redd scouring, and juvenile stranding for steelhead.

During the summer, Reclamation is required to maintain applicable DO standards on the lower Stanislaus River for species protection. The 7.0 milligrams per liter DO requirement at Ripon applies year-round, but is most often controlling (requiring additional releases from Goodwin Dam) from June 1 to September 30.

In the fall, Reclamation operates to a D-1641 fall pulse flow requirement in October for fish attraction. Otherwise, Reclamation operates to base flow requirements in order rebuild storage. If necessary, releases might be made for DO at Ripon or electrical conductivity concerns at Vernalis, but these are rare.

E.2.5.2 Ramping Rates

Reclamation will coordinate releases on the Stanislaus River as shown in Table E-3. For determining the water year type, Reclamation will use the San Joaquin Valley "60-20-20" Water Year Hydrologic Classification (60-20-20 Index) developed for D-1641 implementation and based on a 90% exceedance forecast.

Table E-3. Goodwin Dam Ramping Rates.

Goodwin Release Range (cfs)	Standard Rate of Increase (cfs per 2 hours)	Standard Rate of Decrease (cfs per 2 hours)	C and D Rate of Increase (cfs per 2 hours)	C and D Rate of Decrease (cfs per 2 hours)
≥ 4,500	250	250	250	250
2,000–4,499	500	250	500	250
500–1,999	250	100	500	200
300–499	100	50	200	100

cfs = cubic feet per second; C = Critical water year (60-20-20 Index); D = Dry water year (60-20-20 Index).

Reclamation, through the Stanislaus Watershed Team (SWT), may develop a faster down ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs. For winter instability flows, Reclamation, through the SWT, may implement faster ramping rates in critical and dry water year types provide more flexibility for shaping flow volumes of water for the purposes of improving biological benefits. Ramping rates that promote recruitment of native riparian vegetation on floodplain surfaces should be considered when instream flow budgets are sufficient. Reclamation may vary from these ramping requirements during flood control.

E.2.6 San Joaquin River

Reclamation operates the Friant Division for flood control, M&I and agricultural water supplies, and fish and wildlife purposes. Friant Dam provides flood control on the San Joaquin River, downstream releases to meet senior water rights requirements above Gravelly Ford, Restoration Flows under Title X of Public Law 111-11, and diversions into the Madera and Friant-Kern Canals.

The Friant Division facilities include Friant Dam, Millerton Reservoir, and the Friant-Kern and Madera Canals. Water is delivered to about one million acres of agricultural land in Fresno, Kern, Madera, and Tulare Counties in the San Joaquin Valley via the Friant-Kern Canal south into Tulare Lake Basin and via the Madera Canal north to Madera and Chowchilla Irrigation Districts.

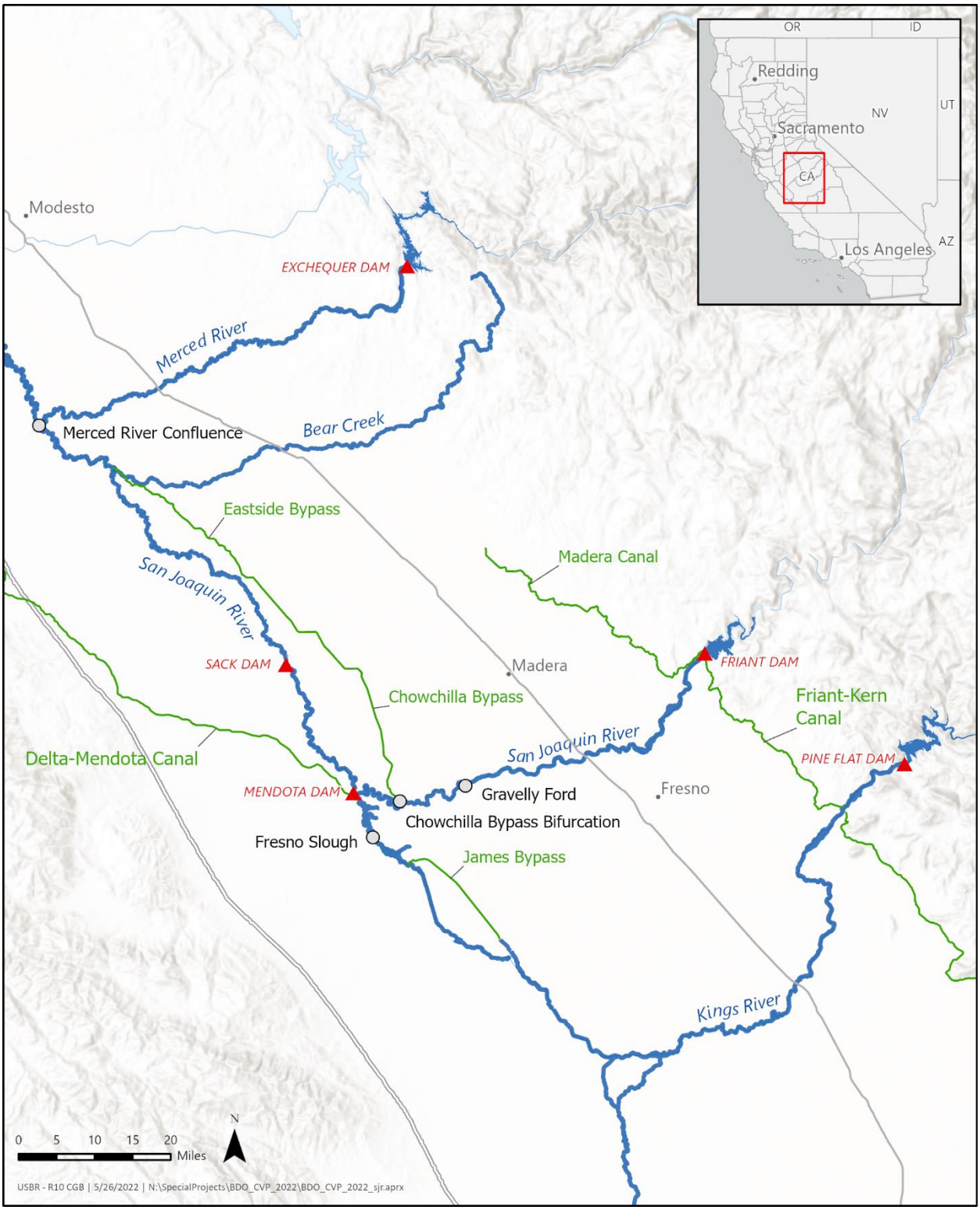


Figure E-7. Map of the Friant Division and San Joaquin River.

Statutory, Regulatory, and Contractual Requirements: (see Appendix A of the Initial Alternatives Report for more details):

- Public Law 74-392 CVP Re-Authorization Act
- Public Law 111-11 (San Joaquin River Restoration Settlement Act)
- SWRCB D-1641
- 1995 Bay Delta Water Quality Control Plan (Bay-Delta Plan)
- USACE Public Notice 5820A Amended
- Friant Division Riparian Holding Contracts
- Friant Division Water Service Contracts

Reclamation would operate the Friant Division consistent with the San Joaquin River Restoration Program Record of Decision.

E.3 No Action Alternative

Under the No Action Alternative, Reclamation would operate the CVP consistent with the 2020 Record of Decision implementing the Proposed Action consulted upon for the 2019 Biological Opinions and the reasonable and prudent measures in the incidental take statements. DWR would operate the SWP consistent with the 2020 Record of Decision and the 2020 Incidental Take Permit for the SWP. The 2020 Record of Decision for the CVP and SWP and the 2020 Incidental Take Permit for the SWP represent current management direction or intensity pursuant to 43 CFR Section 46.30.

Under the No Action Alternative, Reclamation and DWR would operate consistent with authorizing legislation, water rights, contracts, and agreements as described by common components. These include Water Quality Control Plans, the COA, CVP and SWP Water Contracts, Settlement and Exchange Contracts, and Record of Decisions on independent related activities not proposed for modification and reinitiation of consultation under this effort. The No Action Alternative is summarized below.

E.3.1 Sacramento River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. The No Action Alternative for variable components with alternatives are summarized below.

E.3.1.1 Ramping Rates

Ramping rates for Keswick Dam between July 1 and March 31 would be reduced between sunset and sunrise:

- Keswick releases >6,000 cfs, reductions in releases may not exceed 15% per night, and no more than 2.5% per hour.

- Keswick releases 4,000 cfs to 5,999 cfs reductions in releases may not exceed 200 cfs per night, or 100 cfs per hour.
- Keswick releases between 3,250 cfs and 3,999 cfs; reductions in releases may not exceed 100 cfs per night.

Ramping rates do not apply during flood control or if needed for facility operational concerns. The working groups may also determine a need for a variance.

E.3.1.2 Fall and Winter Refill and Redd Maintenance

Under the No Action Alternative, Reclamation would rebuild storage and coldwater pool for the subsequent year. Maintaining releases to keep late spawning winter-run Chinook salmon redds underwater may drawdown storage necessary for water temperature management in a subsequent year. Reclamation would minimize effects by conducting a risk analysis of the remaining winter-run Chinook salmon redds, the probability of sufficient cold water in a subsequent year, and a conservative distribution and timing of subsequent winter-run Chinook salmon redds. If the combined productivity of the remaining redds plus a conservative scenario for the following year is less than the productivity of maintaining releases, Reclamation would reduce releases to rebuild storage. The conservative scenario for the following year would include a 75% (dry) hydrology; 75% (warm) climate; a median distribution for the timing of redds; and the ability to remain within Tier 3 or higher (colder) tiers. The forecast for flows in the fall would include approved water transfers that may occur during this period.

Demands by the wildlife refuges, upstream CVP contractors, and the SRS Contractors in October result in Keswick Dam releases that are generally not maintained throughout the winter due to needs to store water for beneficial uses the following year. These releases result in some early fall-run Chinook salmon redds being dewatered at winter base flows. If, based on the above analysis, Reclamation determines releases need to be reduced to rebuild storage, targets for winter base flows (December 1 through the end of February) from Keswick Dam would be set in October based on Shasta Reservoir end-of-September (EOS) storage. These targets would be set based on EOS storage and the current hydrology after accounting for winter-run Chinook salmon redd stranding. Base flows would be set based on historical performance to accomplish improved refill capabilities for Shasta Reservoir to build coldwater pool for the following year. Table E-4 shows examples of possible Keswick Dam releases based on Shasta Reservoir storage condition; these would be refined through future modeling efforts as part of the seasonal operations planning.

Table E-4. Keswick Dam Example Release Schedule for EOS Storage.

Keswick Release (cfs)	Shasta EOS Storage (MAF)
3,250	≤2.2
4,000	≤2.8
4,500	≤3.2
5,000	>3.2

EOS = end-of-September; cfs = cubic feet per second; MAF = million acre-feet.

High storage years are not necessarily correlated with a following wetter fall and winter. As a result, Reclamation would manage the real time releases based on conditions observed. In scenarios where higher storage exists at EOS but the fall hydrology is dry (generally defined as below 90% exceedance of historical hydrology), Reclamation would coordinate with appropriate agencies, including NMFS and CDFW at a minimum, to reduce flows below those described in the table, if possible.

E.3.1.3 Spring Pulse Flows

Under the No Action Alternative, Reclamation would release spring pulse flows of up to 150 TAF to help spring-run Chinook salmon juvenile out-migration when the projected total May 1 Shasta Reservoir storage indicates a likelihood of sufficient cold water to support summer coldwater pool management, and the pulse does not interfere with the ability to meet performance objectives or other anticipated operations of the reservoir.

Reclamation would evaluate the projected May 1 Shasta Reservoir storage at the time of the February forecast to determine whether a spring pulse would be allowed in March, and would evaluate the projected May 1 Shasta Reservoir storage at the time of the March forecast to determine whether a spring pulse would be allowed in April. If Shasta Reservoir total storage on May 1 is projected to be sufficient for coldwater pool management, Reclamation could make a spring pulse release of up to 150 TAF in coordination with the upper Sacramento River scheduling team. Reclamation would make a determination of whether water could be released without affecting water temperature management; Reclamation uses 4 MAF as a surrogate for planning and analysis. Reclamation would not make pulse flow releases during times that Shasta Reservoir is releasing flood flows or if the release would interfere with the ability to meet other anticipated demands on the reservoir. Figure E-8 summarizes this operational regime. This figure shows timing of pulse flows potentially in March, April, or May, but the pulse flow total volume during the March through May period is up to 150 TAF total.

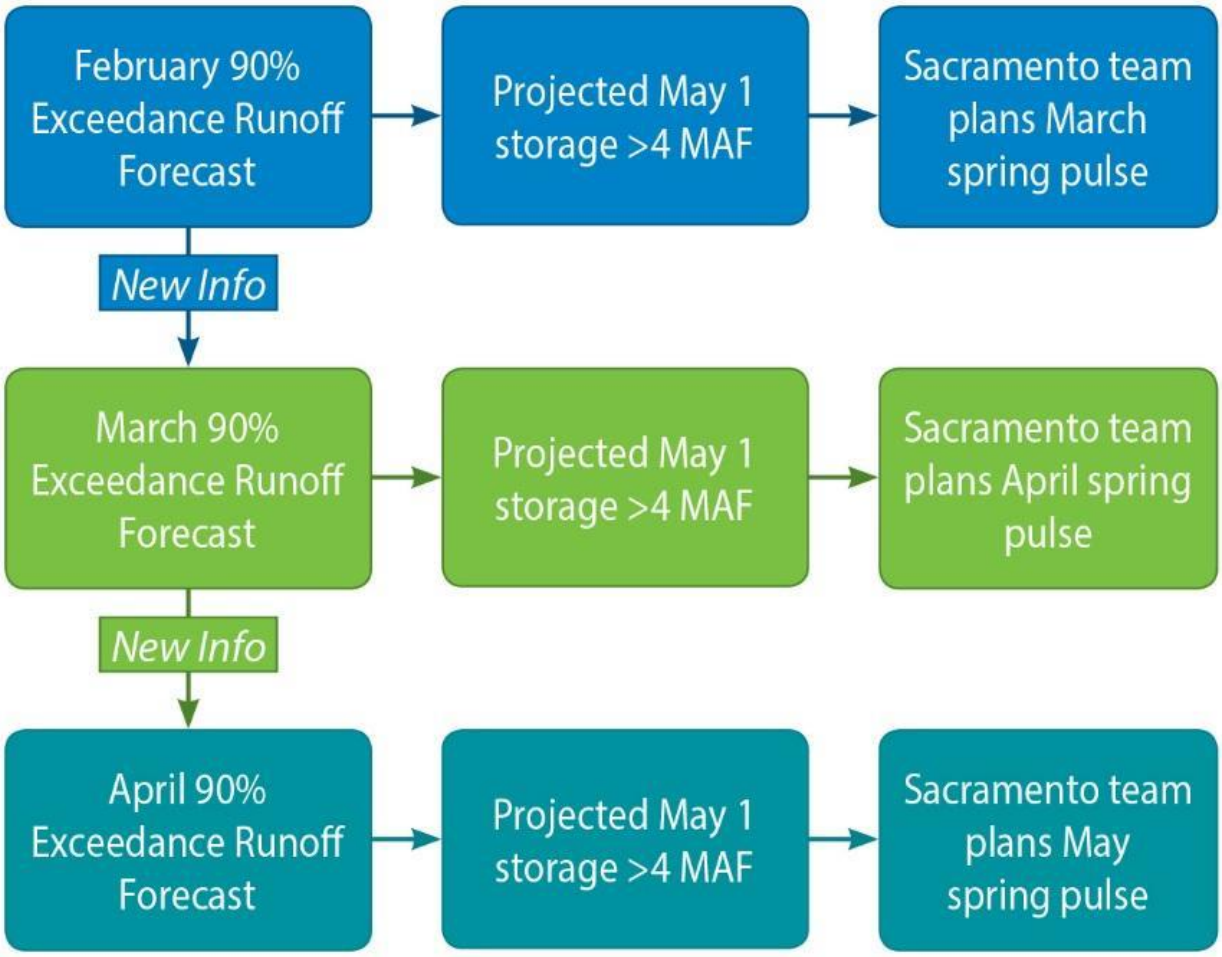


Figure E-8. Lake Shasta Spring Pulse Flow Operations.

E.3.1.4 Water Temperature Management

Under the No Action Alternative, Reclamation would operate the Shasta TCD to provide water temperature management while minimizing impacts on power generation as described in the 2020 Record of Decision. The 2020 Record of Decision described a tiered strategy that allows for strategically selected water temperature objectives, based on projected total storage and coldwater pool, meteorology, Delta conditions, and habitat suitability for incoming fish population size and location. The tiered strategy recognizes that cold water is a scarce resource that can be managed to achieve desired water temperatures for fisheries objectives.

The closer Shasta Reservoir is to full by the end of May, the greater the likelihood of being able to meet the winter-run Chinook salmon temperature control criteria throughout the entire temperature control season. If Shasta Reservoir storage is high enough to use the Shasta Reservoir TCD upper shutters by the end of May, Reclamation can maximize the coldwater pool potential. Figure E-9 provides an approximate rule of thumb for the relationship between temperature compliance, total storage in Shasta Reservoir, and coldwater pool in Shasta Reservoir. Figure E-9 also provides an approximate expected performance for tiers based on total storage and coldwater pool in Shasta Reservoir.

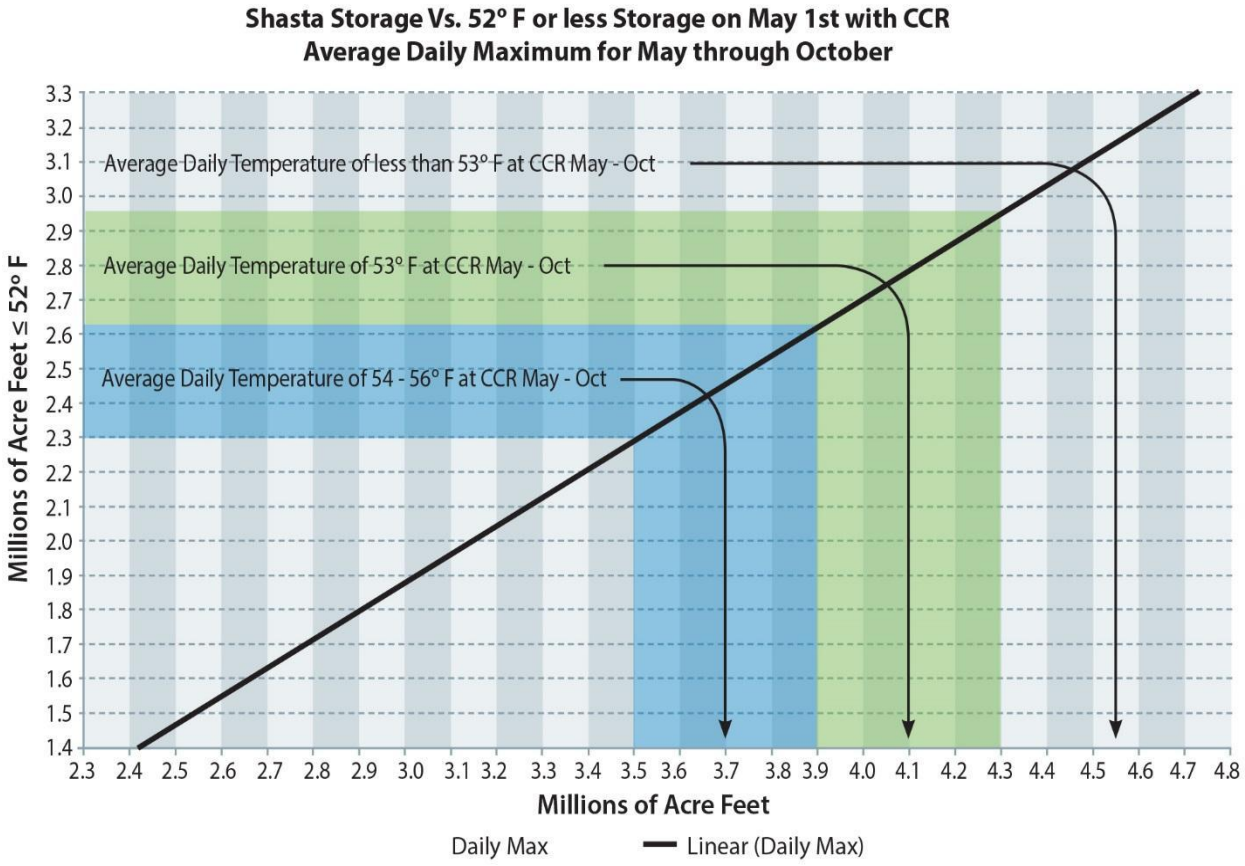


Figure E-9. Relationship between Temperature Compliance, Total Storage in Shasta Reservoir, and Coldwater Pool in Shasta Reservoir.

Under the No Action Alternative, Reclamation would operate the Shasta Reservoir TCD to continue providing water temperature management in accordance with CVPIA Section 3406(b)(6) while minimizing impacts on power generation. Coldwater pool is defined as the volume of water in Shasta Reservoir that is less than 52°F, which Reclamation would determine based on monthly (or more frequently) reservoir temperature profiles. The Sacramento River above Clear Creek gage is a surrogate for the downstream extent of most winter-run Chinook salmon redds. Water temperature management would start after May 15 or when the monitoring working group determines, based on real-time information, that winter-run Chinook salmon have spawned, whichever is later. Water temperature management would end October 31 or when the monitoring working group determines, based on real-time monitoring, that 95% of winter-run Chinook salmon eggs have hatched and alevin have emerged, whichever is earlier.

Reclamation would address coldwater management using a tiered strategy that allows for strategically selected water temperature objectives, based on projected total storage and coldwater pool, meteorology, Delta conditions, and habitat suitability for incoming fish population size and location. The tiered strategy recognizes that cold water is a scarce resource that can be managed to achieve desired water temperatures for fisheries objectives. Figure E-10 provides a decision tree explaining the decision points for Shasta Reservoir temperature management.

Reclamation would provide a draft temperature management plan to the Sacramento River Temperature Task Group (SRTTG) in April for its review and comment, consistent with WRO 90-5. The draft temperature management plan would describe which of the four tiers Reclamation forecasts for that year's summer water temperature management season, along with a water temperature modeling scenario and the operations forecast. The scenario would include projected reservoir releases, assumed meteorological conditions, and anticipated water temperatures and target locations for the planned water temperature targets. Reclamation expects that tolerances would be based on conditions and modeling for that year.

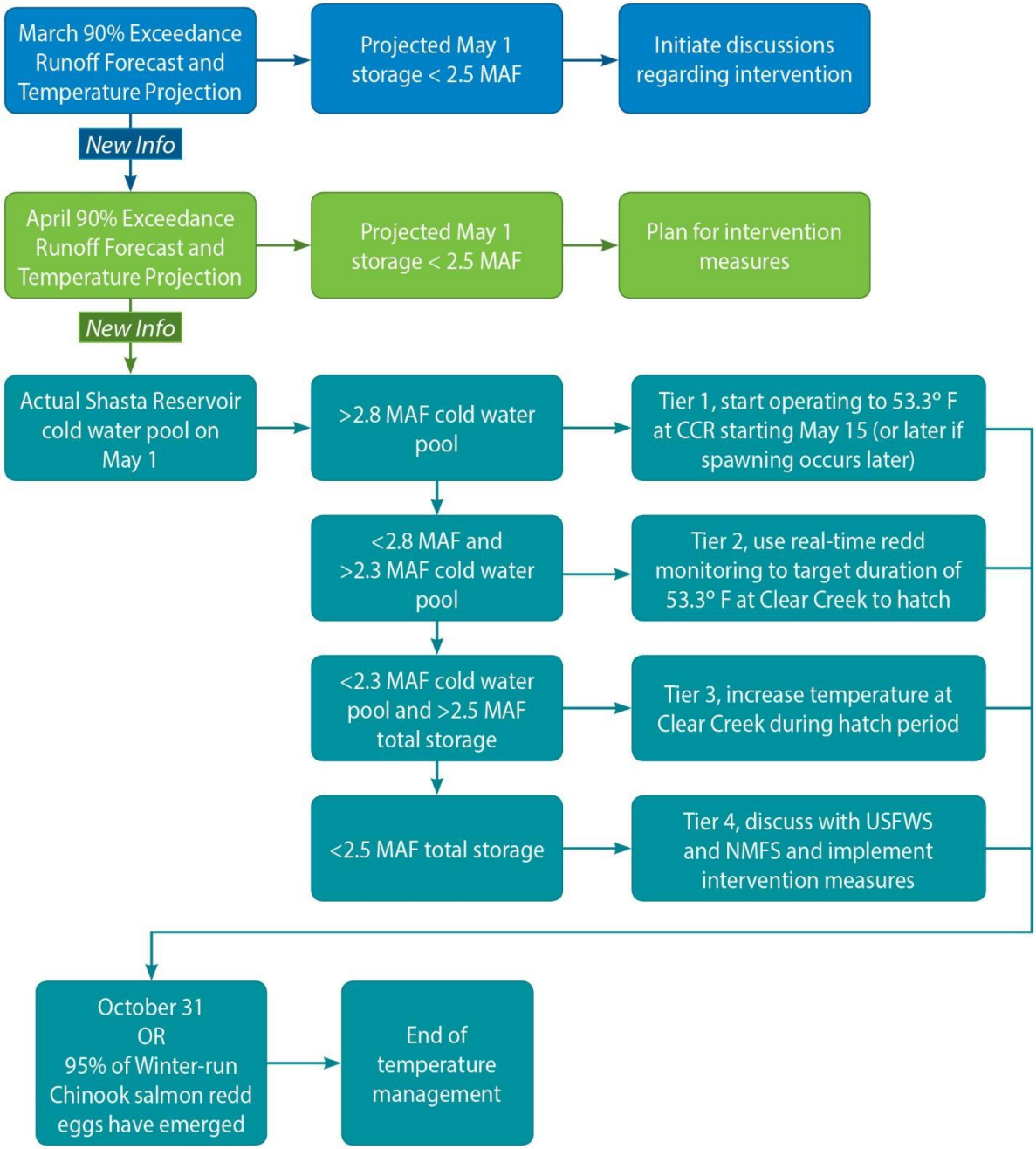


Figure E-10. Decision Tree for Shasta Reservoir Temperature Management.

Commitment to Coldwater Management Tiers

Once the initial tier is selected by May 15th, Reclamation would not cause a shift into a warmer tier during real-time implementation of the Shasta Coldwater Management Plan except in the event of responding to emergency and/or unforeseen conditions. Reclamation would reevaluate the temperature management plan (and associated tier) at least monthly and would notify NMFS within two business days of determining a potential change to the plan is necessary. Reclamation may be able to adjust operations to overcome unexpected events without changing to a lower tier. Should Reclamation be unable to remain within the same or cooler tier identified by the Shasta Cold Water Pool Management Plan, Reclamation would coordinate with NMFS on the need to charter an independent panel, at the end of the temperature management season, consistent with "Chartering of Independent Panels) under Section E.4.10, *Governance* (Alternative 1). The purpose of the independent review would be to evaluate the conditions experienced during the years under review, the success of the implementation of the tiered strategy, the effect of the implementation on the species, and, if needed, to develop recommendations to improve its implementation.

Upper Sacramento Performance Metrics

Reclamation would apply performance metrics for assessing coldwater management under the different tiers. The objective is to ensure that the performance falls within the modeled range, and shows a tendency towards performing at least as well as the distribution produced by the simulation modeling of No Action Alternative. If No Action Alternative performance falls outside the performance metrics in any single year, Reclamation would work with NMFS to determine if an independent panel is necessary. If necessary, the independent panel process would move forward as described in Section E.3.10, *Governance* (No Action Alternative).

E.3.1.5 Winter-Run Chinook Salmon Supplementation

Under the No Action Alternative, Reclamation would increase use of Livingston Stone National Fish Hatchery (NFH) during droughts to increase production of winter-run Chinook salmon. Increased production during drought could help populations continue over multiple years. Increased production would aim to offset temperature dependent mortality on the Sacramento River. Reclamation would consider New Zealand or Great Lake winter-run Chinook salmon stock for augmenting conservation hatchery stock to improve heterozygosity. Reclamation would continue to coordinate with USFWS and NMFS as part of the "Drought and Dry Year Actions to determine the need to improve the facility and associate collection facilities. Improvements may include permanent chillers, additional tanks, and other features.

E.3.1.6 Raised Shasta Dam

The No Action Alternative anticipated a separate process and EIS for the Shasta Dam Raise; therefore, no further description will be provided in this EIS.

E.3.1.7 Spawning and Rearing Habitat Restoration

The No Action Alternative reflects the 2020 Record of Decision evaluation of habitat restoration in concert with operations. Reclamation's habitat programs will continue through separate environmental compliance and future restoration plans as independent programs; therefore, no further discussion will be provided in this EIS.

E.3.2 Clear Creek

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. The No Action condition for variable components with alternatives are described below.

E.3.2.1 Minimum Instream Flows

Reclamation would release Clear Creek flows in accordance with the August 11, 2000 agreement between Reclamation, USFWS, and CDFW and the April 15, 2002 SWRCB permit, which established minimum flows to be released to Clear Creek at Whiskeytown Dam. Reclamation would release a minimum base flow in Clear Creek of 200 cfs from October through May and 150 cfs from June through September in all water year types except critical water year types. In critical years, Clear Creek base flows may be reduced below 150 cfs based on available water from Trinity Reservoir. Additional flow may be required for water temperature management during the fall.

E.3.2.2 Pulse Flows

Reclamation would create pulse flows for both channel maintenance and spring attraction flows. For spring attraction flows, Reclamation would release 10 TAF up to the safe release capacity (approximately 900 cfs, depending on reservoir elevation and downstream capacity), in all water year types except for critical water year types to be shaped by the Clear Creek Implementation Team in coordination with Reclamation's Central Valley Operations Office. For channel maintenance flows, Reclamation would release 10 TAF from Whiskeytown Dam up to the safe release capacity, in all water year types except dry and critical (based on the Sacramento Valley index) to be shaped by the Clear Creek Implementation Team in coordination with Reclamation Central Valley Operations Office.

E.3.2.3 Water Temperature Management

The outlet from Whiskeytown Reservoir to Clear Creek is equipped with outlets at two different elevations. Releases can be made from either or both outlets to manage downstream water temperature releases. Reclamation would manage Whiskeytown Reservoir releases to meet a daily average water temperature of 60°F at the Igo gage from June 1 through September 15 and 56°F or less at the Igo gage from September 15 to October 31. Reclamation may not be able to meet these water temperatures in critical or dry water year types. In those years, Reclamation would operate as close to these water temperatures as possible. Additional flow may be released for water temperature management during the fall if water is available.

E.3.2.4 Spawning and Rearing Habitat Restoration

The No Action Alternative reflects the 2020 Record of Decision evaluation of habitat restoration in concert with operations. Reclamation's habitat programs will continue through separate environmental compliance and future restoration plans as independent programs; therefore, no further discussion will be provided in this EIS.

E.3.3 American River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. The No Action Alternative variable components are described below.

E.3.3.1 Minimum Instream Flows (Minimum Release Requirement)

Reclamation would implement the minimum release requirement (MRR) proposed by the Sacramento Area Water Forum in 2017, as modified by the 2020 Record of Decision, based on the month and annual hydrology, Figure E-11 and Figure E-12.

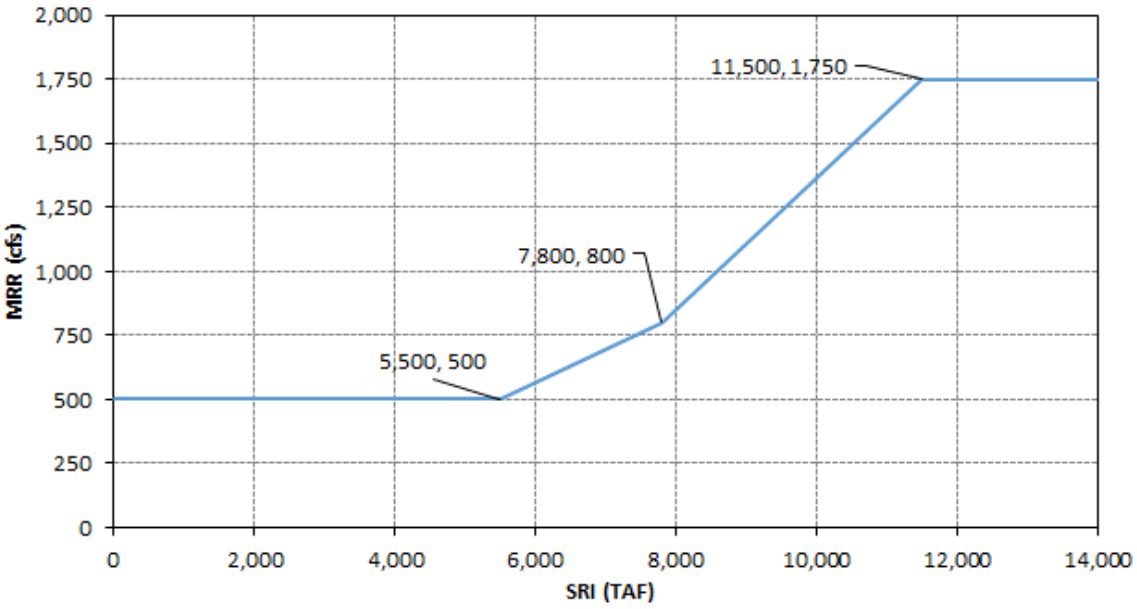


Figure E-11. January Relationship Between the Sacramento River Index or American River Index and the Minimum Release Requirements.

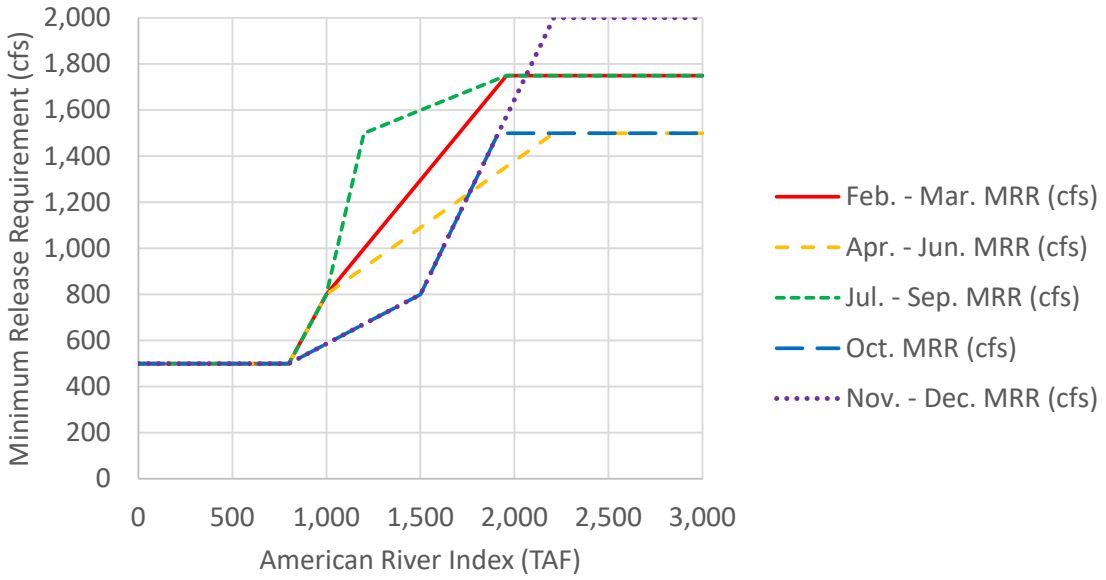


Figure E-12. February through December Relationship Between the American River Index and the Minimum Release Requirements.

Reclamation will use the 90% exceedance from the Sacramento River Index in January and the American River Index in February through December to develop the MRR (with certain spills subtracted) through the Governance process. MRR calculations use the hydrologic indices reported in the first Bulletin 120 of each month.

E.3.3.2 Spring Pulse Flows

Reclamation will implement a spring pulse in years that the MRR for March (based on the March forecast) is between 1,000 cfs and 1,500 cfs. The peak flow of the pulse flow would be three times the March MRR, even if implemented in April or May, but no higher than 4,000 cfs and lasting two days. Following two days at the peak flow, Nimbus Dam releases would be decreased at no more than 500 cfs per day and no more than 100 cfs per hour. Changes in Nimbus Dam releases would occur at night, if possible.

Reclamation, through ARG, will develop a pulse flow schedule. Reclamation, through Governance, may also facilitate an additional spring pulse flow event if water is made available from non-CVP sources, or if there is flexibility to shape planned releases in a more variable schedule.

E.3.3.3 Redd Dewatering Adjustments

In January, the MRR can only decrease and cannot be less than 70% of the December MRR. In February, the MRR cannot be less than 70% of the December MRR. Based on the January MRR, Table E-5 shows the minimum flow for steelhead redds through May. If the February MRR is higher than January, the February MRR is used through May.

Table E-5. Steelhead Redd Dewatering Protective Adjustment-based MRR for February through May.

January or February MRR (cfs)	Steelhead Redd MRR through May (cfs)
≤700	500
800	520
900	580
1,000	640
1,100	710
1,200	780
1,300	840
1,400	950
1,500	1,030
1,600	1,100
1,700	1,180
1,800	1,250

cfs= cubic feet per second; MMR = minimum release requirement.

Reclamation, through Governance, will schedule MRR releases consistent with the implementation of redd dewatering protective adjustments to limit potential redd dewatering January through May. Values between those in the table would be linearly interpolated.

The purpose of redd dewatering protective adjustments is to protect fall-run Chinook salmon redds in January and February and steelhead redds during February through May from changes due to the MRR. Releases can be above the MRR in the fall and winter, the period during which MRR does not control operations.

E.3.3.4 Water Temperature Management

By June 15, Reclamation, through Governance, will annually prepare a Temperature Management Plan (TMP) for the summer through fall. By May 15, Reclamation will provide a draft TMP to solicit input. The TMP will contain: (1) forecasts of hydrology and storage; and (2) a modeling run or runs, using these forecasts, demonstrating what temperature compliance schedule can be attained. Reclamation will plan shutter configurations to attain the best possible (lowest numbered) temperature schedule. The priority for use of the lowest water temperature control shutters at Folsom Dam, within operational constraints, shall be to achieve the water temperature requirement for steelhead, and may also be used to provide cold water for fall-run Chinook salmon spawning. During plan implementation, if the temperature is exceeded for three consecutive days, or is exceeded by more than 3°F for a single day, Reclamation, will notify NMFS through Governance, and outline steps to realign Lower American River water temperatures with the TMP.

Reclamation will implement the Automated Temperature Selection Procedure (ATSP), Appendix M of the Initial Alternatives Report in developing the TMP. Each ATSP schedule determines a monthly series of water temperature targets (for daily average water temperature) at the Watt Avenue bridge. Schedule 1 has a water temperature upper limit of 63°F from May through September, and 56°F in October and November. Schedule 78 has a water temperature upper limit of 72°F from May through November. Schedules 2 through 77 each represent a change in a single month's upper temperature limit by 1.0°F. The ATSP may be modified as follows:

- For Schedule 28 or higher (greater than 65°F at Watt Avenue Bridge, May through September), the TMP may consider a temperature location at Hazel Avenue.
- For greater than 65°F at Hazel Avenue bridge for May through September, the TMP will include an evaluation of whether modified Folsom Reservoir operations could support an improved temperature schedule (e.g., an alternate release schedule over the summer).
- For greater than 68°F at Hazel Avenue for May through September, the TMP will evaluate a power bypass during the summer and/or fall.
- For greater than 56°F at Hazel Avenue in November, the TMP will evaluate a power bypass.

E.3.3.5 Spawning and Rearing Habitat Restoration

The No Action Alternative reflects the 2020 Record of Decision evaluation of habitat restoration in concert with operations. Reclamation's habitat programs will continue through separate

environmental compliance and future restoration plans as independent programs; therefore, no further discussion will be provided in this EIS.

E.3.4 Delta

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. The No Action Alternative variable components are described below.

E.3.4.1 Old and Middle River Reverse Flow Management

Reclamation and DWR would operate the CVP and SWP in a manner that maximizes exports while minimizing entrainment of fish and protecting critical habitat. From the onset of OMR management to the end, Reclamation and DWR would operate to an OMR index no more negative than a 14-day moving average of -5,000 cfs, unless a storm event occurs. Onset occurs after a "First Flush" event or after January 1 if more than 5% of listed salmonid species are present. Reclamation and DWR would manage to more positive OMR for turbidity bridge avoidance, larval and juvenile Delta smelt protections, cumulative loss thresholds, and single year loss thresholds. DWR would additionally manage to daily loss thresholds and additional smelt protections. OMR offramp would occur when salmonids have exited the Delta and/or upon exceeding water temperature thresholds.

Reclamation and DWR would operate the CVP and SWP in a manner that maximizes exports while minimizing entrainment of fish and protecting critical habitat. Net flow from OMR provides a surrogate indicator for how export pumping at Banks and Jones Pumping Plants influences hydrodynamics in the south Delta. OMR management, in combination with other environmental variables, can minimize or avoid the entrainment of fish in the south Delta and at CVP and SWP salvage facilities. Reclamation and DWR would maximize exports by incorporating real-time monitoring of fish distribution, turbidity, temperature, hydrodynamic models, and entrainment models into the decision support for OMR management to focus protections for fish when necessary and provide flexibility where possible, consistent with WIIN Act Sections 4002 and 4003. Estimates of species distribution would be described by multiagency, Delta-focused technical teams. From the onset of OMR management to the end, Reclamation and DWR would operate to an OMR index no more negative than a 14-day moving average of -5,000 cfs unless a storm event occurs (see below for storm-related OMR flexibility). Grimaldo et al. (2017) indicate that -5,000 cfs OMR is an inflection point for fish entrainment. The OMR could be more positive than -5,000 cfs if additional real-time OMR restrictions are triggered (described below), or constraints other than OMR control exports. Reclamation and DWR would operate to an OMR index computed using an equation. An OMR index allows for shorter-term operational planning and real-time adjustments. Reclamation and DWR would make a change to exports within three days of the trigger when monitoring, modeling, and criteria indicate protection for fish is necessary. The three-day trigger would allow for efficient power scheduling.

Start of OMR Management

Reclamation and DWR would start OMR management when one or more of the following conditions have occurred:

- **Integrated Early Winter Pulse Protection (First Flush Turbidity Event):** Reclamation and DWR would reduce exports for 14 consecutive days so that the 14-day averaged OMR index for the period would not be more negative than −2,000 cfs, in response to "First Flush" conditions in the Delta. The population-scale migration of Delta smelt is believed to occur quickly in response to inflowing fresh water and turbidity (Grimaldo et al. 2009; Sommer et al. 2011). Thereafter, best available scientific information suggests that fish make local movements, but there is no evidence for further population-scale migration (Polanksy et al. 2018). "First flush" may be triggered between December 1 and January 31 and include:
    - Running 3-day average of the daily flows at Freeport is greater than 25,000 cfs; and
    - Running 3-day average of the daily turbidity at Freeport is 50 Nephelometric Turbidity Unit (NTU) or greater; or
    - Real-time monitoring indicates a high risk of migration and dispersal into areas at high risk of future entrainment.
  - This "First Flush" may only be initiated once during the December through January period and would not be required if:
    - Spent female Delta smelt are collected in a monitoring survey.
- **Salmonids Presence:** After January 1, if more than 5% of any one or more salmonid species (wild young-of-year winter-run Chinook salmon, wild young-of-year spring-run Chinook salmon, or wild California Central Valley steelhead) are estimated to be present in the Delta as determined by their appropriate monitoring working group based on available real-time data, historical information, and modeling.

Additional Real-Time OMR Restrictions and Performance Objectives

Reclamation and DWR would manage to a more positive OMR than -5,000 cfs based on the following conditions:

- **Turbidity Bridge Avoidance (South Delta Turbidity):** After the Integrated Early Winter Pulse Protection or February 1 (whichever comes first) and until a ripe or spent female is detected or April 1 (whichever is first), Reclamation and DWR would manage exports in order to maintain daily average turbidity in Old River at Bacon Island (OBI) at a level of less than 12 NTU. The purpose of this action is to minimize the risk to adult Delta smelt in the OMR corridor, where they are subject to higher entrainment risks. This action seeks to avoid the formation of a turbidity bridge from the San Joaquin River shipping channel to the south Delta fish facilities, which historically has been associated with elevated salvage of pre-spawning adult Delta smelt. If the daily average turbidity at Bacon Island could not be maintained at less than 12 NTU, Reclamation and DWR would manage exports to achieve an OMR no more negative than −2,000 cfs until the daily average turbidity at Bacon Island drops below 12 NTU. However, if five consecutive days of OMR less negative than −2,000 cfs do not reduce turbidity at Bacon Island below 12 NTU in a given month, Reclamation and DWR could determine that OMR restrictions to manage turbidity are infeasible, and will instead implement an OMR target that is

deemed protective, based on turbidity, adult Delta smelt distribution, and salvage, but no more negative than −5,000 cfs.

- Reclamation and DWR recognize that readings at individual sensors or localized groups of sensors can generate spurious results in real-time. To avoid triggering an OMR flow action during a sensor error or a localized turbidity spike that might be caused by local flows or a wind-driven event, Reclamation and DWR will consider and review data from other locations. In the event that the daily average turbidity at OBI is 12 NTU (or greater) and Reclamation and DWR believe that a Turbidity Bridge Avoidance action is not warranted based on additional data sources (isolated and/or wind-driven turbidity event at OBI), Reclamation and DWR will take no additional action and provide the supporting information to USFWS within 24 hours.

- **Larval and Juvenile Delta Smelt:** Reclamation and DWR would use results produced by USFWS approved life cycle models to manage the annual entrainment levels of larval/juvenile Delta smelt. The USFWS will coordinate with the Delta Fish Monitoring Working Group to identify a Delta Smelt recruitment level that Reclamation and DWR can use in OMR management. The life cycle models statistically link environmental conditions to recruitment, including factors related to loss as a result of entrainment such as OMR flows. In this context, recruitment is defined as the estimated number of post-larval Delta smelt in June per number of spawning adults the prior February–March.

- Reclamation and DWR, in coordination with the USFWS, will operationalize the life cycle model results through the use of real-time monitoring for the spatial distribution of Delta smelt. On or after March 15 of each year, if QWEST (the average daily flow traveling past Jersey Point, which represents the net flow in the lower San Joaquin River) is negative, and larval or juvenile Delta smelt are within the entrainment zone of the pumps based on real-time sampling of spawning adults or young of year life stages, Reclamation and/or DWR will run hydrodynamic models and forecasts of entrainment, informed by the Enhanced Delta Smelt Monitoring Program or other relevant survey data to estimate the percentage of larval and juvenile Delta smelt that could be entrained. If necessary, Reclamation will manage exports to limit entrainment to be protective based on the modeled recruitment levels. Reclamation and DWR will re-run hydrodynamic models when operational changes or new sampling data indicate a potential change in entrainment risk. This process will continue until the offramp criteria have been met as described in *End of OMR Management*. In the event the life cycle models cannot be operationalized in a manner that can be used to inform real-time operations then Reclamation, DWR and the USFWS will coordinate to develop an alternative plan to provide operational actions protective of this life stage.

- **Cumulative Loss Threshold:** Reclamation and DWR would avoid exceeding cumulative loss thresholds over the duration of the 2019 Biological Opinions for:

    - Natural winter-run Chinook salmon (cumulative loss = 8,738)
    - Hatchery winter-run Chinook salmon (cumulative loss = 5,356)

        - Natural Central Valley Steelhead from December through March (cumulative loss = 6,038)
        - Natural Steelhead from April 1 through June 15 (cumulative loss = 5,826)
    - Natural Steelhead would be separated into two time periods to protect San Joaquin origin fish that historically appear in the Mossdale trawls later than Sacramento origin fish. The loss threshold and loss tracking for hatchery winter-run Chinook salmon does not include releases into Battle Creek. Loss (for development of thresholds and ongoing tracking) for Chinook salmon are based on length-at-date criteria.
    - The cumulative loss thresholds would be based on cumulative historical loss from 2010 through 2018. Reclamation's and DWR's performance objectives are intended to avoid loss such that this cumulative loss threshold (measured as the 2010-2018 average cumulative loss multiplied by 10 years) would not be exceeded by 2030.
    - If, at any time prior to 2024, Reclamation and DWR would exceed 50% of the cumulative loss threshold, Reclamation and DWR would convene an independent panel to review the actions contributing to this loss trajectory and make recommendations on modifications or additional actions to stay within the cumulative loss threshold, if any.
    - In the year 2024, Reclamation and DWR would convene an independent panel to review the first five years of actions and determine whether continuing these actions are likely to reliably maintain the trajectory associated with this performance objective for the duration of the period.
    - If, during real-time operations, Reclamation and DWR would exceed the cumulative loss threshold, Reclamation and DWR would immediately seek technical assistance from USFWS and NMFS, as appropriate, on the coordinated operation of the CVP and SWP for the remainder of the OMR management period. In addition, Reclamation and DWR would, prior to the next OMR management season, charter an independent panel to review the OMR Management Action. The purpose of the independent review would be to evaluate the efficacy of actions to reduce the adverse effects on listed species under OMR management and the non-flow measures to improve survival in the south Delta and for San Joaquin origin fish.
- **Single-Year Loss Threshold:** In each year, Reclamation and DWR would avoid exceeding an annual loss threshold equal to 90% of the greatest salvage loss that occurred in the historical record from 2010 through 2018 for each of:
        - Natural Winter-Run Chinook Salmon (loss = 1.17% of juvenile production estimate [JPEs])
        - Hatchery Winter-Run Chinook Salmon (loss = 0.12% of JPE)

    - Natural Central Valley Steelhead from December through March (loss = 1,414)
    - Natural Central Valley Steelhead from April through June 15 (loss = 1,552)
- Natural Central Valley Steelhead are separated into two time periods to protect San Joaquin Origin fish that historically appear in the Mossdale trawls later than Sacramento origin fish. The loss threshold and loss tracking for hatchery winter-run Chinook salmon does not include releases into Battle Creek. Loss (for development of thresholds and ongoing tracking) for Chinook salmon would be based on length-at-date criteria.
- During the year, if Reclamation and DWR would exceed the annual loss from 2010 through 2018, Reclamation and DWR would review recent fish distribution information and operations with the fisheries agencies at the Water Operations Management Team (WOMT) and seek technical assistance on future planned operations. Any agency could elevate from WOMT to a Directors discussion, as appropriate.
- During the year, if Reclamation and DWR exceed 50% of the annual loss threshold, Reclamation and DWR would restrict OMR to a 14-day moving average OMR index of no more negative than -3,500 cfs, unless Reclamation and DWR determine that further OMR restrictions are not required to benefit fish movement because a risk assessment shows that the risk is no longer present based on real-time information.
- The -3,500 cfs OMR operational criterion adjusted and informed by this risk assessment would remain in effect for the rest of the season. Reclamation and DWR would seek NMFS technical assistance on the risk assessment and real-time operations.
- During the year, if Reclamation and DWR exceed 75% of the annual loss threshold, Reclamation and DWR would restrict OMR to a 14-day moving average OMR index of no more negative than -2,500 cfs, unless Reclamation and DWR determine that further OMR restrictions are not required to benefit fish movement because a risk assessment shows that the risk is no longer present based on real-time information.
- The -2,500 cfs OMR operational criterion adjusted and informed by this risk assessment would remain in effect for the rest of the season. Reclamation and DWR would seek NMFS technical assistance on the risk assessment and real-time operations.
- Risk assessments (identified above): Reclamation and DWR would evaluate and adjust OMR restrictions under this section by preparing a risk assessment that considers several factors including, but not limited to, real-time monitoring, historical trends of salmonids exiting the Delta, entering the south Delta, fish detected in salvage, and relevant environmental conditions. Risks will be

measured against the potential to exceed the next single year loss threshold. Reclamation and DWR would share its risk assessment and supporting documentation with USFWS and NMFS, seek their technical assistance, discuss the risk assessment and future operations with WOMT at its next meeting, and elevate to the Directors as appropriate.

- If, during real-time operations, Reclamation and DWR would exceed the single-year loss threshold, Reclamation and DWR would immediately seek technical assistance from USFWS and NMFS, as appropriate, on the coordinated operation of the CVP and SWP for the remainder of the OMR management period. In addition, Reclamation and DWR would, prior to the next OMR management season, charter an independent panel to review the OMR Management Action. The purpose of the independent review would be to evaluate the efficacy of actions to reduce the effects on listed species under OMR management and the non-flow measures to improve survival in the south Delta and for San Joaquin origin fish.

Reclamation and DWR would continue monitoring and reporting the salvage at the Tracy and Skinner fish facilities. Reclamation and DWR would continue the release and monitoring of yearling Coleman NFH Late-fall-run Chinook salmon as yearling spring-run Chinook salmon surrogates.

Real-Time Decision-Making and Salvage Thresholds

When real-time monitoring demonstrates that criteria in "Additional Real-Time OMR Restrictions and Performance Objectives" are not supported, then Reclamation and DWR may confer with the Directors of NMFS, USFWS, and CDFW if they desire to operate to a more negative OMR than what is specified in this section. Upon mutual agreement, the Directors of NMFS and USFWS may authorize Reclamation and DWR to operate to a more negative OMR than the Additional Real-Time OMR Restrictions, but no more negative than -5,000 cfs. This process would be separate from the risk analysis process referenced above.

Figure E-13 shows OMR management in a decision tree.

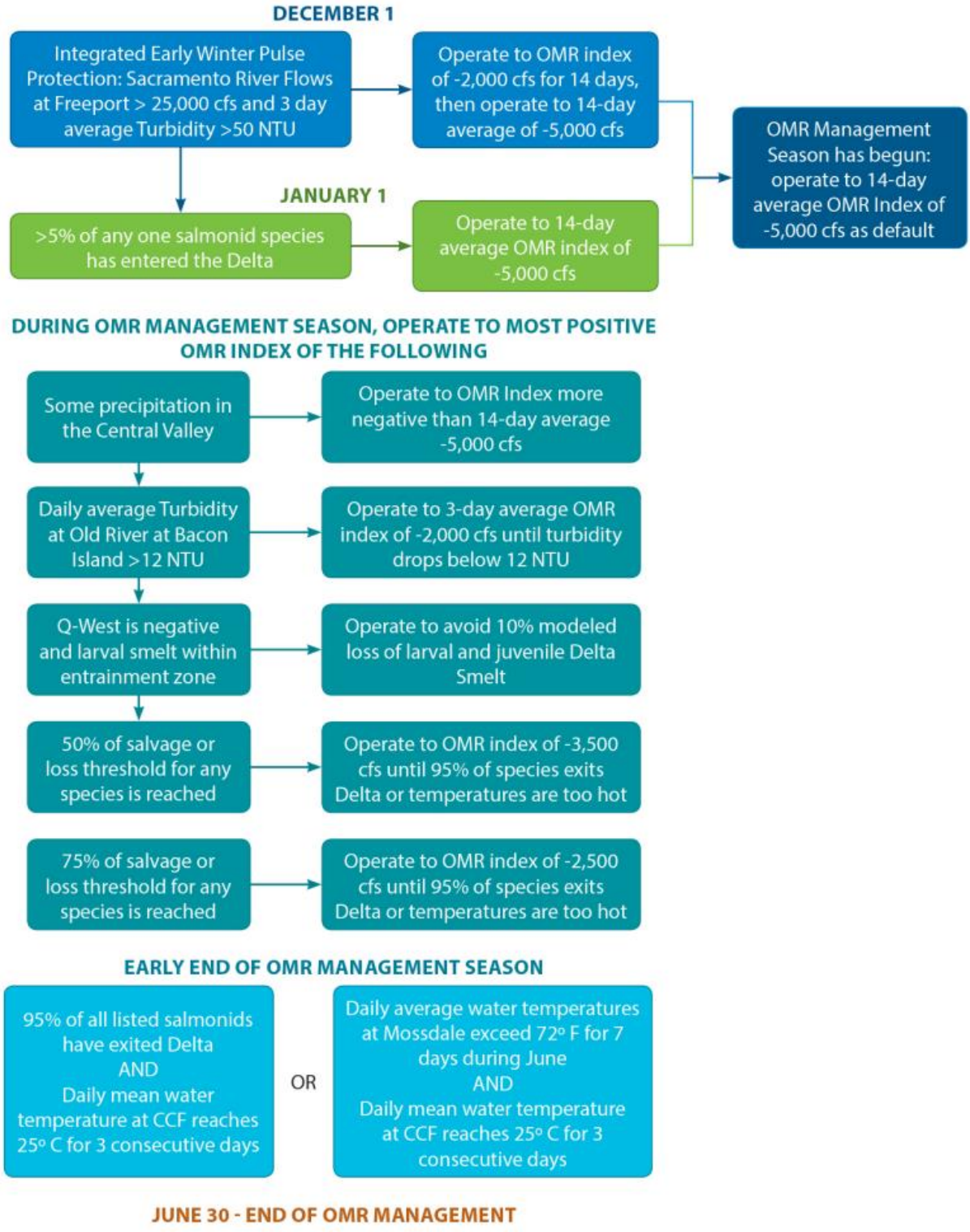


Figure E-13 Decision Tree for OMR Reverse Flow Management.

Storm-Related OMR Flexibility

Reclamation and DWR could operate to a more negative OMR up to a maximum (otherwise permitted) export rate of 14,900 cfs (which could result in a range of OMR values) at Banks and Jones Pumping Plants to capture peak flows during storm-related events. A storm-related event occurs when precipitation falls in the Central Valley and Delta watersheds and Reclamation and DWR determine that the Delta outflow index indicates a higher level of flow available for diversion. Reclamation and DWR would define storm-related events in the first year of implementation. Reclamation and DWR would continue to monitor fish in real-time and would operate in accordance with the thresholds described in *Additional Real-Time OMR Restrictions*.

Under the following conditions, Reclamation and DWR would not pursue storm-related OMR flexibility for capturing peak flows from storm-related events:

- Integrated Early Winter Pulse Protection (above) or Additional Real-Time OMR Restrictions (above) are triggered. Under such conditions, Reclamation and DWR would have already determined that more restrictive OMR is required.
- An evaluation of environmental and biological conditions indicates more negative OMR would likely cause Reclamation and DWR to trigger an Additional Real-Time OMR Restriction (above).
- Salvage of yearling Coleman NFH late-fall run Chinook salmon (as yearling Spring-Run Chinook Salmon surrogates) exceeds 0.5% within any of the release groups.
- Reclamation and DWR identify changes in spawning, foraging, sheltering, or migration behavior beyond those anticipated to occur under OMR management.

Reclamation and DWR would continue to monitor conditions and could resume management of OMR to no more negative than -5,000 cfs if conditions indicate the above offramps are necessary to avoid additional adverse effects. If storm-related flexibility causes the conditions in "Additional Real-Time OMR Restrictions," Reclamation and DWR would implement additional real-time OMR restrictions.

End of OMR Management

OMR criteria may control operations until June 30 (for Delta smelt and Chinook salmon), until June 15 (for Steelhead/Rainbow Trout), or when the following species-specific off ramps have occurred, whichever is earlier:

- **Delta Smelt:** When the daily mean water temperature at CLC reaches 77°F for 3 consecutive days.
- **Salmonids:**
    - When more than 95% of salmonids have migrated past Chipps Island, as determined by their monitoring working group, or
    - After daily average water temperatures at Mossdale exceed 71.6°F for 7 days during June (the 7 days do not have to be consecutive).

E.3.4.2 Spring Delta Outflow

Under the No Action Alternative, Reclamation would operate to D-1641, subject to entrainment protections. DWR would operate to the SWP 2020 Incidental Take Permit, which includes a number of export restrictions and storage of water for release at other times.

E.3.4.3 Barker Slough Pumping Plant

The BSPP would continue to operate under applicable regulatory requirements and remove sediment and aquatic weeds as needed. The annual maximum diversion is 125 TAF and the maximum daily diversion rate for the BSPP is 175 cfs. Sediment accumulates in the concrete apron sediment trap in front of the BSPP fish screens and within the pump wells behind the fish screens. Sediment removal from the sediment trap and the pump wells would be removed as needed.

Accumulated sediment from the apron in front of the fish screen and in the pump wells behind the fish screen would be removed by suction dredge. Removal of sediment from within the pump wells would occur as needed, year-round. Removal of sediment from the apron area in front of the fish screens would occur during summer and early fall months and during the annual NBA shutdown in March. The NBA is annually taken off-line for one-to-two weeks for routine maintenance and repairs, and the BSPP is non-operational during the shutdown.

Aquatic weeds would be removed, as needed, from in front of the fish screens at the BSPP. Aquatic weeds accumulate on the fish screens, blocking water flow, and causing water levels to drop behind the screens in the pump wells. The low water level inside of the pump wells causes the pumps to automatically shut off to protect the pumps from cavitation. The aquatic weed removal system consists of grappling hooks attached by chains to an aluminum frame. A boom truck, staged on the platform in front of the BSPP pumps, would lower the grappling system into the water to retrieve the accumulated aquatic vegetation. The removed aquatic weeds would be transported to two aggregate base spoil sites located near the pumping plant. Removal of aquatic weeds from the fish screens would typically occur during summer and fall months when aquatic weed production is highest. Floating aquatic vegetation (i.e., water hyacinth) may need to be removed during spring months if it becomes entrained into Barker Slough and accumulates in front of the fish screens.

E.3.4.4 Delta Smelt Supplementation

Under the No Action Alternative, Reclamation proposes to continue to fund a two-phase process that would lead to annual supplementation of the wild Delta smelt population with propagated fish within three to five years starting in 2019. The agencies have implemented the first step which included the development of a supplementation strategy that l describes the capacity needed at hatchery facilities to accommodate the Delta smelt production needed to meet genetic and other hatchery considerations with a goal of increasing production to a number and the life stages necessary to effectively augment the population.

The second step will involve using the existing University of California, Davis Fish Conservation and Culture Laboratory (FCCL). FCCL maintains the refugial population of Delta smelt and generates additional captive-bred fish for research. The FCCL has maintained a continuous refugial population since 2008. The FCCL has closed the life cycle of Delta smelt

meaning that they can produce new generations of fish at their facility with or without the addition of new wild spawners, and keep enough progeny alive to repeat the process for multiple generations.

E.3.4.5 Delta Smelt Summer and Fall Habitat

Under the No Action Alternative, Reclamation and DWR would improve Delta smelt food supply and habitat through actions that manage X2 to 80 kilometers (km) in wet and above normal years, operate the SMSCG in below normal and above normal years, and undertake food enhancement actions developed through structured decision making. DWR would operate the SMSCG based on 4 ppt at Belden's Landing.

Reclamation and DWR would use structured decision-making to implement Delta Smelt habitat actions. In the summer and fall (June through October) of below normal, above normal, and wet years, based on the Sacramento Valley Index, the environmental and biological goals are, to the extent practicable, the following:

- Maintain low salinity habitat in Suisun Marsh and Grizzly Bay when water temperatures are suitable;
- Manage the low salinity zone to overlap with turbid water and available food supplies; and
- Establish contiguous low salinity habitat from Cache Slough Complex to Suisun Marsh.

The Delta Smelt Summer and Fall Habitat Action (SFHA) described below is intended to improve Delta smelt food supply and habitat, thereby contributing to the recruitment, growth, and survival of Delta smelt. The current conceptual model is that Delta smelt habitat should include low salinity conditions of 0–6 parts per thousand (ppt), turbidity of approximately 12 NTU or greater, temperatures below 25°C, food availability, and littoral or open water physical habitats (FLaSH Synthesis, pp. 15–25). The SFHA is being undertaken, recognizing that the highest quality habitat in this large geographical region includes areas with complex bathymetry, in deep channels close to shoals and shallows, and in proximity to extensive tidal or freshwater marshlands and other wetlands. The SFHA is to provide these habitat components in the same geographic area through a range of action to improve water quality and food supplies.

The action may include, but is not limited to the following components:

- SMSCG operations for up to 60 days (not necessarily consecutive) in June through October of below normal, above normal, and wet years;
- Project operations to maintain a monthly average 2 ppt isohaline at 80 km from the Golden Gate Bridge in above normal and wet water years in September and October with offramp criteria when:
    - Sufficient habitat acreages in Suisun Marsh, Grizzly Bay, and other adjacent areas are available to support Delta smelt recruitment (e.g., 0-6 ppt at Hunter's Cut, non-lethal temperatures, etc.);

- Suitable recruitment projections based on USFWS approved lifecycle modeling and/or monitoring to indicate a positive trend in Delta smelt and a determination that the SFHA is not necessary to continue that trend; or
- The absence of Delta smelt in target areas based on Enhanced Delta Smelt Monitoring Program or similar sampling; or other factors that would limit the benefits of the action (lack of suitable habitat, based on presence/absence modeling such as the Hurdle Model or similar).

- Food enhancement actions; for example, those included in the Delta Smelt Resiliency Plan to enhance food supply, the North Delta Food Subsidies and Colusa Basin Drain Project, Sacramento River Deepwater Ship Channel lock reoperation, and Suisun Marsh Food Subsidies (Roaring River distribution system reoperation).

Through collaborative planning, Reclamation and DWR would develop a SFHA Plan to meet the environmental and biological goals in years when SFHA are triggered. In above normal and wet years, operating to a monthly average X2 of 80 km in September and October is an operational back-stop that would be available to provide a specific acreage of low salinity habitat. In every action year, Reclamation and DWR would propose, based on discussions with the USFWS, a suite of actions that would meet the action's environmental and biological goals. If it is determined that any of the off-ramps identified above are applicable, Reclamation and DWR would include a discussion of those off-ramps in the SFHA Plan.

As part of the Delta Smelt Habitat Action, Reclamation intends to meet Delta outflow augmentation in the fall primarily through export reductions as they are the operational control with the most flexibility in September and October. Storage releases from upstream reservoirs may be used to initiate the action by pushing the salinity out further in August and early September; however, the need for this initial action would depend on the particular hydrologic, tidal, storage, and demand conditions at the time. In addition, storage releases could be made in combination with export reductions during the fall period during high storage scenarios where near-term flood releases to meet flood control limitations are expected. In these scenarios, Reclamation would make releases in a manner that minimizes redd dewatering where possible.

The offramp criteria would be more fully defined and examples of potential implementation developed through the structured decision making or other review process. The review would include selection of appropriate models, sampling programs, and other information to be used. The specific offramp criteria may be modified through the process. The process would be completed prior to implementation and may be improved in subsequent years as additional information is synthesized and reviewed.

E.3.4.6 Bernice Frederic Sisk Dam Raise and Reservoir Expansion

The No Action Alternative does not include Sisk Dam Raise and Reservoir Expansion as an operational component of the CVP.

E.3.4.7 Tidal Habitat Restoration

Reclamation and DWR would complete the 8,000 acres required by the 2020 Record of Decision and additional 396.3 acres as required by the Incidental Take Permit for the SWP.

DWR and Reclamation have or will carry out tidal habitat restoration acre targets identified from the 2008 and 2019 USFWS Biological Opinions (8,000 acres) and the 2020 State Incidental Take Permit (396.3) to complete mitigation requirements for Delta smelt and longfin smelt (per the 2020 Incidental Take Permit). Currently, twelve restoration projects have been identified to satisfy the total acreage requirement of 8,396.3 acres (Table E-6). The twelve projects are in different phases of completion: (1) constructed (3,584 acres), (2) in construction (3.490 acres) or (3) planned (1,662 acres). All twelve restoration projects are located in the northern arc of the upper estuary (area of highest Delta smelt occupation) and are designed to enhance food production and rearing habitat for delta smelt and longfin smelt (per the 2020 Incidental Take Permit for the SWP).

Table E-6. Tidal Habitat Restoration.

Project	Estimated Acres	Phase
Arnold Slough	138	Constructed
Decker Island	113	Constructed
Lower Yolo Ranch	1,713	Constructed
Tule Red	590	Constructed
Winter Island	544	Constructed
Wings Landing	190	Constructed
Yolo Flyway Farms	296	Constructed
Bradmoor Island	490	Under construction
Lookout Slough	3,000	Under construction
Prospect Island	1,500	Construction planned in 2024
Chipps Island	687	Construction planned in 2024

Tidal habitat restoration is a commitment from the 2009 Biological Opinion, carried into the 2020 Record of Decision. All planned actions presented in Table E-6 have separate environmental compliance (either programmatically or site-specific) and no further analysis of impacts will be performed in this document. State and Federal agencies would analyze impacts for the site specific and programmatic tidal habitat restoration compliance separate from the Long-Term Operation of CVP and SWP.

E.3.5 Stanislaus River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. The No Action Alternative variable components are described below.

E.3.5.1 Minimum Instream Flows

Reclamation would operate to the New Melones SRP with the default schedule shows in Figure E-14. SRP flows would be Reclamation's contribution to D-1641's Vernalis standards.

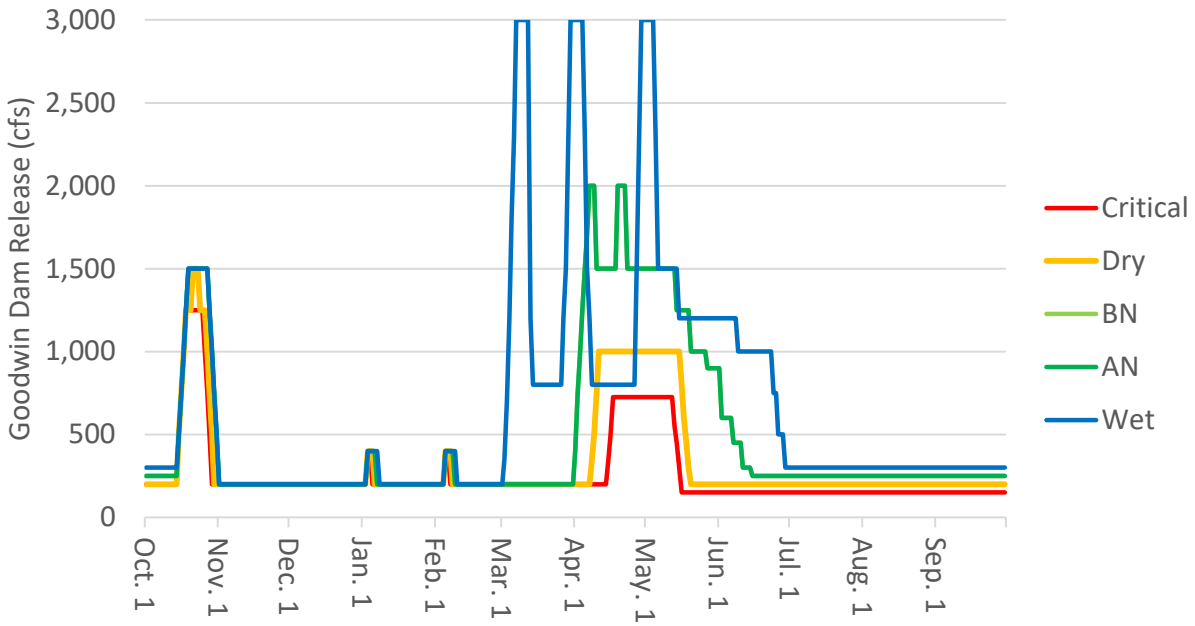


Figure E-14. 2019 New Melones Stepped Release Plan by San Joaquin River Index.

The SRP includes the ability to shape monthly and seasonal flow volumes as described below. Reclamation would operate New Melones Reservoir (as measured at Goodwin Dam) in accordance with an SRP that varies by hydrologic condition and water year type as shown in Table E-7.

Table E-7. New Melones Stepped Release Plan Annual Releases by Water Year Type.

Water Year Type	**Annual Release (TAF)**
Critically Dry	184.3
Dry	233.3
Below Normal	344.6
Above Normal	344.6
Wet	476.3

TAF = thousand acre-feet.

The New Melones SRP would be implemented similarly to the No Action Alternative with a default daily hydrograph and the ability to shape monthly and seasonal flow volumes to meet specific biological objectives. The default daily hydrograph is the same as prescribed under the No Action Alternative for critically dry, dry, and below-normal water year types. The difference occurs in above normal and wet years, where the minimum requirement for larger releases is reduced from the No Action Alternative to promote storage for potential future droughts and preserve coldwater pool. When compared to minimum daily flows from the No Action Alternative, the daily hydrograph for the New Melones SRP is identical for critically dry, and

below normal year types; above normal and wet year types follow daily hydrographs for below normal and above normal year types from current operating requirements, respectively.

During the summer, Reclamation would be required to maintain applicable DO standards on the lower Stanislaus River for species protection. Reclamation currently operates to a 7 milligrams per liter DO requirement at Ripon from June 1 to September 30. Reclamation would move the compliance location to Orange Blossom Bridge, where the species are primarily located at that time of year.

E.3.5.2 Winter Instability Flows

Reclamation releases additional flow in January and February to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats. Reclamation, through Governance, schedules the winter instability flow volume in consideration of timing flows to coincide with a natural storm event which may naturally cue outmigration. Rain events may meet the need for winter instability flows and not require additional releases.

E.3.5.3 Spring Pulse Flows

Reclamation will release additional flows starting as early as March through as late as June. Reclamation, through Governance, will schedule spring pulse flow volumes consistent with volumes in the SRP.

E.3.5.4 Fall Pulse Flows

Fall pulse flows improve instream conditions and provide an attraction cue for adult salmonids returning to spawn. Reclamation will release additional flows in October. Reclamation, through Governance, will schedule fall pulse flow volumes consistent with the volumes in the SRP.

E.3.5.5 Spawning and Rearing Habitat Restoration

The No Action Alternative reflects the 2020 Record of Decision evaluation of habitat restoration in concert with operations. Reclamation's habitat programs will continue through separate environmental compliance and future restoration plans as independent programs; therefore, no further discussion will be provided in this EIS.

E.3.6 San Joaquin River

The No Action Alternative reflects the 2020 Record of Decision evaluation of habitat restoration in concert with operations. Reclamation's habitat programs will continue through separate environmental compliance and future restoration plans as independent programs; therefore, no further discussion will be provided in this EIS.

E.3.7 Monitoring

The 2020 Record of Decision included a list of anticipated monitoring programs permitted through other efforts.

E.3.8 Special Studies

The No Action Alternative includes studies that are now ongoing or completed programs. Examples include:

- DCC Gate Improvements
- San Joaquin Basin Steelhead Telemetry Study
- San Joaquin Basin Steelhead Collaborative
- San Joaquin River Scour Hole Predation Reduction
- Shasta TCD Performance Evaluation
- Water Temperature Modeling Platform
- Temperature Management Study
- Yellow-Billed Cuckoo Baseline Surveys

E.3.9 Drought

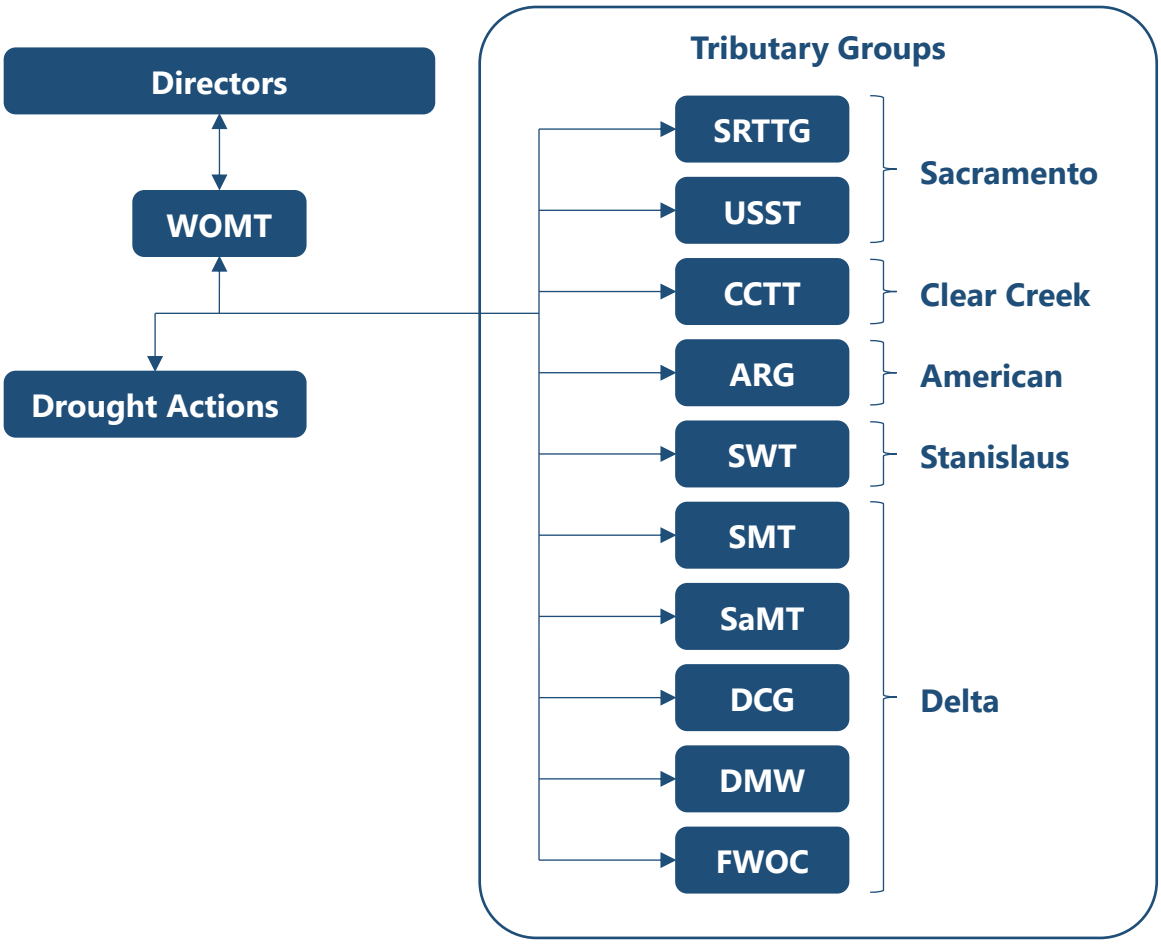
The 2020 Record of Decision included actions to address drought. These include:

- Drought Toolkit
- Agency Directors Meeting
- Agency Meet and Confer
- SRS Contractors Meet and Confer

Reclamation and DWR completed the toolkit with the most recent version updated in January 2022.

E.3.10 Governance

The No Action Alternative includes a WOMT supported by tributary groups that developed plans for scheduling flows and targeting water temperatures. If a dispute arose within a tributary group, members could elevate the dispute to their WOMT representative. If the members of WOMT could not resolve the dispute, WOMT representatives could elevate the dispute to the directors of CDFW, DWR, NMFS, Reclamation, and USFWS for resolution.



WOMT = Water Operations Management Team; SRTTG = Sacramento River Temperature Task Group; USST = Upper Sacramento River Scheduling Team; CCTT = Clear Creek Technical Team; ARG = American River Group; SWT = Stanislaus Watershed Team; SMT = Smelt Monitoring Team; SaMT = Salmon Monitoring Team; DCG = Delta Coordination Group; DMW = Delta Monitoring Workgroup; FWOC = Fish and Water Operations Call.

Figure E-15. No Action Alternative Governance Structure.

The Sacramento River is further divided into a SRTTG and an Upper Sacramento River Scheduling Team (USST). The Delta is further divided into a Smelt Monitoring Team (SMT), Salmon Monitoring Team (SaMT), Delta Coordination Group (DCG), Delta Monitoring Workgroup (DMW), and a Fish and Water Operations Call (FWOC). The No Action Alternative governance included participation in other programs (e.g., Collaborative Science and Adaptive Management Program, Delta Plan Interagency Implementation Committee), all of which include representatives from CDFW, NMFS, and USFWS. The No Action Alternative governance identified project specific teams for monitoring and special studies.

E.4 Alternative 1 – Water Quality Control Plan

Alternative 1 (Water Quality Control Plan) operates the CVP and SWP to D-1641 and tributary specific water right requirements and agreements. Alternative 1 does not include the operational

restrictions in the USFWS and NMFS 2008 and 2009 biological opinions Reasonable and Prudent Alternatives or 2019 biological opinions for the management of exports, Delta salinity, and releases from upstream facilities. Comparisons using analyses of Alternative 1 inform the effectiveness of non-flow measures versus addressing stressors by restrictions on water operations. Large investments in habitat restoration have occurred and continue, yet long-lead times for landscape level changes and salmonid lifecycles mean that many projects remain in progress with few generations of fish to assess benefits, except on Clear Creek.

Under Alternative 1, Reclamation and DWR would operate consistent with authorizing legislation, water rights, contracts, and agreements as described by common components. These include Water Quality Control Plans, the COA, CVP and SWP Water Contracts, Settlement and Exchange Contracts, and Record of Decisions on independent related activities not proposed for modification and reinitiation of consultation under this effort.

E.4.1 Sacramento River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.4.1.1 Ramping Rates

Under WRO 90-5, the release rate (ramping) from Keswick Dam when not in a flood control event of other unforeseen emergency conditions, from September through February shall not decrease more than the following rates to minimize stranding of salmon.

- Releases shall not be decreased more than 15% in a 12-hour period.
- Releases shall not be decreased more than 2.5% in a 1-hour period.

E.4.1.2 Minimum Instream Flows

Similar action to Fall and Winter Instream Flows

Reclamation will operate to the minimum flows set forth in WRO 90-5. The minimum flows set forth are as follows:

- March 1 through August 31 – minimum flows of 2,300 cfs
- September 1 through February 28 – minimum flows of 3,250 cfs

In addition, the agreement contains a schedule providing for flow reductions in critical dry years.

However, releases may be greater since Reclamation operates Shasta and Keswick dams in coordination with other CVP and SWP facilities to comply with D-1641's minimum flow requirements near Rio Vista and Delta outflow requirements.

E.4.1.3 Winter and Spring Pulse Flows

Alternative 1 does not include winter or spring pulse flows.

E.4.1.4 Water Temperature Management

Under Alternative 1, Reclamation would make releases based on Delta requirements under D-1641, settlement contracts, and making use of available water supply for deliveries to CVP water service contractors while reducing the potential for spill. Reclamation would operate the TCD on Shasta Dam, consistent with WRO 90-5, to target 56°F at the most downstream location feasible from May 15 through October 30 each year.

E.4.1.5 Fall and Winter Instream Flows

Same as the No Action Alternative.

E.4.1.6 Winter-Run Chinook Salmon Supplementation

Same as the No Action Alternative.

E.4.2 Clear Creek

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.4.2.1 Minimum Instream Flows

Reclamation would release minimum flows per the August 11, 2000 Instream Flow Preservation Agreement executed by Reclamation, USFWS, and CDFW as shown below.

Table E-8. Minimum flows per the August 11, 2000 Instream Flow Preservation Agreement executed by Reclamation, USFWS, and CDFW

Period	Normal Year (cfs)	Critical Year (cfs)
January–October	50	50
November–December	100	70

cfs = cubic feet per second.

E.4.2.2 Pulse Flows

Alternative 1 does not include winter or spring pulse flows.

E.4.2.3 Water Temperature Management

Under Alternative 1, while there is no specific requirement in water rights, Reclamation would target Whiskeytown Dam releases to not exceed the mean daily temperatures at Igo gauge of:

- 61°F from June 1 through August 15.
- 60°F from August 16 through September 15.
- 56°F from Sept 15 through Nov 15.

The temperature targets were developed in Alternative 2 through collaboration with CDFW, NMFS, and USFWS; however, Alternative 1 does not include increased flows. In dry, critical, or import curtailment years, Reclamation may not be able to meet these water temperatures and will operate Whiskeytown Dam as close to these water temperatures as practicable within the constraints of minimum instream flows.

E.4.3 American River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.4.3.1 Minimum Instream Flows

D-893 established that the minimum allowable flows in the lower American River at H Street Bridge, in the interest of fish conservation, should not ordinarily fall below 250 cfs between January 1 and September 15 or below 500 cfs at other times.

E.4.3.2 Spring Pulse Flows

Alternative 1 does not include spring pulse flows.

E.4.3.3 Redd Dewatering Adjustments

Alternative 1 does not include redd dewatering adjustments.

E.4.3.4 Water Temperature Management

Reclamation would operate the Folsom Dam temperature control shutters in the same manner as the No Action Alternative.

E.4.4 Delta

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.4.4.1 Old and Middle Flow Management

Alternative 1 does not include OMR criteria.

E.4.4.2 Spring Delta Outflow

Under Alternative 1, Reclamation and DWR would operate to D-1641. This is the same D-1641 criteria as the No Action Alternative; however, the absence of OMR flow management would result in lower Delta outflows under Alternative 1. Additionally, DWR would not operate to the spring outflow in the Incidental Take Permit for the SWP.

E.4.4.3 Delta Smelt Summer and Fall Habitat

Alternative 1 does not include SFHA. Reclamation and DWR would operate to achieve X2 westward locations required by D-1641's outflow and salinity objectives. Reclamation and DWR would operate the SMSCG for additional month of September as required by the SMPA.

E.4.4.4 Delta Smelt Supplementation

Alternative 1 does not include Delta Smelt Supplementation.

E.4.4.5 Sisk Dam Raise and Reservoir Expansion

Upon completion of construction, Reclamation would operate an expanded San Luis Reservoir in accordance with D-1641. The raising of the Bernice Frederic Sisk Dam will increase reservoir storage capacity by 130 TAF. Reclamation and San Luis and Delta-Mendota Water Authority completed a final Supplemental EIS/Environmental Impact Report in December 2020 to raise the dam crest by 10 feet and increase the maximum water surface elevation in the reservoir by 10 feet. Reclamation executed a Record of Decision for the project in October 2023.

E.4.5 Stanislaus River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.4.5.1 Minimum Instream Flows

Under Alternative 1, Reclamation would operate to the 1987 Stipulation with CDFW (Figure E-16).

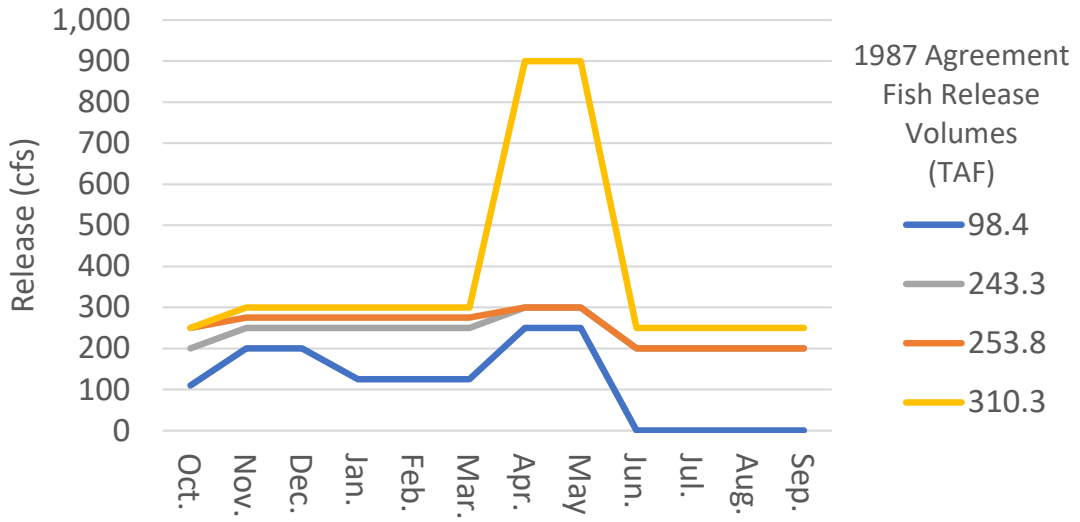


Figure E-16. Minimum Instream Flows under the CDFW Agreement.

The fisheries release volume is the end of February New Melones Reservoir storage plus the March through September inflows, less an estimated delivery to Oakdale and South San Joaquin Irrigation Districts (this uses 95% of their entitlement under the 1988 Stipulation of Settlement (usually 600 TAF), less CVP East side demand estimates (assumes 90 TAF), less the estimated water quality releases (70 TAF), less assumed New Melones Reservoir evaporation (52 TAF),

less 1700 TAF for carryover. This is bounded by a minimum of 98.3 TAF and a maximum of 302.1 TAF.

Monthly flows are linearly interpolated from the annual volume (the lines in Figure E-16). June through September flows will be higher due to releases for DO, which are assumed to be approximately 255 cfs in June, 265 cfs in July, 283 cfs in August, and 249 cfs in September.

Reclamation would release water from New Melones Reservoir to meet D-1641 salinity and flow objectives at Vernalis (not including the pulse flows during the April 15 – May 16 period). The flow requirement is based on the required location of X2 and the 60-20-20 Index as summarized in Table E-9.

Table E-9. D-1641 Vernalis Flow Objectives (average monthly cfs).

60-20-20 Index	Flow Required if X2 is West of Chipps Island	Flow Required if X2 is East of Chipps Island
Wet	3,420	2,130
Above Normal	3,420	2,130
Below Normal	2,280	1,420
Dry	2,280	1,420
Critical	1,140	710

60-20-20 Index = San Joaquin Valley "60-20-20" Water Year Hydrologic Classification; cfs = cubic feet per second.

E.4.5.2 Winter Instability Flows

Alternative 1 does not include winter instability flows.

E.4.5.3 Spring Pulse Flows

Alternative 1 does not include spring pulse flows.

E.4.5.4 Fall Pulse Flows

Alternative 1 does not include fall pulse flows.

E.4.6 San Joaquin River

Same as the No Action Alternative. Reclamation would continue implementation of the San Joaquin River Restoration Program as an independent related activity.

E.4.7 Monitoring

Under Alternative 1, Reclamation and DWR would undertake monitoring to address water quality control plan requirements and to minimize anticipated take of federally listed species and adverse modification to critical habitats. Monitoring metrics for performance, by category, include:

- Physical Conditions

- Flow (e.g., releases, diversions, instream, outflow)
- Water Quality (e.g., temperature, turbidity, salinity, nutrients)

- Primary Production
  - Biomass and Composition (e.g., chlorophyl a, phytoplankton species)
- Secondary Production
  - Biomass and Composition of Invertebrates (e.g., zooplankton, shrimp, clams)
- Abundance and Productivity of Federally Listed Species
  - Chinook Salmon, All Runs
    - Adult Escapement
    - Redd Distribution and Timing
    - Juvenile Abundance and Outmigration Timing
    - Juvenile Outmigration Survival
  - Delta and Longfin Smelt
    - Adult Abundance and Distribution
    - Larval Abundance and Distribution
    - Juvenile Abundance and Distribution
  - Green Sturgeon
    - Adult Spawner Abundance and Distribution
    - Juvenile Abundance and Distribution
  - Steelhead
    - Adult Escapement
    - Redd Distribution and Timing
    - Juvenile Abundance and Outmigration Timing
    - Juvenile Outmigration Survival
- Fish Community Assemblages
  - Delta Seasonal Fish Assemblages
    - Composition and Abundance
  - Tributary Seasonal Fish Assemblages

    - Composition and Abundance
- Hatchery Proportion and Straying
- Salvage at the Fish Facilities

Reclamation and DWR, through Governance, would update its Monitoring Plan, Appendix U of the Initial Alternatives Report. Updates to the monitoring plan will incorporate learning and adopt new technologies, while maintaining comparability to historical information on fish and the environment. Updates ensure the monitoring program evolves with the changing environment and supports operational needs including:

- **Regions:** different tributaries and areas of the Delta that may respond to different drivers
- **Seasons:** how fish may use areas at different times of the year
- **Years:** how conditions change over time
- **Gear:** how to integrate data from different monitoring methods

Monitoring data will be made available in a timely manner, following state and federal open-data protocols and requirements including machine readable formats, accessibility, and a description of the quality assurance/quality control processes.

Alternative 1 includes the monitoring of the CVP and Delta SWP facilities into the Long-Term Operation so that subsequent changes to existing monitoring programs would be coordinated and included in future consultations of the long-term operation of the CVP and SWP to allow for a more uniform analysis and improved accounting of take associated with the operation of the CVP and SWP.

E.4.8 Special Studies

This alternative does not identify specific species studies; however, Reclamation's science enterprise will continue through separate environmental compliance and future plans as independent programs.

E.4.9 Drought

Under Alternative 1, Reclamation and DWR would implement elements of a drought toolkit such as the Drought Barrier on West False River. Reclamation and DWR may request a Temporary Urgency Change Petitions (TUCP) to meet public health and safety needs when dry conditions prevent meeting D-1641. Reclamation and DWR would not apply for TUCPs to preserve storage in upstream reservoirs beyond water required to maintain public health and safety.

E.4.10 Governance

Alternative 1 the Directors would meet as necessary to administer the drought toolkit. Reclamation and DWR would still participate in other programs (e.g., Collaborative Science and Adaptive Management Program, Delta Plan Interagency Implementation Committee) all of which include CDFW, NMFS, and USFWS. Project specific teams would oversee monitoring and special studies.

E.5 Alternative 2 – Multi-Agency Discussion

Alternative 2 (Multi-Agency Discussion) represents actions and tradeoffs made to reach consensus among Reclamation, DWR, USFWS, CDFW, and NMFS. Alternative 2 includes CDFW for harmonizing the state's regulatory approach for the operation of the SWP under CESA with the federal regulatory approach for the CVP and SWP under ESA. It includes actions and approaches identified by the state and federal fish agencies, in addition to the objectives of Reclamation and DWR regarding operation of CVP and SWP. The multi-agency discussion resulted in revised descriptions of actions considered to be common to all alternatives, including the No Action Alternative. To preserve the specific wording that was important to our state and federal partners, in addition to variable components, Reclamation has included the revised text below for conservation measures that are common components even where the action is the same.

Alternative 2 includes authorizing legislation, contracts, and agreements as described by common components. These include Water Quality Control Plans, the COA, CVP and SWP Water Contracts, Settlement and Exchange Contracts, and Record of Decisions on independent related programs not proposed for modification and reinitiation of consultation under this effort.

In addition to the description below of Alternative 2, the analysis of alternative is further broken down into three additional Phases. These phases are intended to further demonstrate the flexibility and impacts of these components, some of which are outside Reclamation's direct control. Those phases include: *Alt 2 With TUCPs, Without Voluntary Agreements, Early Implementation of Delta Voluntary Agreements*, and Implementation of *All Voluntary Agreements*. It should be noted that the phases of Alternative 2 could be utilized under its implementation. All four phases are considered in the assessment of Alternative 2 to demonstrate the range of potential impacts.

Alternative 2b is derived from Alternative 2, but includes recent components developed by CDFW and DWR as part of the Incidental Take Permit application process for the SWP.

These components are not included in water operations modeling. Components that are expected to result in changes from the analysis provided for Alternative 2 are evaluated qualitatively in each resource chapter. This appendix includes additional description of each of the components of Alternative 2B.

E.5.1 Sacramento River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.5.1.1 Ramping Rates

Rapid changes in river elevation from ramping reservoir releases up or down can impact aquatic biota. Sudden flow decreases can strand fishes and macroinvertebrates. Ramping rates to limit how quick releases are reduced can lessen or minimize these impacts. Under WRO90-5, the release rate (ramping) from Keswick Dam when not in a flood control event of other unforeseen

emergency conditions, from September through February shall not decrease more than the following rates to minimize stranding of salmon.

- Releases shall not be decreased more than 15% in a 12-hour period.
- Releases shall not be decreased more than 2.5% in a 1-hour period.

In addition to the requirements under WRO 90-5, ramping rates for Keswick Dam between July 1 and March 31 would be reduced between sunset and sunrise:

- Keswick Dam releases >6,000 cfs, reductions in releases may not exceed 15% per night, and no more than 2.5% per hour.
- Keswick Dam releases 4,000 cfs to 5,999 cfs reductions in releases may not exceed 200 cfs per night, or 100 cfs per hour.
- Keswick Dam releases between 3,250 cfs and 3,999 cfs; reductions in releases may not exceed 100 cfs per night.
- Operations will be managed by Reclamation in coordination with the Shasta Operations Team (SHOT).
- Reclamation after coordination through the SHOT, may make slight deviations from this ramping rate to provide incremental benefits to fish species. Such deviations would be initially discussed through the Sacramento River Group (SRG) prior to coordination through the SHOT.

E.5.1.2 Sacramento River and Shasta Reservoir Coordination Forums

Governance is described in detail in Section E.5.16, *Governance*, which includes group members, protocols, meeting frequencies, decision making approaches and other details. For the Sacramento River and Shasta Reservoir, three main coordination forums will meet regularly to discuss seasonal and real-time operations. These include the Winter-run JPE Subteam, SRG and the SHOT. The Winter-run JPE Subteam is a technical group tasked with development of the winter-run JPE each year and the winter-run broodstock assessment. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, and CDFW. The SRG is a technical group to discuss pulse flow shaping, temperature management, fall flow smoothing and fall/winter base flows. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, CDFW, SRS Contractors, Western Area Power Administration, SWRCB and Native Tribes. The SHOT is a policy level group that discusses the actions described in this alternative when implementation may have biological, system conditions or water supply impacts or tradeoffs. It is composed of management and policy staff from key management agencies including the SRS Contractors. Generally, topics will be discussed at a technical level through SRG with agency feedback provided prior to being discussed at the SHOT. Each action below briefly describes the coordination process within these two groups prior to Reclamation making decisions that have risks, impacts and tradeoffs. For the matters listed below, Reclamation requests NMFS, USFWS and CDFW provide technical assistance along with the other members through these groups.

E.5.1.3 Fall and Winter Baseflows for Shasta Refill and Redd Maintenance

Reclamation will operate to a consistent fall and winter baseflow between December and February unless additional releases are necessary for meeting downstream purposes. Consistent minimum flows are intended to avoid unintentional dewatering, support aquatic habitat, and avoid other impacts from regular flow fluctuations. Targets for fall and winter base flows (December 1 through the end of February) from Keswick would be set in October based on Shasta Reservoir EOS storage and the current hydrology. Base flows will range from 3,250 cfs to 5,000 cfs. Each year, the base flow will be set to balance between the risk of required storage management or flood control releases in the coming fall and winter with supporting refill capabilities for Shasta Reservoir to build coldwater pool for the following year.

Table E-10. Keswick Dam December through February Default Release Schedule determined by EOS Storage.

Keswick Release (cfs)	Shasta EOS Storage (MAF)
3,250	≤2.4
4,000	≤2.8
4,500	≤3.2
5,000	>3.2

EOS = end-of-September; cfs = cubic feet per second; MAF = million acre-feet. These may be refined through future modeling and/or analysis efforts as part of the seasonal operations planning.

Reclamation, after coordination through the SRG and SHOT, will determine the schedule for release reductions as well as deviations from this default table by developing a risk analysis that relies on real-time fish monitoring data, winter-run Chinook salmon redds remaining in the river, fall-run Chinook salmon returns, expected fall water deliveries and transfers. Based on this analysis and the coordination through SRG and SHOT, Reclamation may delay or extend the ramp down to minimum fall and winter flows for the benefit of the fish populations. Such a delay will be coordinated through SRG and SHOT in light of the expected tradeoffs between minimizing winter-run redd dewatering, building storage for the next water year for water temperature management and minimizing fall-run Chinook salmon stranding and redd dewatering later in the fall. When higher storage exists at EOS, but the fall hydrology is dry (generally defined as below 90% exceedance of historical hydrology), Reclamation, after coordination through the SRG and SHOT, may reduce flows below those described in the table (or as modified by the risk analysis), if beneficial for fish populations and to building storage for the following year.

This approach to selecting fall, winter, and spring minimum flows allows Reclamation to build and conserve storage for supporting coldwater pool management and summer demands. Data indicating that the flood control curve will be reached in December may result in flood control releases over the minimum flows, typically in the December through May period. Low minimum flows in the fall and winter period directly increases the likelihood and magnitude of the flood control releases in the winter and spring months.

In order to minimize the risk of juvenile stranding and redd dewatering during the fall season, to the extent possible given Reclamation's other legal and contractual obligations, Reclamation will coordinate with the SRG to consider planned summer flows that are smoothed out to minimize the net difference between the flow at spawning versus emergence.

E.5.1.4 Minimum Instream Flows

Under certain hydrologic circumstances, side flows from creeks within and around the City of Redding may experience short term periods of high flows in response to major storm events. Reclamation, after coordination through the SRG and SHOT, and also through adaptive management, will determine whether these flows achieve the same biological effects as the minimum flow of 3,250 cfs at Keswick Dam. If these flows are determined to meet the same biological intent, Reclamation may temporarily reduce flows below 3,250 cfs to preserve storage.

E.5.1.5 Sacramento River Pulse Flows

To increase outmigration survival of Chinook salmon, Reclamation would release up to 150 TAF in pulse flow(s) each water year, typically in the spring, to benefit Chinook salmon in the Sacramento River watershed when the pulse does not interfere with the ability to meet temperature objectives or other anticipated operations of the reservoir. Reclamation will schedule this pulse after coordination through the SRG and SHOT and may include coordinating timing with natural flow events, potential storage management operations and/or pulse flows in tributaries.

The timing, magnitude, duration, and frequency of the pulse flows will be refined through the SRG to maximize multi-species benefits, which may include coordinating timing with natural flow events, potential storage management operations, potential SRS Contractor demands and infrastructure limitations, and/or pulse flows in tributaries or reducing the volume of the pulse flow. The pulse flow volume and schedule will be developed through the SRG and provided to the SHOT. Reclamation, through the SHOT, will discuss the plan and make any appropriate and/or necessary refinements prior to implementation.

The voluntary agreement (VA) flow assets may contribute to augmenting a pulse flow. Under conditions when the pulse flow is reduced or not released due to potential impacts on temperature management or other project purposes, the VA flow assets may be used to meet part or all of the pulse flow action. In certain cases, it may be most beneficial to release both the pulse flow and the VA asset together to provide the best benefit to the species. The VA system-wide governance group is expected to ensure the VA releases are protected as outlined in the VA MOU.

E.5.1.6 Sacramento River Settlement Contractor Voluntary Agreement Spring Pulse Flows

Alternative 2 includes advancing up to 100 TAF in releases from Shasta Reservoir for a spring-pulse in consideration of actions by SRS Contractors to make the water available later in the year.

E.5.1.7 Adult Migration and Holding Temperature Objectives

Spring temperatures can impact winter-run Chinook salmon adults in multiple ways (gamete viability, spawning initiation, temperature shock, adult migration, disease risk, interaction with thiamine deficiency) as well as Late fall-run Chinook salmon (impacts to redds). Water temperatures in the March through May period (prior to the start of the typical temperature management season) are typically well under any thresholds of concern for adult migration and adult holding. It is possible that high air temperatures and/or an intentional warmwater power bypass could cause warmer temperatures than normal and may require additional protective measures. Under a circumstance where these conditions may cause water temperatures to rise to concerning levels prior to the final temperature management plan, Reclamation will begin temperature management as early as March 1 to target water temperatures of 58.0° F daily average at the Sacramento River above the Clear Creek Gage (CCR).

Reclamation, through the SRG and SHOT, may propose a different temperature based on potential impacts to winter-run Chinook salmon spawning and egg incubation in the developing temperature management plan. Adaptive management may include a proposal to look more closely at these pre-spawning temperature objectives and eventually refine the standard.

Additional details on a potential warmwater power bypass to aid in water temperature management are included in the drought tool kit and described further in the drought operations priority framework.

E.5.1.8 Water Temperature and Storage Management

Alternative 2 changes the balance between risks of flood control releases (aka spills) and maintaining water in storage for future drought protection and temperature management. This approach, described below, places a higher priority on maintaining storage for drought protection for all project purposes while limiting the frequency of spilling water due to flood control limitations. Reclamation is committed to support a separate Winter-Run Action Plan with NMFS, USFWS, CDFW, DWR and SRS Contractors to pursue a science and monitoring plan, winter-run Chinook salmon habitat and infrastructure actions, and water operations. Alternative 2 evaluates the water operations of CVP facilities in the Shasta and Sacramento Division of the CVP.

The following sections describe the management framework for the Shasta Management Plan and drought protection; an annual winter-run Chinook salmon brood year assessment that influences Livingston Stone NFH decision making, the monthly actions that will be considered by the SHOT; the temperature objectives for winter-run Chinook salmon holding, spawning, egg development and early rearing downstream from Shasta and Keswick Reservoirs; and the process for developing an annual temperature management plan.

E.5.1.9 Water Temperature and Storage Framework

The goals of the Shasta Reservoir Management Plan are to provide increased drought protection and maximize suitable water temperature regimes for the critically endangered Sacramento River winter-run Chinook salmon. The Shasta Reservoir Management Plan considers drought protection actions in nearly every year and identifies actions that will protect storage for multiple project purposes including temperature management. A key principle of the Shasta Reservoir Management Plan is that drought protection and fish protections are linked. The strategy is

framed around an objectives-based management framework adapted from the multi-year drought sequence experienced in Victoria, Australia (Mount et al. 2016, "Victorian Objectives") that establishes different objectives depending on hydrologic conditions and identifies actions that can be taken for fishery management and drought protection. The general premise is that when hydrologic conditions are good and water resources are available to meet demands they are managed to improve species conditions, which follows the ENHANCE category in Mount et al. 2016, when hydrologic conditions are moderately limited and not available to meet all demands they are managed to RECOVER and MAINTAIN species conditions, and when hydrologic conditions are constrained and the system is stressed they are managed to PROTECT species conditions.

The Shasta Reservoir Management Plan proposes to integrate Sacramento Basin flow and non-flow measures that are part of the Voluntary Agreements to update and implement the Bay-Delta Water Quality Control Plan. The Voluntary Agreements offer a watershed-wide approach that includes new flows, habitat restoration, and a governance and science program that would be deployed adaptively. Specifically, under the VAs, flow and non-flow actions covered under Alternative 2 are not intended to conflict with the SWRCB's Narrative Salmon Objective of the Narrative Viability Objective once adopted.

E.5.2 Framework Approach

The framework establishes management "Bins" to manage water temperature and storage to meet the Victorian Objectives described above. The framework includes three Bins that are each divided into two categories: standard (Bin A) and drought protection (Bin B). The Bin number (1, 2 or 3) is defined by the projected end-of-April (EOA) storage which is primarily driven by hydrology. The letter of the Bin (A or B) is primarily driven by the expected demands on the reservoir which are a function of hydrology, meteorology, system-wide conditions, contractual requirements and other conditions. The A Bins are years when the expected demand from the reservoir is lower meaning it's likely to result in better drought protection should the following year be dry. The B-bins are intended to increase the priority of storage conservation to address the risk that the ensuing year could be a drought. B bins may be conditions where there is limited water supply in the Shasta system or the system as a whole is more stressed and additional actions are necessary to reach the objectives of that bin. A stressed system is typically indicated by multiple reservoirs across the CVP and SWP having below average storage with below average hydrology either seasonally or in a particular month. Bin assignments will begin in February and will be updated monthly as needed through mid-April. Adjustments after April will be made as appropriate based on changes in hydrology and through coordination with the SHOT. The approach establishes biological objectives for each Bin and identifies potential actions based on forecasted EOA storage and forecasted EOS storage indicators.

Based on the outcome of the brood year assessment prepared by the Winter-run JPE sub-team, Reclamation, NMFS, USFWS, and CDFW will convene appropriate technical staff to make recommendations if it is necessary to increase the production of winter-run Chinook salmon associated with the Integrated-Recovery Supplementation Program or take other actions to protect production of winter-run Chinook salmon at the Livingston Stone NFH. USFWS, through coordination with the SHOT, will implement measures as appropriate. The outcome of the brood

year assessment may also be considered in implementing actions within the drought toolkit as described in Section E.5.15, *Drought*.

During any of the Bins described below, Reclamation may request that the SRS Contractors employ some of their voluntary actions to help improve temperature management and/or protect against winter-run redd dewatering and fall-run stranding. If requested, these actions would be implemented in a manner that does not impact the ability of the SRS Contractors to divert per their contract and would be discussed through SHOT with final decision making by the SRS Contractors. These actions include:

- Delaying or shifting spring diversions to maximize storage
- Shifting timing of delivery of transfer water
- Smoothing of fall rice decomp flows

In addition, the SRS Contractors are expected to have an action under the Voluntary Agreement to make water available for the purposes of benefiting aquatic species in the upper Sacramento River and increasing delta outflow. This action may occur in any Bin and is more likely to occur in Bins 1 or 2. Decisions on Shasta-related VA flow assets would be managed through SHOT, as described in Section E.5.16, *Governance*.

Reclamation recognizes that some years may indicate (using a conservative forecast) a 0% CVP north of delta agricultural allocation early in the year (primarily February and March) even though a non-zero allocation is expected in the coming months as the hydrology solidifies. This may be due to late precipitation, lower storage from the previous year or higher regulatory requirements. In some cases, this 0% early allocation could have detrimental impacts to agricultural lands due to the gap in available supplies between the previous contract year (which ends in February) and when transfer water may come available (in April). In consideration of these unique years, Reclamation will consider providing an allocation by mid-February for 3-30 TAF to avoid these significant agricultural impacts while also maintaining the goals of this alternative and not risking a Bin 3 year. Whether or not this allocation maintains the goals will be determined through discussions with the SHOT. The SHOT may discuss the expected risks with the relevant contractors to determine the appropriate volume to evaluate and may choose to support an incremental allocation between February and March as more information is received. Should the SHOT determine that even the minimum allocation of 3 TAF cannot be made while meeting the goals of this alternative and/or risks the potential of a Bin 3 year, then the 0% allocation will remain.

E.5.2.1 Bin 1 – Enhance – ~80% of Years

Under Bin 1, hydrologic conditions are generally good and water resources are available to meet demands. Generally, EOA Shasta Reservoir storage is forecasted to allow use of the upper gates of the TCD to preserve the colder water for later in the season when air temperatures are much higher. This bin begins with an EOA storage forecasted at least 3.7 MAF with a possible storage increase in May and/or June. Bin 1 typically comes with a high confidence to meet coldwater temperatures for winter-run Chinook salmon downstream from the Clear Creek gage and to meet drought protection objectives of at least 2.4 MAF EOS storage. In these years, the primary management objectives are to target 53.5F at a location downstream of CCR to maximize

suitable habitat for winter-run Chinook salmon and to look for water supply neutral opportunities throughout the system to improve Shasta Reservoir carryover storage for future year drought protection.

During Bin 1 years, Shasta Reservoir may be operated to meet a variety of different demands. During the typical irrigation season (April through September), when Wilkins Slough is controlling and there is flexibility to have a Wilkins Slough flow below 5,000 cfs, Reclamation will discuss the appropriate minimum Wilkins Slough flow with the SHOT to ensure flows can both meet biological goals and objectives while also meeting obligations to senior water right holders under the SRS Contracts. Expected monthly average Keswick and Wilkins Slough flows for these types of years are shown below for reference. October flows may vary due to demands, water transfer operations and protection of winter-run Chinook salmon redds and are likely to be in the 5,000-7,000 cfs range although higher flows may be necessary at times. Flows beyond these ranges will be discussed through the SHOT with a comparison of expected biological and storage tradeoffs including the potential for these higher flows to increase the likelihood of a bin 2 year the following year. Due to the higher storage that defines Bin 1, it is unlikely that higher releases would result in a Bin 3 year the following year.

Bin 1A

Bin 1A is typically a result of a good water year where the system is not stressed and additional water management actions are not necessary to achieve an EOS storage of at least 3.0 MAF. Bin 1A is defined as having an EOA storage at or above 3.7 MAF and a projected EOS storage of at least 3.0 MAF. In these years, the primary management goal is to target 53.5F at a location downstream of CCR to maximize suitable habitat for winter-run Chinook salmon. The SHOT will discuss tradeoffs of establishing downstream temperature locations that support the biological goal of maximizing suitable habitat and the risk of running out of cold water. As discussed in previous sections, minimum fall and winter flows would be expected to be in the 4,000 – 5,000 cfs range to provide increased fall run habitat or higher if needed for storage management. Bin 1A is defined as having an EOA storage at or above 3.7 MAF and a projected EOS storage of at least 3.0 MAF. As discussed above, this EOA storage ensure good temperature management through providing access to using the upper gates of the TCD and the EOS storage provides a high likelihood of EOA storage greater than 3.7 MAF the following year. An EOS storage of 3.0 MAF along with the higher fall/winter minimum flows also limits the high potential for fall/early winter flood control releases, although these releases are still expected to occur under wetter hydrology.

Bin 1B

Bin 1B is typically a result of a good water year but the system may be slightly stressed or the water supply may be less than what is seen under Bin 1A. Bin 1B is defined as having an EOA storage at or above 3.7 MAF and a projected EOS storage of at least 2.4 MAF. Consistent with Bin 1A years, this EOA storage ensures good temperature management through providing access to using the upper gates of the TCD. The EOS storage of 2.4 MAF provides a high likelihood of EOA storage greater than 2.8 MAF the following year which is a point at which biological impacts from higher temperatures start to increase significantly. An EOS storage of 2.4 MAF along with the higher fall/winter minimum flows also lessens the potential for fall/early winter flood control releases, although these releases are still expected to occur under wetter hydrology.

Similar to Bin 1A, Reclamation, through coordination with SRG and the SHOT, will analyze tradeoffs of establishing downstream temperature locations that support the biological goal of maximizing suitable habitat and the risk of running out of cold water. Reclamation will consider light system tradeoffs for supporting higher Shasta storage (up to 3.0 MAF) with minimal impacts to other parts of the system during their monthly forecasting process. If there are tradeoffs with higher impacts that should be considered to meet the Bin 1 Shasta EOS storage range, Reclamation will consider these through coordination with the SHOT. Available actions primarily include rebalancing between other CVP reservoirs while maintaining all operational goals. If available actions result in storage of 2.4-3.0 MAF, then no further actions would be pursued. If available actions are not sufficient to result in a storage of at least 2.4 MAF, then this year would be reclassified as Bin 2A.

Operational Goals and Objectives

- Maintain sufficient storage for drought protection should the next year be dry
- Limit early season October through December spill
- Deliver available water while meeting regulatory requirements and obligations to senior water right holders under the SRS Contracts

Biological Goals and Objectives

- Victorian objective: Enhance and Recover
- Maximize species recruitment opportunities
- Increase spatial diversity
- Maximize floodplain linkages
- Enhance ecological flows
- Manage winter-run spawning habitat downstream from CCR to average daily water temperature of 53.5
- Targeted Resulting Temperature Dependent Mortality to be ≤3%
- When necessary, manage adult holding temperatures to a daily average temperature no higher than 58dFto minimize pre-spawning mortality
- Increase available habitat for fall-run Chinook salmon in the fall and winter months
- Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.

Bin 1A Operational Goals and Indicators

- February, March, and April forecasts project ≥3.7 MAF EOA storage based on 90% exceedance, or other conservative approach
- February, March, and April forecasts projects ≥3.0 MAF EOS storage based on 90% exceedance, or other conservative approach

Bin 1B Operational Goals and Indicators

- Hydrologic Goal: Initiate drought protection
- February or March forecasts project ≥3.7 MAF EOA storage based on 90% exceedance
- February or March forecasts project ≥2.4 MAF EOS storage based on 90% exceedance
- The goal of actions is to increase projected EOS storage above 2.4 MAF. If this is not possible, shift to Bin 2A.

E.5.2.2 Bin 2 – Recover and Maintain – ~11.5% of Years:

Under Bin 2, hydrologic conditions are more limited than in Bin 1 and adequate water resources are not available to meet all demands. Generally, the upper end of the EOA storage is showing upper gates may be used temporarily and even when not, there is high confidence to meet coldwater temperatures at the Clear Creek (CCR) gage for the critical development periods of the temperature management season and to meet some drought protection objectives that prevent critical storage levels at EOS and in the subsequent year. Shasta Reservoir management actions in this Bin would have light to moderate reductions in water supply or require light to moderate adjustments to system management.

During Bin 2 years, Shasta Reservoir may be operated to meet a variety of different demands. During the typical irrigation season (April through September), when Wilkins Slough is controlling and there is flexibility to have a Wilkins Slough flow below 5,000 cfs, Reclamation, through coordination with the SRG and SHOT, will identify the appropriate minimum flow to ensure flows can both meet biological objectives while also meeting obligations to senior water right holders under the SRS Contracts. Expected monthly average Keswick and Wilkins Slough flows for these types of years are shown below for reference. October flows may vary due to demands, water transfer operations and protection of winter-run Chinook salmon redds and are likely to be in the 5,000-7,000 cfs range although higher flows may be necessary at times. Reclamation expects to begin ramping down to the minimum flow of 3,250 cfs as described above in late October or early November. Reclamation, through coordination with the SRG and SHOT, will determine when to begin this ramp down after discussing the tradeoffs between storage, next year's temperature management, winter-run Chinook salmon redd dewatering and fall-run Chinook salmon stranding and redd dewatering. Flows or timing outside all ranges described above will be discussed through the SHOT with a comparison of expected biological and storage tradeoffs including the potential for these higher flows to increase the likelihood of a bin 2 or bin 3 year the following year. Should the following year be a Bin 3 year which, in part, was due to releases higher than these expected ranges, these higher flows may limit the available actions to conserve storage in that year.

Bin 2A

Bin 2A is a drier water year and can be the start of a multi-year drought sequence or a single year within a multi-year drought sequence. Bin 2A is defined as having an EOA storage at or above 3.0 MAF and a projected EOS storage of at least 2.2 MAF. This EOA storage does not typically allow full use of the TCD, but, when combined with the EOS of 2.2 MAF, is expected to be adequate to provide sufficient temperatures during the majority of the winter-run Chinook salmon spawning and egg incubation period to avoid high temperature-related biological impacts. An EOS storage of 2.2 MAF provides a high likelihood of exceeding an EOA storage of 3.0 MAF the following year and has a low potential for fall/early winter flood control releases, although these releases may still occur under wetter hydrology. In these years, the primary management goals are to target meeting 53.5F at CCR during the winter-run spawning and egg incubation period and to manage water supply to support a carryover that provides some drought protection. The temperature management objectives may be shaped through SRG and SHOT based on forecasted and/or real-time meteorologic and hydrologic conditions and best available science. Reclamation will consider water supply (CVP allocation) reductions and, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications with the goal of meeting both of these temperature and storage goals. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system. If available actions result in storage of 2.2-2.4 MAF, then no further actions would be pursued. If available actions are not sufficient to result in a storage of at least 2.2 MAF, then this year would be reclassified as Bin 2B.

Bin 2B

Bin 2B is typically a drier water year and can be the start of a multi-year drought sequence or a single year within a multi-year drought sequence. Bin 2B is defined as having an EOA storage at or above 3.0 MAF and a projected EOS storage of at least 2.0 MAF. This EOA storage does not typically allow full use of the TCD, but, when combined with the EOS of 2.0 MAF, is expected to be adequate to provide sufficient temperatures during the majority of the winter-run spawning and egg incubation period to avoid high temperature-related biological impacts. An EOS storage of 2.0 MAF provides a high likelihood of exceeding an EOA storage of 2.8 MAF the following year and has a low potential for fall/early winter flood control releases, although these releases may still occur under wetter hydrology. In these years, the primary management goals are to target meeting 53.5F at CCR during the winter-run spawning and egg incubation period and to manage water supply to support a carryover that provides some drought protection. The temperature management objectives may be shaped through coordination with SRG and SHOT based on forecasted and/or real-time meteorologic and hydrologic conditions and best available science. Reclamation will consider water supply (CVP allocation) reductions and, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications and with the goal of meeting both of these goals. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to address developing drought conditions and other actions from the drought toolkit. If available actions result in an EOS storage of 2.0-2.2 MAF, then no further actions would be pursued. If available actions are not

sufficient to result in an EOS storage of at least 2.0 MAF, then this year would be reclassified as Bin 3.

Operational Goals and Objectives

- Maintain sufficient storage for drought protection should the next year be dry
- Limit early season October through December spill to the extent possible
- Deliver available water while meeting regulatory requirements and obligations to senior water right holders under the SRS Contracts

Biological Objectives

- Victorian objectives: Recover (Bin 2a) and Maintain (Bin 2b)
- Maintain or maximize species recruitment opportunities with some reduction in spawning habitat compared to Bin 1.
- Maintain or restore river function and key floodplain linkages
- Restore key ecological flows
- Manage the majority of winter-run spawning habitat at CCR to average daily water temperature of 53.5° F
- Targeted Resulting Temperature Dependent Mortality to be ≤3%
- Manage adult holding temperatures to 58° F to minimize pre-spawning mortality
- Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.

Bin 2A Operational Goals and Indicators

- February or March forecasts project 3.0-3.7 MAF EOA storage based on 90% exceedance or other conservative approach
- February or March forecasts project 2.2-2.4 MAF EOS storage based on 90% exceedance or other conservative approach
- The goal of actions is to increase projected EOS storage above 2.2 MAF. If this is not possible, shift into Bin 2B.

Bin 2B Operational Goals and Indicators

- Hydrologic Goal: Increase drought protection
- February or March forecasts project 3.0-3.7 MAF EOA storage based on 90% exceedance or other conservative approach
- February or March forecasts project 2.0-2.2 MAF EOS storage based on 90% exceedance or other conservative approach

- The goal of actions is to increase projected EOS storage above 2.0 MAF. If this is not possible, shift into Bin 3A.

E.5.2.3 Bin 3 – Protect – ~8.5% of Years

Under Bin 3, critically dry conditions exist, the system is stressed and water resources are not available to meet all demands. There is low confidence to meet sufficient temperatures at the Clear Creek gage and future drought protection is at risk. The main biological objective is to protect winter-run Chinook salmon against decline. This Bin includes the widest array of potential water supply and fishery management actions to protect winter-run Chinook salmon from significant impacts and to protect against future drought risks.

During Bin 3 years, Shasta Reservoir is expected to be operated primarily for meeting public health and safety (including salinity management in the delta), obligations to senior water right holders under the SRS and minimum instream flows. The extent to which Shasta is relied upon to meet these demands depends on both hydrology and available water in other parts of the system. During the typical irrigation season (April through September), when Wilkins Slough is controlling releases from Keswick, Reclamation, through coordination with the SHOT, will identify the appropriate minimum Wilkins Slough flow to ensure flows can both meet biological goals and objectives while also meeting obligations to senior water right holders under the SRS Contracts. As a default, Reclamation will target a minimum flow of 3,400 cfs under these conditions. October flows may vary due to demands, water transfer operations and protection of winter-run redds and are likely to be in the 3,250 – 5,000 cfs range although higher flows may be necessary at times. After the irrigation season, Reclamation expects to begin ramping down to the minimum flow of 3,250 cfs as soon as possible given deliveries, delta conditions and winter-run redd dewatering concerns. Reclamation, through coordination with the SHOT, will determine the appropriate ramp down date after evaluating tradeoffs between storage, next year's temperature management, winter-run Chinook salmon redd dewatering and fall run stranding and redd dewatering. Should the following year be a Bin 3 year which, in part, was due to releases higher than these expected ranges, these higher flows may limit the available actions to conserve storage in that year.

Bin 3A

Bin 3A is an unusual year type where the hydrology is generally drier, but with a wetter spring or heavy snow-melt based inflow with lower demands expected. Bin 3A is defined as having an EOA storage below 3.0 MAF and a projected EOS storage greater than 2.0 MAF. This EOA storage does not allow full use of the TCD and is unlikely to meet sufficient temperatures at CCR. In these years, the primary management goals are to conserve storage and operate the TCD to target 53.5 F upstream of CCR for the most critical period during the winter-run Chinook salmon spawning and egg incubation period to avoid critical loss of winter-run Chinook salmon population. Reclamation will reduce Shasta Dam releases for water supply (CVP allocations) to conserve storage with the goal of meeting the EOS storage objective of 2.0-2.2. Reclamation, through coordination with the SHOT, will identify moderate system-wide tradeoffs and potential transfer modifications with the goal of conserving storage and meeting temperature objectives. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to

address developing drought conditions and other actions from the drought toolkit. If available actions result in storage of 2.0-2.2 MAF, then no further actions would be pursued. If available actions are not sufficient to result in a storage of at least 2.0 MAF, then this year would be reclassified as Bin 3B.

Bin 3B

Bin 3B is typically a dry water year and is often within a series of drier years such as during a multi-year drought sequence. Bin 3B is defined as having an EOA storage below 3.0 MAF and a projected EOS storage less than 2.0 MAF. An EOA storage below 3.0 MAF combined with an EOS storage of below 2.0 MAF will make protective temperature management very challenging. In addition, carryover less than 2.0 MAF provides little drought protection if the following year continues to be dry. As a result, years which fall into bin 3B are intended to be an "all-hands-on-deck" year where all actions from the drought tool kit are considered to determine if they can help support increased Shasta Reservoir storage. In addition, these years are likely to be ones where the entire system is stressed and many actions from the drought toolkit may be required to address the status of the entire system. It is likely that many drought actions considered in these years are not solely targeting Shasta storage but looking at system wide storage for meeting highest priority demands and providing some overall system wide drought protection should the following year be dry. There is confidence that a temperature management plan will include a strategy to provide winter-run Chinook spawning temperatures that avoid critical losses of egg and fry production, maintain key spawning refuges in upstream areas and avoid catastrophic impacts to the brood year.

In these years, the primary management goals are to conserve storage and operate the TCD to target 53.5° F upstream of CCR for the most critical period during the winter-run spawning and egg incubation period to avoid critical loss of winter-run population. Reclamation will reduce Shasta releases for water supply (CVP allocations) to only that needed for meeting public health and safety demands, including minimum salinity levels in the Delta. Reclamation, through Chinook salmon coordination with the SHOT, will identify moderate and heavy system-wide tradeoffs with the goal of conserving storage and meeting minimal temperature objectives. Moderate system wide tradeoffs generally include, but are not limited to, rebalancing between other CVP reservoirs with moderate impacts to other parts of the system, transfer timing modifications, situation-specific adjustments to Delta water quality standards under D-1641 to address developing drought conditions and other actions from the drought toolkit. Heavy system wide actions include requesting significant relaxations to D-1641, limitations in water available under contract (see further description below) and other actions from the drought toolkit. In extremely dry years or in multi-year droughts, it is possible that these actions will not achieve an EOS storage above 2.0 MAF.

During Bin 3B years, defined as having an EOA storage below 3.0 MAF and a projected EOS storage less than 2.0 MAF, which are also designated as critical years under the SRS Contractors' contracts and have an October through April inflow of less than 2.5 MAF, available water supply for diversion under the SRS Contractors is limited to between 75% and 50% of total contract quantities, or approximately 1.5 - 1.1 MAF. The available water for diversion within this range depends on the water available to meet an expected EOS storage of 2.0 MAF using a conservative forecast (90% exceedance or equivalent). This reduced volume of available water will be applied to all SRS Contractors collectively and individual contractor reductions may vary

based on agreements and transfers between different SRS Contractors. In these years, previously described SRS Contractor voluntary actions under their resolution may not be possible due to the very limited supply. It is also unlikely that VA water would be made available in these years as they are typically critical water year types. Should there be a request for a VA asset, the origin and use of that asset will be discussed through the appropriate governance teams. During these years, Reclamation will coordinate with USFWS to maintain summer deliveries of Level 2 supplies to Sacramento Valley CVPIA refuges to provide essential dry year habitat for Giant Garter Snake, Western Pond Turtle, Tricolored blackbirds and migratory waterfowl in a manner consistent with refuge contracts and agreed upon operational priorities. If conditions remain dry through the fall Reclamation and USFWS will coordinate on how to address instream flow objectives, lake levels and refuge needs. Reclamation will continue to utilize level 4 to supplement supplies for refuges in drier years when storage and coldwater pool are limited.

SRS Contractors will be asked to provide input through the SHOT on minimum Keswick and Wilkins Slough flows to meet obligations to senior water right holders under the SRS Contracts while meeting biological objectives and other requirements such as public health and safety. In situations where appropriate fall and winter flows were discussed and tradeoffs were evaluated but there was not agreement on the implemented flow regime from the SRS Contractors, SRS Contractors propose alternative methods to meet obligations to senior water right holders under the SRS Contracts with the SHOT should the following year be a 3B year. Should a similar disagreement occur during a Bin 3B year after the Bin has been designated, flows in disagreement will not affect the determination on volume of available water. Under these conditions, the likelihood of storage below 2.0 MAF will increase. Reclamation will coordinate through the SHOT with a goal of agreement on all release decisions in 3B years in order to avoid a disagreement on the use of critical and limited water supplies.

Operational Goals and Objectives

- Maintain and conserve minimal storage for to avoid catastrophic low storages should the next year also be dry
- Meet public health and safety demands including delta salinity
- Meet obligations to senior water right holders under the SRS Contracts

Biological Objectives

- Victorian objective: Protect
- Avoid critical loss of population
- Maintain key refuges of spawning and early rearing habitat
- Avoid catastrophic changes to habitat and impacts to the brood year
- Manage winter-run spawning habitat upstream of CCR average daily water temperature of 53.5° F during the critical periods of the spawning and egg incubation period
- Targeted Resulting Temperature Dependent Mortality to be ≤30%

- Manage adult holding temperatures below 58 daily average to minimize pre-spawning mortality
- Appropriate reach-specific survival objectives will be developed through the Winter-Run Action Plan.

Bin 3A Operational Goals and Indicators

- February or March forecasts project <3.0 MAF EOA storage based on 90% exceedance or other conservative approach
- February or March forecasts project >2.0 MAF EOS storage based on 90% exceedance or other conservative approach
- The goal of actions is to increase projected EOS storage to 2.2 MAF. If this is not possible to increase projected EOS storage above 2.0 MAF shift to Bin 3B.

Bin 3B Operational Goals and Indicators

- Hydrologic Goal: Increase drought protection
- February forecasts projects <3.0 MAF EOA storage based on 90% exceedance or other conservative approach
- February forecasts projects <2.0 MAF EOS storage based on 90% exceedance or other conservative approach
- The goal of actions is to increase projected EOS storage above 2.0 MAF, If this is not possible identify system priorities and contingencies.

E.5.3 Egg Incubation and Emergence Temperature Objectives

Water temperature management generally occurs May 15 through October 30; however, start and end dates may be adjusted through coordination with the SRG and SHOT based on the winter-run Chinook salmon spawning and emergence. Water temperature management would target 53.5°F at locations identified in the Bins above. The application of Victorian Objectives will be applied to support a greater habitat extent, duration and frequency on the Sacramento River below Keswick Dam, when storage resources allow, water temperature management will expand habitat for early or later spawners, spawners further downstream, and juveniles rearing.

E.5.3.1 Temperature Management Plan

Reclamation will coordinate through the SRG to prepare a draft TMP in April. The draft TMP will include: projected reservoir releases, assumed meteorological conditions, anticipated water temperatures and target locations, and temperature-dependent mortality estimates for both Martin (2017) and Anderson (2022). Reclamation will finalize the TMP in May or later through coordination with the SRG and SHOT. Reclamation may update the TMP through coordination with the SRG and SHOT.

A final TMP after May is more likely in wetter years when the location of 53.5° F is expected to be downstream of CCR or in years when hydrologic conditions changed significantly after the draft TMP. For the final TMP, Reclamation will use conservative assumptions for determining

the temperature management strategy, including relying on the actual May 1 storage, a conservative inflow forecast for inflow May through September, expected releases based on a conservative forecast and a conservative historical meteorology. Reclamation will utilize a forecast with 90% exceedance in the aggregate (when jointly considering multiple significant known uncertainties such as hydrology and meteorology) to develop conservative water temperature forecasts, although certain circumstances may lead Reclamation to use different exceedance levels to incorporate an appropriately more conservative approach.

Reclamation will operate the TCD to manage water temperatures below Keswick Dam according to the TMP and monitor the results. Reclamation will proactively monitor and manage water temperatures and make operational changes to maintain temperatures consistent with the objectives from the TMP throughout the temperature management season. If monitored water temperatures exceed the average daily target temperature for three consecutive days, despite efforts to monitor conditions and manage proactively, Reclamation will notify NMFS of what actions, if any, are being or will be taken to address the exceedances and will arrange for a follow-up on day 4 if the actions do not resolve the issue. Reclamation will monitor implementation of the TMP using updated data on reservoir storage and coldwater pool via reservoir profiles and water temperatures downstream of Keswick Reservoir.

E.5.3.2 Temperature Profile Tracking

Reclamation will collect temperature profile measurements for Shasta, Whiskeytown, and Trinity reservoirs every month at 25 ft intervals and distributed through the SRG following quality assurance/quality control.

Table E-11. Temperature Profile Measurements for Shasta Reservoir.

	Profiles	
Dates	**Frequency**	**Intervals (feet)**
December–February	Monthly	25
March–April	Every Two Weeks	5
May–November 15	Every Week	5
November 15–30	Every Two Weeks	5

E.5.3.3 Annual Winter-run Chinook Salmon Brood Year Assessment

In order to inform operations, risk tradeoffs for determining the downstream extent of water temperature management, and the need to pursue increasing production or taking other actions at LSNFH, the JPE Subteam will conduct a winter-run Chinook salmon broodyear assessment for the previous year's cohort and the cohort of return adults that hatched three years prior. The purpose is to track species conditions and take appropriate actions to avoid adverse impacts to the following year’s cohort. If the previous year’s cohort and the cohort three years prior, is determined to have experienced “adverse conditions”, then more actions would be taken to manage the objectives for each Bin, including both biological and drought protection objectives. The broodyear assessment will be developed by February 1 or each year using the best available science to guide calculation of each metric described below. The broodyear assessment will be

based on the best available science each year and the JPE Subteam may consider using the following indicators or information:

- >30% TDM
- <20% ETF survival
- 25%ile of historic JPE
- TMP compliance point was above CCR
- Adverse Population Viability Trends (per previous years annual brood year report if there was an increase in any of the five criteria in Lindley et. al. 2007)
- High Risk of Extinction (per 5 year status review)
- Outyear adult escapement forecast based on Pacific Fishery Management Council winter-run stock abundance analyses

The JPE Subteam will provide the broodyear assessment to Reclamation and the SHOT. If the broodyear assessment determines Adverse Conditions for Winter-run Chinook salmon and identifies that Shasta storage and hydrology are expected to result in continuing adverse conditions to the coming broodyear, the SHOT will report these conditions and proposed actions to the Directors and all reasonable actions will be taken to avoid continued adverse conditions. These indicators of broodyear strength can be revised by the SHOT with NMFS approval.

E.5.4 Sacramento River Settlement Contractors Resolution

The SRS Contractors approved A Resolution Regarding Salmon Recovery Projects in the Sacramento River Watershed, Actions Related to Shasta Reservoir Annual Operations, and Engagement in the Ongoing Collaborative Sacramento River Science Partnership Effort. Pursuant to the resolution, the SRS Contractors will continue to participate in, and act as project champions for future Sacramento Valley Salmon Recovery Program projects, subject to the availability of funding, regulatory approvals, acceptable regulatory assurances, and full performance of the SRS Contracts.

Pursuant to the resolution, the SRS Contractors will meet and confer with Reclamation, NMFS, and other agencies as appropriate to determine if there is any role for the SRS Contractors in connection with Reclamation's operational decision-making for Shasta Reservoir annual operations in those years. This determination will include consideration of what actions are feasible, consistent with the terms of the SRS Contracts. In addition to the 25% reduction during Shasta critical years as set forth in the SRS Contracts, the types of actions that may be considered include, but are not necessarily limited to: (1) the scheduling of spring diversions by the SRS Contractors; (2) voluntary, compensated water transfers by the SRS Contractors subject to Reclamation approval; and (3) smoothed SRS Contractor diversion for rice straw decomposition during the fall months. Any mutually agreeable proposed actions resulting from these meet-and-confer discussions must be consistent with the terms of the SRS Contracts and may also be subject to other regulatory approvals.

Decisions related to implementation of these Shasta-related voluntary actions will be carried out through SHOT.

E.5.4.1 Monthly SHOT Planning and Actions

This section describes the monthly SHOT planning process and actions that will be discussed. The planning approach is based on the seasonal water year and identifies actions that are necessary to implement the Shasta Management Plan.

October

- The SHOT begins meeting for the new water year
- Begin technical discussion for yearling Spring-run surrogates hatchery releases.
- Kick-off JPE Subteam – establish 5-agency team, confirm meetings, schedule, work products
- Expected work products: JPE, Winter-run brood year assessment
- Begin tracking system conditions and hydrologic outlook. Goal is to take stock of system conditions and tracking water year hydrology
- SHOT discussing October releases for purpose of tracking winter-run dewatering and incidental take limits
- SHOT available for elevation for Redd Maintenance and Fall Flow Smoothing actions
- Reclamation, through coordination with SHOT, planning for winter refill flows
- Reclamation, through coordination with SHOT, tracking VA assets and discussing options for deployment
- If necessary, SHOT discussing water transfer schedules
- SHOT tracking downstream winter-run counts

November

- SHOT provides support to JPE Subteam as needed
- Continue tracking system conditions and hydrologic outlook
- SHOT discuss November-April Keswick minimum releases based on EOS. In the event of a dry fall where the previous year was a Bin 2 or 3 year, strive to get to 3,250 cfs by December 1 or sooner.
- SHOT available to the SRG for elevation for Redd maintenance and Fall Flow Smoothing
- SHOT tracking winter refill flows
- SHOT is tracking VA assets and discussing options for deployment
- Receive winter-run adult spawning escapement numbers from summer

- SHOT tracking downstream winter-run counts

December

- SHOT provides support to JPE Subteam
- JPE Subteam issues JPE Memo to SHOT by December 31
- Continue tracking system conditions and hydrologic outlook
- For the most part, December is not a drought planning month, but may be in extreme low storage conditions
- Under very dry fall conditions that have resulted in extremely low storage conditions, Reclamation and DWR, in coordination with the SHOT, will start to review the drought toolkit in anticipation of drought conditions developing or persisting.
- Tracking fishery conditions
- SHOT is tracking VA assets and discussing options for deployment
- Review the temperature and temperature-dependent mortality results from the previous water year versus the objectives from TMP to determine if: 1) any deviances from the TMP were understood by the SRG and SHOT team, 2) if an independent panel review is appropriate for better understanding the differences and 3) if any adjustments to the planning process are warranted. In some cases, the SHOT may work with the SRG to conduct an operational and/or biological necropsy to determine the cause of any exceedance.

January

- SHOT provides support to JPE Subteam.
- If an adjustment is needed, the JPE Subteam will issue JPE Adjustment Memo to SHOT Team by January 15-31
- SHOT reviewing drought tool kit in low storage years or if drought conditions are present
- SHOT is tracking VA assets and discussing options for deployment
- SHOT evaluating possible need for Livingston Stone NFH production adjustments or other actions to protect winter-run Chinook salmon production at the hatchery.
- SHOT considering non-critical year voluntary actions if low storage conditions or drought conditions are developing.

February

- If February 90% forecast EOA/EOS projections indicate Bin 2:
    - SHOT may initiate Meet and Confer regarding water supply neutral actions. Discussions based on 90% February forecast unless a different forecast is more appropriate to reflect a conservative outlook

    - SHOT evaluating system-wide tradeoffs
    - SHOT evaluating drought toolkit for possible actions
    - USFWS, through coordination with SHOT, determines if it's appropriate to increase production at Livingston Stone NFH or to take other actions to protect winter-run production
    - Broodstock collection begin.
    - VA asset planning begins
- If February 90% forecast EOA/EOS projections indicate potential Bin 3:
    - SHOT may initiate Meet and Confer regarding voluntary actions discussions based on 90% February forecast unless a different forecast is more appropriate to reflect a conservative outlook
    - SHOT evaluating system-wide tradeoffs
    - SHOT evaluating drought toolkit for possible actions
    - USFWS, through coordination with SHOT, determines if it's appropriate to increase production at Livingston Stone NFH or to take other actions to protect winter-run production
    - Broodstock collection begin.
- Regardless of Bin type:
    - JPE Subteam issues annual winter-run brood year assessment memo to SHOT
    - SHOT coordination on February Operational Outlook
    - Reclamation announces initial Shasta-critical determination and CVP allocations – Note: most deliveries do not start until April or May
    - If Shasta Reservoir EOS storage is projected to be above 2.4 MAF, then walk through the forecast after the allocation comes out
    - If a borderline year, then Reclamation will discuss any key forecasting assumptions with the SHOT prior to allocations. This may include expected release ranges and storages for all reservoirs, expected pumping levels and expected regulatory requirements. Due to the very tight time frame for reviewing any data before the allocation is released, this may not include a full outlook but rather the key factors that prevent Shasta from reaching 2.4 MAF or higher. This may be done either verbally in a SHOT meeting or via email.
    - SHOT is tracking VA assets and discussing options for deployment
    - VA asset planning begins
    - SHOT begins discussing system-wide tradeoff actions

- SRG meets to start planning for possible March pulse flow.If SRG recommends an early (March) pulse flow, it will be recommended to SHOT as soon as possible but no later than the end of February.
- SHOT decision on spring pulse flow could be based on temperature modeling or could be based on storage and broodstock only. If the SRG decides spring pulse flow is appropriate, will pass to SHOT as a recommendation. To the extent possible when consistent with action objectives, try to combine the spring pulse flow with meeting delta objectives, either D-1641 or the VA system-wide objectives depending on the source of the pulse flow water.
- SHOT considers tradeoffs associated with a pulse flow action in the context of the brood year assessment, projected EOA and EOS storage, system conditions, current hydrology and forecasts.

March

- If March 90% forecast indicates EOA/EOS projections indicate Bin 2:
    - SHOT needs confirmation on scheduling for spring diversions per SRS Contractor resolution
    - Confirmation on resolution items, particularly the delayed spring offset and begin to get an idea of volumes of transfers
    - Preliminary temperature modeling; convene SRG
- If March 90% forecast EOA/EOS projections indicate Bin 3:
    - Preliminary signal for allocation or delivery adjustments
    - Preliminary temperature modeling; convene SRG
- Regardless of Bin type:
    - SHOT begins meeting weekly or as needed
    - SHOT begins enhanced reporting out to WOMT
    - SHOT initiates preliminary scenarios and TMP planning.
    - SHOT begins discussions to plan for April and May release patterns
    - Continue to coordinate on non-critical year voluntary actions. Need a preliminary idea of SRS Contractor diversion quantities and transfers
    - SHOT evaluating drought toolkit for possible actions
    - SHOT discusses potential signals for possible drought actions
    - Continuing to evaluate system wide tradeoffs
    - Livingston Stone NFH broodstock collection continues

- Reclamation shares the March Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
- Reclamation tracking Shasta Critical Determination
- Reclamation announces March allocations if appropriate. SHOT coordination involves:
- If Shasta EOS is projected to be above 2.4 EOS, then walk through the forecast after the allocation comes out
- If a borderline year, discuss key forecasting parameters that prevent Shasta from reaching 2.4 MAF
- VA asset planning continues
- SHOT discussing system-wide tradeoff actions
- SRG Planning
- SRG pulse flow group planning for possible March or April pulse flow
- SHOT Decision on spring pulse flow – could be based on preliminary temperature modeling or could be based on storage and broodstock only. If the SRG decides spring pulse flow is appropriate, will pass to SHOT as a recommendation. To the extent possible when consistent with action objectives, try to combine the spring pulse flow with meeting delta objectives either D-1641 or the VA system-wide objectives depending on the source of the pulse flow water.
- SHOT considers pulse flow action in consideration of brood year assessment, storage, system conditions…risk/balance/tradeoffs

April

- If April 90% forecast indicates EOA/EOS projections indicate Bin 2:
    - Transfer planning – Identify bounds of volume and timing
- If April 90% forecast EOA/EOS projections indicate Bin 3:
    - Transfer planning – Identify bounds of volume and timing
    - Final decisions on many drought actions including available water supply for SRS Contractor diversions and diversion patterns
- Regardless of Bin type:
    - SHOT meeting weekly or as needed
    - SHOT continues enhanced reporting out to WOMT
    - Reclamation announces April allocations if appropriate. SHOT coordination involves:

- If Shasta EOS is projected to be above 2.4, then walk through the forecast after the allocation comes out
- If a borderline year, then discuss key forecasting parameters that prevent Shasta from reaching 2.4 MAF
- SHOT continues planning discussions for April and May release patterns
- Continue to coordinate on non-critical year voluntary actions
- May pulse flow decision
- Livingston Stone NFH actions continuing
- Reclamation shares the April Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
- Draft TMP (table and/or graphs only – no report):
- If going into a bin 2 or 3 (90% exceedance unless altered by hydrology) then based on March forecast with a date of April 15 to allow for SRG coordination
- If bin 1, then date of April 30 using the April forecast unless later decided by SHOT
- Profile frequency – SHOT determines optimal frequency
- Determine final shoulder temps if necessary

May

- If May 90% forecast indicates EOA/EOS projections indicate Bin 2:
    - Transfer planning – Identify bounds of volume and timing
- If May 90% forecast EOA/EOS projections indicate Bin 3:
    - Continue Meet and Confer. Make decisions regarding commitments under SRS Contractor resolution
    - Transfer modifications – Draft/Final bounds
    - Evaluating drought toolkit if necessary
- Regardless of Bin type:
    - SHOT back to meeting Monthly or as needed
    - Reclamation shares the May Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
    - SHOT continues planning discussions for May release patterns
    - Final allocations in appropriate: SHOT Coordination includes:

- If Shasta EOS is projected to be above 2.4, then walk through the forecast after the allocation comes out
- If a borderline year, then discuss key forecasting parameters that prevent Shasta from reaching 2,4 MAF
- It is common that May will be the final allocation
- Continue to coordinate on non-critical year voluntary actions
- Evaluate system wide trade offs
- Livingston Stone NFH actions continue
- Possible May pulse flow
- Final TMP shared with both NMFS and SWRCB with a copy to all SHOT and SRG members. Final will be issued by May 31 unless a later date is agreed upon by the SHOT.

June

- SHOT is meeting monthly or as needed and coordinating with the SRG during implementation of the TMP
- SHOT may consider adjustments to the TMP if recommended by the SRG

July

- SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP
- SHOT may consider adjustments to the TMP

August

- SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP
- SHOT may consider adjustments to the TMP
- SRG begins discussing fall release planning

September

- SHOT is meeting monthly, or as needed, and coordinating with the SRG during implementation of the TMP. There may be a need to coordinate on fall transition planning to minimize redd dewatering based on available coldwater and overall storage conditions.

E.5.4.2 Drought Operations Priority Framework

Under certain conditions, such as prolonged drought or unexpected hydrologic conditions, the February 90% forecast may indicate that EOS is projected to be less than 2.0 MAF. Under these conditions, Reclamation will develop a drought emergency plan that, at a minimum, will include

the following actions with the goal of achieving a projected EOS storage as close to 2.0 MAF as possible:

- Evaluation of system priorities
- Plan to continue to pursue all applicable 3B actions
- Full assessment of hydrologic and ecosystem conditions
- Assessment of Public Health and Safety needs
- Managing salinity to meet basic public health and safety needs
- Ability to meet demands for public health and safety water deliveries
- Enhanced coordination between the SHOT, Directors and SRS Contractors
- After exploring all applicable 3B actions, develop a TMP which accounts for the drought emergency plan and applies the best available approaches for managing the available coldwater supply to best balance tradeoffs between the spatial and temporal extent of winter-run suitable habitat while considering impacts to other species.

All actions in the Drought Toolkit will also be considered. Over the long-term additional actions are being considered or implemented to provide improved conditions for species during future droughts in addition to the actions identified in this plan:

- Designing habitat projects with drought refugia and resilience in mind
- Investments in other habitats for salmon spawning
- Consider objectives when planning for and implementing other water projects

Management Rationale: In these circumstances, all of the relevant Bin 3B actions will be considered but there is a low likelihood that taking all of the actions would increase forecasted EOS conditions above 2.0 MAF and therefore, Reclamation, in coordination with the SHOT and WOMT, will develop a drought emergency plan that establishes system priorities and a temperature management plan that seeks to provide winter-run Chinook spawning temperatures to avoid catastrophic losses related to summer temperature management.

E.5.5 Clear Creek

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.5.5.1 Minimum Instream Flows (Seasonally Variable Hydrograph)

Reclamation will release water through Whiskeytown Dam to provide intra-annual variation to emulate natural processes. As provided in Figure E-17 and Table E-12, flows will oscillate over a 1-year period, with releases transitioning from 300 cfs in the winter, down to 100 cfs in the summer, and back to 300 cfs by the following winter. In critical years, Reclamation will target an

average 150 cfs based on available water from Trinity Reservoir and attempt to maintain above 100 cfs.

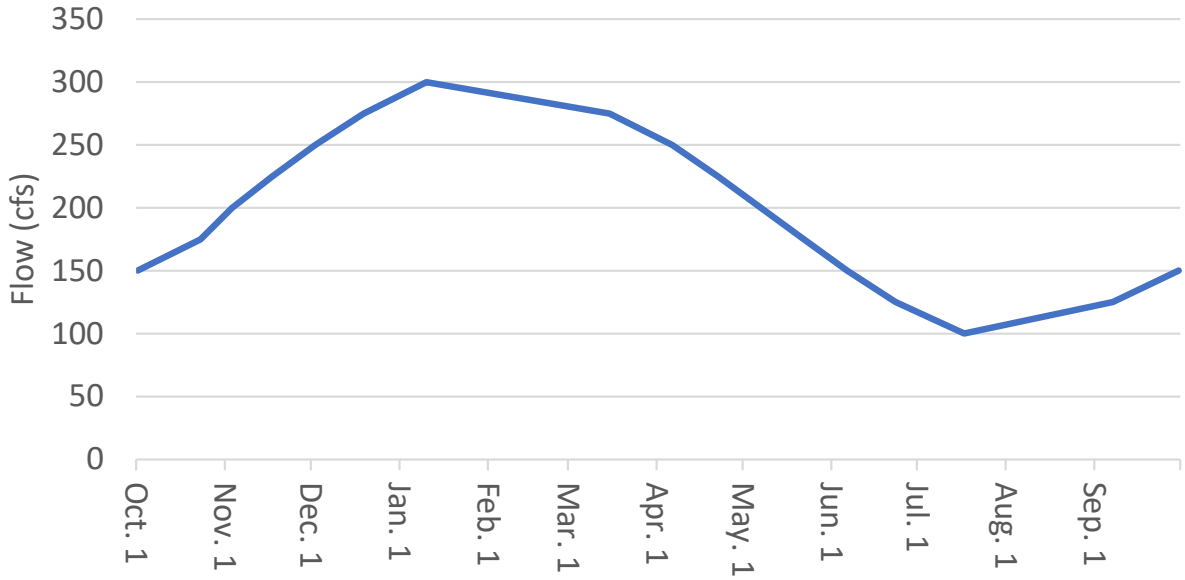


Figure E-17. Clear Creek Seasonally Variable Hydrograph Minimum Flows, Except Critical Years.

Table E-12. Proposed Annual Clear Creek Flows Changes.

Date	From (cfs)	To (cfs)
October 1	125	150
October 23	150	175
November 3	175	200
November 17	200	225
December 2	225	250
December 19	250	275
January 10	275	300
March 15	300	275
April 6	275	250
April 22	250	225
May 7	225	200
May 22	200	175
June 6	175	150
June 23	150	125
July 17	125	100
September 7	100	125

cfs = cubic feet per second.

Reclamation, through the CCTT, will schedule the hydrograph to maximize multi-species benefits. Reclamation, through the CCTT, may modify the timing and flow rates provided in Figure E-17 and Table E-12 by February 1 and updated through May on a case-by-case basis. The flow schedule is subject to agreement by Redding Electric Utility for use of their facilities.

E.5.5.2 Pulse Flows

Except in years with significant uncontrolled spill, Reclamation will release up to 10,000 acre-feet from Whiskeytown Dam for channel maintenance, spring attraction flows, and to meet other physical and biological objectives. In critical years, Reclamation will release up to 5,000 acre-feet. Reclamation, through CCTT, will develop pulse flow schedules, which include measures (e.g., nighttime down ramping, slow down ramping rates, coordination with natural precipitation events) to mitigate for potential risks (e.g., potential juvenile fish stranding). The pulse flows are not to exceed safe outlet works capacity of Whiskeytown Dam, currently 840 cfs, and will be scheduled on or after February 1.

Availability of water for pulse flows is tied to water year type. The determination of water year type will be based on the Sacramento Valley Index (SVI), at 90% exceedance level. Due to unknowns in winter precipitation, Clear Creek pulse flows are not to occur prior to the February SVI reporting. The full pulse flow volume (10,000 acre-feet) will be available if the SVI is greater than 5.4, at the SVI updates (i.e., dry or wetter years). If the SVI updates are equal to or less than 5.4 (critical years), Reclamation would limit releases of pulse flows to 5,000 acre-feet.

E.5.5.3 Water Temperature Management

Reclamation will target Whiskeytown Dam releases to not exceed the mean daily temperatures at Igo gauge:

- 61°F from June 1 through August 15.
- 60°F from August 16 through September 15.
- 56°F from September 16 through November 15.

Water temperature management on Clear Creek is implemented through changes in guard gate configurations and flow manipulations. In dry, critical, or import curtailment years, Reclamation may not be able to meet these water temperatures and will operate Whiskeytown Dam as close to these water temperatures as practicable.

Additional flows may be required to meet temperature objectives. Reclamation will determine if additional water is available for temperature management and inform the agency representatives through the CCTT. If two consecutive days of mean daily temperature are exceeded, and Reclamation determines additional water is available, then 25 cfs per day will be added to the base flow to address temperatures.

Any flow changes completed for temperature management in the late-summer or fall, implemented at 25-cfs increments, would be maintained until the base flow of the seasonal hydrograph rises to meet the elevated temperature release. For example, if flows were increased

to 150 cfs on September 10 to decrease water temperatures, they would remain there until October 23 when the hydrograph would normally increase to 175 cfs. This relieves the need to down ramp during spawning and potentially dewater redds. If additional flows are needed to meet temperature in late spring or summer during a hot spell for instance, ramp-down to base flow would occur when meteorological conditions allow.

E.5.6 American River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. Operations on the American River are the same as the No Action Alternative.

E.5.7 Delta

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.5.7.1 Old and Middle River Flow Management

OMR provides a surrogate indicator for how export pumping at Banks and Jones Pumping Plants influence hydrodynamics in the south Delta. OMR will be calculated using the equation provided in Hutton 2008. If an equation is developed that results in a better representation of OMR flows, and Reclamation, DWR, NMFS, USFWS, and CDFW agree, then that equation will be updated in calculating the OMR index.

Winter-Run Early Season Migration

DWR and Reclamation will reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs for seven consecutive days when the genetically verified 7-day rolling sum of winter-run and spring-run Chinook salmon loss, calculated daily, exceeds the following thresholds:

- From November 1 – November 30: 0.0132% of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in October.
- From December 1 – December 31: 0.0265% of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total estimated at the end of the second biweekly period in November.

If the 7-day rolling sum of winter-run and spring-run Chinook salmon loss, calculated daily, is exceeded during a period of reduced exports, DWR and Reclamation will continue to reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs until 7 days after the most recent exceedance.

Reclamation and DWR will restrict exports in response of meeting the threshold above based on initial length-at-date identification of natural older juvenile Chinook salmon. If genetic analysis of natural older juvenile Chinook salmon observed in salvage at the SWP or CVP indicates that any given Chinook salmon is not genetically winter-run or spring-run Chinook salmon, these fish will not count towards the loss threshold exceedance, and continued export restrictions pursuant to the OMR limit are not required. Given that SHERLOCK is a new methodology currently

undergoing peer review and field testing, both methodologies will be used to determine the final identification. In the event that SHERLOCK and GT-seq provide different run assignments, the results from the GT-seq method will be used to determine the final run assignment for the purposes of implementing this early season migration action.Start of OMR Management

The OMR management season starts any time after December 1 if a First Flush Action occurs (i.e., immediately following completion of the First Flush Action) or any time after December 20 if the turbidity threshold in the Adult Delta Smelt Entrainment Protection Action is reached. If neither the First Flush Action occurs or the Adult Delta Smelt Entrainment Protection Action is reached, the OMR management season starts automatically on January 1. Once initiated, the OMR index on a 14-day running average will be no more negative than -5,000 cfs until the end of the OMR management season. A reduction in exports to achieve a new OMR index will occur within three days of an action that requires a change in OMR.

First Flush Action: to minimize project influence on the movement of Delta smelt and potentially other listed fish species into the South Delta, Reclamation and DWR will reduce CVP and SWP exports for 14 consecutive days, anytime between December 1 and the last day of February, to maintain a 14-day average OMR index no more negative than -2,000 cfs within three days of when the following criteria are met:

- Three-day running average of daily flows at Freeport is greater than, or equal to, 25,000 cfs, and
- Three-day running average of daily turbidity at Freeport is greater than, or equal to, 50 Formazin Nephelometric Units (FNU)

These criteria will be evaluated using data from the CDEC Sacramento River at Freeport (FPT). The First Flush Action may only be initiated once each water year. The First Flush Action is exempt from the high-flow offramps as outlined below.

Reclamation and DWR, through WOMT, may prepare an assessment to initiate the First Flush Action early if real-time monitoring of abiotic and biotic factors and salvage prediction models indicates the First Flush Action is likely to be triggered (i.e., within two to three days) and Delta smelt salvage is possible.

Reclamation and DWR recognize that readings at individual turbidity sensors or localized groups of turbidity sensors can generate spurious results in real-time. To avoid triggering an OMR flow action during a sensor error or a localized turbidity spike that might be caused by local flows or a wind-driven event, Reclamation and DWR will consider and review data from other locations. In the event that the three-day running average of daily turbidity at Freeport is 50 FNU (or greater), and Reclamation and DWR believe that a First Flush action is not warranted based on additional data sources, DWR and Reclamation will provide the additional data to the SMT and request they convene to confirm criteria will be met because of increased precipitation rather than sensor error or localized turbidity spike. If it is determined through WOMT that there is sensor error or a localized turbidity spike, Reclamation and DWR will take no additional action and provide the supporting information to the Service and CDFW within 24 hours.

Real-time Adjustments

Reclamation and DWR will manage to a more positive OMR than -5,000 cfs on a 14-day average under the following conditions:

Delta Smelt Adult Entrainment Protection Action (Turbidity Bridge)

The purpose of this action is to minimize adult Delta smelt entrainment risk by reducing exports during periods when turbidity is elevated in the south Delta resulting in habitat conditions that support movement of Delta smelt from the lower San Joaquin River into the south Delta and toward the export facilities (Smith et al. 2021). If after a First Flush Action or after December 20, whichever occurs first, daily average turbidity remains or becomes elevated to 12 FNU or higher at each of three turbidity sensors in the OMR corridor creating a continuous bridge of turbidity from the lower San Joaquin River to the CVP and SWP export facilities, Reclamation and DWR will manage exports to achieve a five-day average OMR flow that is no more negative than -3,500 cfs until the daily average turbidity in at least one of the three turbidity sensors is less than 12 FNU for two consecutive days, thereby indicating a break in the continuous bridge of turbidity. The three turbidity sensors are Holland Cut (HOL), OBI, and Old River at Franks Tract near Terminus (OSJ).

If the three turbidity sensors remain over 12 FNU at the end of a High Flow Off-Ramp or any time after five consecutive days, then Reclamation and DWR, through WOMT, may prepare an assessment to determine if another Adult Delta Smelt Entrainment Protection Action is warranted based on continued entrainment risk following the period of elevated flows and whether Delta smelt distribution has shifted downstream, as informed by available quantitative tools and real-time data.

The Adult Delta Smelt Entrainment Protection Action ends when the three-day continuous average water temperatures at Jersey Point or Rio Vista reach 53.6ºF (12ºC).

When daily average San Joaquin River flows at Vernalis are greater than 10,000 cfs, the Adult Delta Smelt Entrainment Protection Action (Turbidity Bridge) is off ramped. While off ramped, the OMR Index will be managed to no more negative than –5,000 cfs on a 14-day average. The Adult Delta Smelt Entrainment Protection Action (Turbidity Bridge) would be immediately reinstated when daily average San Joaquin River flows at Vernalis drop below 8,000 cfs.

Delta Smelt Larval and Juvenile Protection Action

Larval and juvenile Delta smelt protections start upon the end of the Adult Delta Smelt Entrainment Protection Action. Reclamation and DWR will operate south Delta exports to a 7-day average OMR index no more negative than -5,000 cfs when the average Secchi disk depth in the most recent survey is greater than one meter. The Secchi disk depth will be calculated as the average measurement from all sampled stations on the San Joaquin River upstream of Jersey Point and stations south of the lower San Joaquin River. If the average Secchi disk depth in the most recent survey is less than 1 meter, then Reclamation and DWR will operate to an OMR index no more negative than -3,500 cfs until the average Secchi depth has increased to more than 1 meter. The projects will operate to whichever of these OMR thresholds is appropriate given the latest Secchi disk depth data until the End of OMR Management Season.

Longfin Smelt Adult Entrainment Protection Action

If cumulative water year salvage of Longfin smelt with fork length ≥60 millimeters (mm) at the CVP and SWP facilities exceeds the savage threshold, where:

$$Salvage\ threshold = \left(\frac{San\ Francisco\ Bay\ Study\ Longfin\ smelt\ index^{1}}{20}\right) + 1$$

Where:

The San Francisco Bay Study Longfin smelt index is calculated using age 1+ fish captured in the mid water trawl from the full Bay Study sampling area (CDFG 1999). The index is additive for the months of August, September, October, November, and December. If December data is not available at the start of this action period, then the August to November threshold will be used until the December data is available.

Then:

- From December 1 to the start of the OMR management season, Reclamation and DWR shall operate to an OMR flow no more negative than -5,000 cfs on a seven-day average for seven consecutive days. If salvage of longfin smelt ≥60 mm continues following the 7-day period where OMR is no more negative than -5,000 cfs, then WOMT may determine if OMR management should be initiated.
- From the start of the OMR management season to the end of February, Reclamation and DWR shall operate to an OMR flow no more negative than -3,500 cfs on a seven-day average for seven consecutive days. If salvage of longfin smelt ≥60 mm continues following the 7-day period where OMR is no more negative than -3,500 cfs, then Reclamation and DWR, through WOMT, may prepare an assessment to determine if additional longfin smelt entrainment protection action is warranted based on continued entrainment risk, as informed by available quantitative tools and real-time data.

Longfin Smelt Larval and Juvenile Protection Action

From January 1 through the end of OMR management season (see below), if:

- The 7-day average QWEST (the average daily flow traveling past Jersey Point, which represents the net flow in the lower San Joaquin River) is <+1,000 cfs, and;
- Larval and juvenile longfin smelt catch in the most recent smelt larval survey or 20-mm survey at stations 809 and 812 exceeds the catch threshold set by the San Francisco Bay Study longfin smelt index (see 7 for catch thresholds).

Reclamation and DWR will restrict the 7-day average OMR flow to no more negative than -3,500 cfs for seven days. This OMR action may be off-ramped if larval and juvenile longfin smelt combined catch per unit effort at stations 809 and 812 is less than 5% of the total catch across the stations identified in 8 for the same smelt larval survey or 20-mm survey used to on-ramp the action (#2 above). This off-ramp would be in effect until a subsequent smelt larval survey or 20-mm survey is conducted.

If the water year cumulative juvenile longfin smelt salvage at the CVP and SWP facilities exceeds 50% of the average annual salvage observed from 2009 through the water year preceding the current water year, then Reclamation and DWR shall operate to a seven-day average OMR of -3,500 cfs for 14 days. If the water year cumulative juvenile longfin smelt salvage at the CVP and SWP facilities during this period exceeds 75% of the average annual salvage observed from 2009 through the water year preceding the current water year, then Reclamation and DWR shall operate to a 7-day average OMR of -2,500 cfs for 14 days. If salvage of larval and juvenile longfin smelt continues following the 14-day period where OMR is no more negative than -2,500 cfs, then WOMT may request advice from the SMT on appropriate OMR flows through the remainder of the Larval and Juvenile Longfin Smelt Entrainment Protection period.

Table E-13. San Francisco Bay Study Longfin Smelt Index Catch Threshold.

San Francisco Bay Study Longfin Smelt Index	Catch Threshold at 809 & 812
0–149	10
150–299	20
300–499	30
500–999	40
≥1000	50

Source: California Department of Fish and Wildlife 1999.

Table E-14. Smelt Larval Survey and 20-mm Survey Stations.

Station Number
306
308
323
338
340
344
411
602
501
519
606
508
705

Station Number
520
809
812
716
723
711

High-flow Offramps for Larval and Juvenile Delta Smelt and Longfin Smelt

When daily average Sacramento River flows at Rio Vista are greater than 55,000 cfs, or daily average San Joaquin River flows at Vernalis are greater than 8,000 cfs, then the Larval and Juvenile Delta smelt and Longfin smelt Protection Actions are off ramped. While off ramped, the OMR Index will be managed to no more negative than –5,000 cfs on a 14-day average. The Larval and Juvenile Delta Smelt and Longfin smelt Protection Actions would be immediately reinstated when the daily average Sacramento River flows at Rio Vista drop below 40,000 cfs. or the daily average San Joaquin River flows at Vernalis drop below 5,000 cfs. Rio Vista flows are calculated from the Dayflow equation and reported in the daily DWR Delta Hydrologic Conditions Report.

Winter-Run Chinook Salmon Annual Loss Threshold

Reclamation and DWR will manage OMR to avoid exceeding the following annual loss thresholds:

- Natural winter-run Chinook salmon (loss = 0.5% of JPE)
- Hatchery winter-run Chinook salmon (loss = 0.12% of JPE)

JPEs and annual loss thresholds will be calculated for natural winter-run Chinook salmon and for each of the hatchery winter-run Chinook salmon populations from the Livingston Stone NFH and Battle Creek. The JPE for natural and hatchery winter-run Chinook salmon will be calculated by the JPE Subteam annually, consistent with Appendix F of the BA, and transmitted to WOMT and SHOT. Hatchery releases of winter-run Chinook salmon will be tracked individually, and cumulative loss, confirmed by coded wire tagged, will be summed across release groups with the same JPE and annual loss threshold.

Annual loss of natural and hatchery winter-run Chinook salmon at the CVP and SWP salvage facilities will be counted for each Brood Year, starting July 1 of the calendar year through June 30 of the following calendar year. If cumulative loss of either natural or hatchery winter-run Chinook salmon in a brood year exceeds 50% of the annual loss thresholds, then DWR and Reclamation will restrict south Delta exports to maintain a seven-day average OMR value no more negative than -3,500 cfs for seven consecutive days. Once exceeded, each winter-run Chinook salmon observed in salvage would trigger another operation to an OMR limit of -3,500 cfs for seven days.

If the cumulative loss of either natural or hatchery winter-run Chinook salmon in a brood year exceeds 75% of the annual loss thresholds, then DWR and Reclamation will restrict south Delta exports to maintain a 7-day average OMR value no more negative than the -2,500 cfs for seven consecutive days when the Winter-run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that the change to -2,500 cfs will shift the model output to a classification of absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the seven most recent prediction days. These prediction values are calculated based on length-at-date and will be updated once genetic analysis is fully adopted.

Reclamation and DWR will restrict exports in response of meeting the above thresholds based on the initial length-at-date identification of natural older juvenile Chinook salmon and the thresholds described above. If genetic analysis of natural older juvenile Chinook salmon observed in salvage at the SWP or CVP indicates that any given Chinook salmon is not genetically winter-run or spring-run Chinook salmon, these fish will not count towards the loss threshold exceedance, and continued export restrictions pursuant to the OMR limit are not required. Given that SHERLOCK is a new methodology currently undergoing peer review and field testing, both methodologies will be used to determine the final identification. In the event that SHERLOCK and GT-seq provide different run assignments, the results from the GT-seq method will be used to determine the final run assignment for the purposes of implementing this early season migration action.

Winter-Run Chinook Salmon Weekly Distributed Loss Threshold

To minimize the potential for a disproportionate impact of entrainment on any single week of natural winter-run Chinook salmon present in the Delta, Reclamation and DWR will manage the OMR index based on a weekly distributed loss threshold. There is no weekly distributed loss for hatchery winter-run Chinook salmon as they generally move through the Delta quickly.

The weekly loss threshold is a product of the weekly percentage of natural winter-run Chinook salmon present in the Delta, scaled to 100% (Table E-15, Column E), and 50% of the natural winter-run annual loss threshold.

If the weekly distributed loss threshold is exceeded on any single day by the 7-day rolling sum of winter-run Chinook salmon loss, then DWR and Reclamation will reduce exports to achieve a 7-day average OMR no more negative than -3,500 cfs for seven consecutive days.

The averaging period for OMR will begin within 3 days of a criterion being exceeded.

If a JPE is not available at the start of OMR management, then the Red Bluff Diversion Dam brood year total from the most recent bi-weekly period will be used and applied, as described for early season management. If a fish is not genetically identifiable or if genetic identification is pending, then the length-at-date identification will be used to classify the race of the juvenile Chinook salmon in salvage.

Weekly thresholds will be based on historical distribution (Table E-15, Column E) of genetically-identified winter-run Chinook salmon from 2017-2021 and change every week (e.g., January 1-7, January 8-15). Each week, Reclamation and DWR, through SaMT, will compare weekly Delta entry and exit information to determine if the present data is tracking with the historical

distribution data. Reclamation and DWR, through SaMT, may adjust subsequent weekly loss thresholds based on year-specific conditions. At the conclusion of the OMR management season, Reclamation and DWR will review and may adjust the historical distribution table, through SaMT, for the following year.

Reclamation and DWR will restrict exports in response to meeting the above thresholds based on the initial length-at-date identification of natural older juvenile Chinook salmon and the thresholds described above. If genetic analysis of natural older juvenile Chinook salmon observed in salvage at the SWP or CVP indicates that any given Chinook salmon is not genetically winter-run Chinook salmon, these fish will not count towards annual the loss threshold exceedance, and continued export restrictions pursuant to the OMR limit are not required. Given that SHERLOCK is a new methodology currently undergoing peer review and field testing, both methodologies will be used to determine the final identification. In the event that SHERLOCK and GT-seq provide different run assignments, the results from the GT-seq method will be used to determine the final run assignment for the purposes of implementing this early season migration action.

Table E-15. Historical (Water Years 2017–2021) Presence of Winter-run Chinook Salmon Entering the Delta (Column B), Exiting the Delta (Column C), in the Delta (Column D = Column B–Column C) and in the Delta Scaled to 100% (Column E).

Week (starting January 1) (A)	Historical Cumulative entering the Delta (Sherwood Harbor) (B)	Historical Cumulative exiting the Delta (Chipps Island) (C)	Historical Present in Delta (D)	Historical Present in Delta (Scaled to 100%) (E)
1/1–1/7	2.47%	1.65%	0.82%	0.32%
1/8–1/14	2.47%	1.65%	0.82%	0.32%
1/15–1/21	4.94	1.65%	3.29%	1.30%
1/22–1/28	4.94%	1.65%	3.29%	1.30%
1/29–2/4	19.75%	2.20%	17.55%	6.91%
2/5–2/11	38.27%	4.95%	33.32%	13.13%
2/12–2/18	43.21%	5.49%	37.72%	14.86%
2/19–2/25	46.91%	9.89%	37.02%	14.59%
2/26–3/4*	50.62%	18.13%	32.49%	12.80%
3/5–3/11	55.56%	30.77%	24.79%	9.77%
3/12–3/18	77.78%	38.46%	39.32%	15.49%
3/19–3/25	85.19%	64.84%	20.35%	8.02%
3/26–4/1	93.83%	90.11%	3.72%	1.47%
4/2–4/8	98.77%	99.45%	0%	0%
4/9–4/15	100.00%	100.00%	0.00%	0.00%
4/16-End of Winter–run OMR Season	100.00%	100.00%	0.00%	0.00%

Notes: Data from genetically identified winter-run Chinook salmon entering the Delta (Sherwood Harbor Trawl) and exiting the Delta (Chipps Island Trawl) are used to estimate the percentage of winter-run Chinook salmon present in the Delta each week. Presence prior to January 1 each year is included in the first week of presence.
OMR = old and middle river.
[a] The week of February 26–March 4 includes 8 days during leap years

Steelhead Annual Threshold

In each year, Reclamation and DWR will manage exports to reduce loss at the CVP and SWP salvage facilities. To support survival and decrease entrainment loss, Reclamation and DWR will manage OMR to avoid exceeding the following annual loss threshold at CVP and SWP salvage facilities through the weekly distributed loss threshold described below.

Unclipped juvenile California Central Valley steelhead loss = 3,000

Annual loss of unclipped juvenile California Central Valley steelhead at the CVP and SWP salvage facilities will be counted cumulatively for each Brood Year, starting July 1 of the calendar year through June 30th of the following calendar year. Loss will be calculated for the South Delta Export Facilities using CDFW's steelhead loss multiplier until a loss method for steelhead (see Section E.5.11.1) is approved by CDFW and NMFS. This loss threshold will be used until a new loss threshold is developed through the steelhead JPE Special Study (See Section E.5.11.1).

Steelhead Weekly Distributed Loss Threshold

To minimize the potential for a disproportionate impact of entrainment of steelhead present in the Delta on any single week, Reclamation and DWR will manage OMR based on a weekly distributed loss threshold. The weekly loss threshold is the annual loss threshold distributed over the period of observed steelhead salvage between January 1 and June 30 using the 7-day weekly periods identified in the weekly distributed loss table for winter-run Chinook salmon, extended through June 30. DWR and Reclamation will reduce exports to achieve a 7-day average OMR value no more negative than -3,500 cfs for seven consecutive days when the 7-day rolling sum of steelhead salvage, calculated daily, exceeds the weekly loss threshold of 120 fish.

E.5.7.2 Spring-Run Chinook Salmon and Surrogate Thresholds

To provide additional minimization protection for emigrating natural juvenile spring-run Chinook salmon from the Sacramento River and tributaries, including the Feather and Yuba rivers, into the channels of the central Delta, south Delta, and into SWP and CVP south Delta pumping facilities, DWR and Reclamation will restrict exports based on the presence of hatchery produced spring-run and associated yearling late-fall-run and young-of-year fall-run Chinook salmon surrogate groups at the CVP and SWP salvage facilities. DWR and Reclamation, in coordination with CDFW, NMFS, and USFWS through the SaMT, will select spring-run yearling and young-of-year surrogate groups. Yearling spring-run surrogates will be selected from late-fall Chinook salmon in-river release groups from the Coleman National Fish Hatchery. Spring-run young-of-year and associated surrogate groups will be selected from fall- and spring-run Chinook salmon in-river release groups from the Feather River Fish Hatchery and Coleman National Fish Hatchery.

From November 1 through the end of the OMR flow management period of each water year, if a cumulative loss threshold is exceeded, Reclamation and DWR will reduce south Delta exports to achieve a 7-day average OMR index of no more negative than -5,000 cfs in November and December, and no more negative than -3,500 cfs beginning January 1 (or whenever the OMR management begins) through the end of OMR flow management season, or June 30, whichever occurs first. The cumulative loss threshold for coded wire tagged spring-run Chinook salmon surrogate groups at the CVP and SWP salvage facilities is 0.25% for each release group:

- Yearling spring-run Chinook salmon surrogates: WOMT, with input from SaMT, will select three in-river releases of late-fall Chinook salmon from Coleman National Fish Hatchery from November through January to use as yearling spring-run Chinook salmon surrogates. Input from SaMT could include a proposal with several alternatives. If three in-river releases appropriately distributed from November through January are not achievable in a given year because of hatchery limitations, then an alternative plan will be developed to ensure the adequate characterization of natural yearling spring-run Chinook salmon can still be achieved that year.
- Young-of-year spring-run Chinook salmon surrogates: WOMT, with input from SaMT, will select six in-river releases comprised of spring-run and fall-run Chinook salmon from the Feather River Fish Hatchery and fall-run Chinook salmon from the Coleman National Fish Hatchery from March through May to use as young-of-year spring-run Chinook salmon surrogates. Input from SaMT could include a proposal with several alternatives. If six in-river releases appropriately distributed from March through May are not achievable in a given year because of hatchery limitations, then an alternative plan will be developed to ensure the adequate characterization of natural origin young-of-year spring-run Chinook salmon can still be achieved that year.

The surrogate methods are intended to be an interim measure that will be replaced with a measure as described in E.5.11.2, ***Error! Reference source not found.***.

Storm-Flex

During the OMR management season, Reclamation and DWR, through WOMT, may prepare an assessment to evaluate operating to an OMR index no more negative than -6,250 cfs between the start of OMR management season and the larval and juvenile delta smelt Protection Action onramp or the last day of February, whichever occurs first, to capture peak flows during storm-related events when:

1. The Delta is in excess conditions as defined in the 1986 COA, as amended in 2018; and
2. QWEST is greater than +1,000 cfs; and
3. X2 is <81 km; and
4. The daily average turbidity at HOL, OBI, and OH4 sensors are <12 FNU at each station; and
5. A measurable precipitation event has occurred in the Central Valley; and

6. Reclamation and DWR determine that the net Delta outflow index indicates a higher level of outflow available for diversion due to peak storm flows; and
7. None of the additional real-time OMR protections are controlling Project operations; and
8. Cumulative loss of the CVP and SWP export facilities of yearling Coleman NFH late-fall run Chinook salmon (yearling spring run chinook salmon surrogate) is less than 0.5% within any of the release groups; and

If the criteria above are met, DWR and Reclamation will use estimates of the real-time distribution of listed-species, as well as Particle Track Model (PTM) and prediction tool output to assess potential listed-species entrainment risk differences using OMR inputs of -5000 and –6250 cfs. If the assessment indicates that additional entrainment protections for the upcoming week are unlikely to be triggered, Reclamation and DWR may operate to OMR no more negative than -6,250 cfs and will update the assessment no less than weekly, subject to approval by NMFS, USFWS, and CDFW.

If conditions indicate an entrainment protection condition is likely to trigger, Reclamation and DWR will reduce south Delta exports to achieve a 14-day average OMR index no more negative than -5,000 cfs, unless a further reduction in exports is required. If an entrainment protection condition is triggered, Reclamation and DWR will cease storm-flex and implement the entrainment protection condition. Storm flex decisions will be re-evaluated weekly by WOMT.

End of OMR Management Season

OMR Management season for Delta smelt and longfin smelt will conclude when the three consecutive days of water temperature at CLC is 77.0°F (25°C) or higher, or on June 30, whichever occurs first.

Reclamation and DWR will conclude the management of OMR for salmonids on June 30 or when the following conditions have occurred, whichever occurs first:

- Daily mean water temperature at Mossdale has exceeded 72.0°F (22.2°C) for 7 non-consecutive days (does not have to be consecutive) in June; and
- Daily mean water temperature at Prisoner's Point has exceeded 72.0°F (22.2°C) for 7 non-consecutive days (does not have to be consecutive) in June.

End of Year Evaluation

Each year, DWR and Reclamation, in coordination with the SMT, will conduct an annual assessment of OMR protection measures for Delta smelt and longfin smelt, which will include an evaluation of salvage, management actions, and physical conditions in a seasonal report. This seasonal report may support improvements, if necessary, to the OMR Guidance Document, and may also guide operations in the future. This seasonal report will be used to support the development of Reclamation's Annual Report on the Long-Term Operation of the CVP and SWP. Finally, this seasonal report will inform any Four-Year Review Panels adopted under the Record of Decision. The purpose of the independent review will be to evaluate the efficacy of actions undertaken to reduce the adverse effects on listed species.

Each year, DWR and Reclamation, in coordination with the SaMT, will conduct an annual assessment of OMR protection measures for winter-run Chinook salmon, spring-run Chinook salmon, and steelhead, which will include an evaluation of salvage, management actions, and physical conditions. in a seasonal report. This seasonal report may support improvements, if necessary, to the OMR Guidance Document, and may also guide operations in the future. This seasonal report will be used to support the development of Reclamation's Annual Report on the Long-Term Operation of the CVP and SWP. Additionally, this seasonal report will inform any Four-Year Review Panels. The purpose of the independent review will be to evaluate the efficacy of actions undertaken to reduce the adverse effects on listed species.

E.5.7.3 Spring Delta Outflow

Reclamation and DWR will take actions intended to supplement Delta outflow per the terms of the VAs. Actions that will support the additional Delta outflow include: (1) Reclamation and DWR south of Delta export modifications; (2) Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds; and (3) passing Delta inflow from water made available by VA Parties. Actions to result in increased Delta outflow are shown in Table E-16. These volumes (and associated footnotes) are reflected in the MOU signed by VA parties in March 2022.

Table E-16. Water Made Available by the CVP and SWP. [a]

Action	Critical (TAF)	Dry (TAF)	Below Normal (TAF)	Above Normal (TAF)	Wet (TAF)
SWP and CVP Forgone Exports [b]	0	125	125	175	0
SWP Flow Purchases Implemented through Forgone SWP exports	0	30	30	30	0
SRS Contractor Fallowing [c]	2	102	100	100	0
Sacramento Valley Purchase [d]	0	10	10	10	0
American River Groundwater and Reoperation of Upstream Reservoirs [e]	30	40	10	10	0
CVP SOD Purchase [f]	0	12.5	24.5	35	0
Westlands Contract Assignment Purchase [g]	3	6	15	19.5	27
Additional CVP SOD [h]	0	5	5	5	0
San Joaquin River Flows above Tributary VAs	0	50	50	50	0
Flow Purchases Acquired Through SWP Diversion Fees (implemented through tributary inflow from the fallowing program) [i]	0	45	45	45	0
Total CVP and SWP Outflow Potentially through CVP and SWP Operations	33	423.5	414.5	478.5	27
Additional Feather River Actions accounted for under Total VA Outflow (below)		60	60	60	

Action	Critical (TAF)	Dry (TAF)	Below Normal (TAF)	Above Normal (TAF)	Wet (TAF)
Total VA Outflow [j]	**155**	**825.5**	**750.5**	**824.5**	**150**

CVP = Central Valley Project; SWP = State Water Project; cfs = cubic feet per second; TAF = thousand acre-feet; SRS = Sacramento River Settlement; SOD = south of Delta; VA = voluntary agreement.
[a] These numbers are set forth in the Term Sheet, Appendix 1. Flow Tables.
[b] Subject to Public Health and Safety exports of 1,500 cfs.
[c] SRS Contractors will fallow 25,000 acres of rice which is credited with 110 TAF, which includes 10 TAF of fixed price purchase water. Dry year water may be held in Shasta for storage to improve temperature management in the current or future years. 2TAF in Critical and Dry years are contributions from Mill/Cow Creek.
[d] The new flow contributions from the Sacramento River Basin identified in this table, plus new flow contributions resulting from the below-referenced PWA Water Purchase Program, Permanent State Water Purchases, and PWA Fixed Price Water Purchase Program line items in Tables 1a and 1b, are not intended to result in idling more than 35,000 acres of rice land in the Sacramento River Basin.
[e] Contingent on public funding of groundwater substitution infrastructure to be completed by a subsequent year, and compensation of upstream surface storage releases on a per acre-foot basis. These flows are included in the Year 1 subtotal. Only implementable in 3 of 8 dry or critical years and 3 of 8 above normal or below normal years.
[f] Subject to CVP SOD Agricultural Allocation.
[g] Quantity of water made available will be based on the maximum or a portion of the entitlement under certain assignment contracts and only that which is allocated to CVP SOD Agriculture.
[h] If flows are not obtained through this source, the equivalent volume would be obtained at market price or otherwise obtained through other mechanisms.
[i] The VA's governance program will be used to determine the use of available funding to provide additional outflow in above normal, below normal, or wet years. If DWR is called upon to provide the water by foregoing SWP exports, such call will be handled through a separate agreement between DWR and its contractors. The numbers for "Flow Purchases Acquired Through SWP Diversion Fees (implemented through tributary inflow from the fallowing program)" are the SWP's partial contributions to the total values set forth in the Term Sheet, Appendix 1 under the PWA Water Purchase Program's fallowing contributions for about normal, below normal, and dry years.
[j] The volumes identified in this table represent the CVP and SWP contributions. Additional flows from other VA parties and Permanent State Water Purchases increase Delta Outflow.

Reclamation and DWR will operate consistent with the Voluntary Agreements approved by the SWRCB and executed agreements by VA Parties.

Reclamation Early Implementation: Reclamation, after coordination through WOMT, will provide the CVP Foregone Exports, along with other VA parties taking actions similar to those contemplated by the VAs only if: (i) Reclamation issues a Record of Decision for the coordinated operation of the CVP and SWP that are the subject of the consultation, and (ii) the SWRCB has not updated the Water Quality Control Plan. These early implementation actions are intended to develop data that could assist decisions whether to implement the VAs or decisions how to implement the VAs. Delta outflow from Reclamation actions described above would be in March through May and prioritized during the period of April 1 through May 31. These early implementation actions will continue until the SWRCB updates the Water Quality Control Plan or for two years, whichever occurs first.

Reclamation Post Early Implementation: After Reclamation's two-year early implementation period:

- Reclamation will operate consistent with the VAs only if (a) the SWRCB incorporates the VAs, as proposed by the VA parties, into the Water Quality Control Plan, and (b) the VA parties execute the agreements contemplated by the VAs, or
- Reclamation will operate as described by the alternative but without any of the actions contemplated for "early implementation" of the VAs if (i) the SWRCB does not incorporate the VAs, as proposed by the VA parties, into the Water Quality Control Plan, or (ii) the VA parties do not execute the agreements contemplated by the VAs.
- DWR Implementation: DWR will operate pursuant to Section 3.3.3.2 Early Voluntary Agreement Implementation of their *November 2023 Incidental Take Permit Application, Long-Term Operations of the State Water Project*. DWR's early implementation actions will continue until the SWRCB approves the VAs.

E.5.7.4 Delta Smelt Summer and Fall Habitat

Fall X2

To increase the amount of low salinity zone habitat for Delta smelt, in wet and above normal hydrologic year types, Reclamation and DWR will maintain a 30-day average X2 ≤80 km for September through October.

Suisun Marsh Salinity Control Gates

To address effects to critical habitat for juvenile Delta smelt and increase habitat and food access for Delta smelt in summer and fall (June through October) in Suisun Marsh and Grizzly Bay during above normal, below normal years, and dry years following wet or above normal years, DWR will operate the SMSCG for 60 days using a 7 day tidal -7 day open operation (7-7) schedule to maximize the number of days that Belden's Landing three-day average salinity is equal to, or less than, 4 practical salinity units. In dry years following below normal years, DWR will operate SMSCG for 30 days using 7-7 operation to maximize the number of days Belden's Landing three-day salinity is equal to, or less than 6 practical salinity units. DWR and Reclamation, through the Delta Coordination Group (DCG), may prepare an assessment to propose an alternative gate operation if modeling of hydrological and/or existing D-1641 conditions indicate the action can achieve the same habitat benefits in an equal or better manner within the range of effects analyzed. Reclamation and DWR, through the DCG, will develop an annual monitoring plan that responds to uncertainties in the performance metrics to evaluate action performance. DWR and Reclamation will also produce an annual report that summarizes monitoring findings and assess action performance. The SFHA shall be included in Independent Reviews under the Adaptive Management Program.

E.5.7.5 Delta Smelt Supplementation

Delta smelt supplementation addresses the Allee effect in the baseline status of wild Delta smelt. Too few Delta smelt remain for effective breeding in the wild. In water year 2022, the FCCL raised 55,733 fish that were released into the wild as part of experimental releases. Experimental releases are currently planned through water year 2025. The four years of experimental releases (water years 2022 – 2025) entail experimental learning about the logistics and mechanisms of transport and release, with the intent to inform the design and implementation of supplementation.

USFWS ran a simulation using an updated version of the life cycle model described by Smith et al. (2021) to estimate the probability that different release levels would result in wild Delta smelt populations high enough to support FCCL's broodstock collection efforts. Results indicate that an annual release of 150,000–175,000 fish is needed to have a greater than 50% chance of meeting the collection target. Reclamation and DWR will support a minimum production of 150,000 fish by water year 2025, and a minimum of 200,000 fish by water year 2026, if feasible, that are at least 200 days post-hatch or equivalent.

Reclamation and DWR, through the Culture and Supplementation of Smelt Steering Committee, will continue to collaborate with USFWS and CDFW on the development of a program to conduct supplementation of the wild Delta smelt population with propagated fish consistent with USFWS' Supplementation Strategy (U.S. Fish and Wildlife Service 2020). The USFWS and CDFW may update the Supplementation Strategy in coordination with Reclamation and DWR with the next update expected in 2025. The Supplementation Strategy currently uses the FCCL.

The Supplementation Strategy also identifies a need for additional facilities and evaluation of new approaches to maintain these fish, support supplementation, improve transportation and release of fish, maximize genetic diversity, and minimize domestication effects. An existing Master Plan for a Delta Smelt Conservation Facility Fish Technology Center (U.S. Fish and Wildlife Service 2018) is currently being revisited and further developed to a 35% design-level plan, with completion expected 2024. Additional facilities would require a subsequent set of environmental compliance for their construction and eventual operation. Reclamation and DWR will collaborate with USFWS and CDFW for the additional development of this planning effort, incorporation into the Supplementation Strategy, and the construction and operational needs of facilities capable of meeting production of 400,000–500,000 fish that are at least 200 days post-hatch by water year 2030.

E.5.7.6 Barker Slough Pumping Plant

DWR, at its sole expense, will operate the BSPP to an annual maximum diversion of 125 TAF and a maximum daily diversion rate of 175 cfs. The BSPP is a SWP screened diversion that pumps water through the NBA, via an underground pipeline, to Cordelia Forebay outside of Vallejo. The NBA serves Napa County, Vallejo, Benicia, and Travis Air Force Base.

Maximum Spring Diversions

DWR operates the BSPP to divert water from the North Delta into the NBA. Longfin Smelt are attracted to the favorable habitat conditions in the North Delta and can potentially inhabit this area during their spawning period in drier years. The operation of the BSPP in combination with other diversions and losses can result in the net negative flow of water from the North Delta into Barker Slough, and these hydrodynamic conditions can lead to the entrainment of larval longfin smelt when they are present. Cumulative BSPP diversions for the January 1 to March 31 period, at design capacity, are limited to approximately 26 TAF. The incidental take of larval longfin smelt at the BSPP is expected to be low due to: (1) generally minimal diversion rates during periods when larval longfin smelt presence is expected to be greatest (February and March); and (2) BSPP utilizing a positive barrier fish screen making the injury or death of adult and juvenile longfin smelt unlikely. However, a small number of larval longfin smelt may be entrained during BSPP operations when larvae are present in the area.

Barker Slough Pumping Plant Protections for Larval Delta Smelt

Cumulative BSPP diversions for the March to June period, at design capacity, is 42 TAF.

The incidental take of larval Delta smelt at the BSPP is expected to be low due to: (1) generally low diversion rates during periods when larval Delta smelt presence is expected to be greatest (March and April); and (2) BSPP utilizing a positive barrier fish screen making the injury or death of adult and juvenile Delta smelt unlikely. However, a small number of larval Delta smelt may be entrained into Barker Slough during BSPP operations.

Barker Slough Pumping Plant Conservation Measures

Larval Longfin Smelt: DWR proposes to operate the BSPP to protect larval longfin smelt from January 1 to March 31 of dry and critical water years. If the water year type changes after January 1 to below normal, above normal, or wet, this action will be no longer in effect. If the water year type changes after January 1 to dry or critical, DWR proposes to operate according to this measure.

From January 1 to March 31 of dry and critical water years, DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

Larval Delta Smelt: DWR proposes to operate the BSPP to protect larval Delta smelt from March 1 to June 30 of dry and critical water years. If the water year type changes after March 1 to below normal, above normal, or wet, this action will be no longer in effect. If the water year type changes after March 1 to dry or critical, DWR proposes to operate according to this measure.

DWR, at its sole expense, from March 1 to April 30 of dry and critical water years, if catch of larval Delta smelt (length less than 25mm) in 20mm Survey at station 718 exceeds 14% of the total catch of larval Delta smelt across the North Delta (20mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 60 cfs.

DWR, at its sole expense, from May 1 to June 30 of dry and critical water years, if catch of larval Delta smelt (length less than 25mm) in 20mm Survey at station 716 exceeds 5% of the total catch of larval Delta smelt across the North Delta (20mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

Maintenance

Fish screen cleaning, sediment removal, and aquatic weed removal at the BSPP is needed year-round to maintain operation of the BSPP. Raising and cleaning of the fish screens is necessary to prevent excessive head loss and minimize localized approach velocities.

Sediment removal from the trap and concrete apron in front of the facility is necessary to prevent accumulation and clogging of the screens and facility. Removal of aquatic weeds is necessary to avoid blocking flow and causing water levels to drop in the pump wells behind the screens, triggering automatic shutoffs to protect the pumps from cavitation.

E.5.7.7 Bernice Frederic Sisk Dam Raise and Reservoir Expansion

Same as Alternative 1.

E.5.7.8 Tidal Habitat Restoration

Tidal habitat restoration is a commitment from the 2009 Biological Opinion, carried into the 2020 Record of Decision. All planned actions, as described in the No Action Alternative, have separate environmental compliance (either programmatically or site-specific) and no further analysis of impacts will be performed in this document. State and Federal agencies would analyze impacts for the site specific and programmatic tidal habitat restoration compliance separate from the Long-Term Operation of CVP and SWP.

E.5.7.9 Longfin Smelt Culture Program

The Longfin Smelt Culture Program aims to establish and maintain a robust, genetically managed captive population for the imperiled Longfin Smelt. The Longfin Smelt culture program has two primary goals: 1) to buffer against extinction and 2) to provide a source of fish for research, as guided by the Longfin Smelt Science Plan. Due to this importance, Longfin Smelt culture was identified as a science priority in the 2020 ITP.

Attempts at culturing Longfin Smelt were first initiated at the UC Davis Fish Conservation and Culture Lab (FCCL) during the 2010-2011 Longfin Smelt spawning season. Adult brood stock have since been collected annually whenever available from the U.S. Fish and Wildlife Service (USFWS) Chipps Island Trawl, the UC Davis Otolith Geochemistry & Fish Ecology Laboratory, and DWR. With support from DWR, the first successful crosses of cultured fish occurred in the spring of 2023.

Unlike Delta Smelt and salmonids, the San Francisco Bay-Delta Distinct Population Segment (DPS) of the Longfin Smelt lack a refugial population to buffer against the stressors that the species continues to face. Additionally, successfully culturing Longfin Smelt would provide a more thorough understanding of the species life history, thereby improving its management. Cultured fish could also provide further information on reproduction, growth, response to stressors such as suboptimal water quality and feed preferences. This type of information is a critical need for the development of life cycle models, and to identify habitat requirements that could be addressed through management actions (e.g. flow, restoration, etc.). Longfin Smelt culture would also allow for further field and lab studies to support management. One of the bottlenecks in evaluating the effects of management actions on Longfin Smelt is that their numbers are low and take authorization could limit the implementation of additional field sampling. Cultured fish therefore allow us to use laboratory and field approaches (e.g. enclosures) to understand how the species' physiology, ecology, and genetics respond to different environmental variables and management actions.

DWR will continue to fund the Longfin Smelt culture program to achieve the following objectives: 1) fully close the Longfin Smelt life cycle in captivity, 2) initiate and maintain a genetically managed refugial population, and 3) produce fish to meet the needs of research and management projects as coordinated with the Longfin Smelt Science Plan.

E.5.8 Stanislaus River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described below.

E.5.8.1 Minimum Instream Flows

Minimum instream flows (i.e., Goodwin Dam releases) will be in accordance with the 2023 New Melones Stepped Release Plan (2023 SRP, Figure 8 Attachment TBD (excel sheet). The 2023 SRP increases the potential outmigration response of juvenile steelhead and increases the annual total volume of water for all year types. Modifications would use a single pulse and increase peak releases from 400 cfs to 1,500 cfs in the default schedule, Figure E-18.

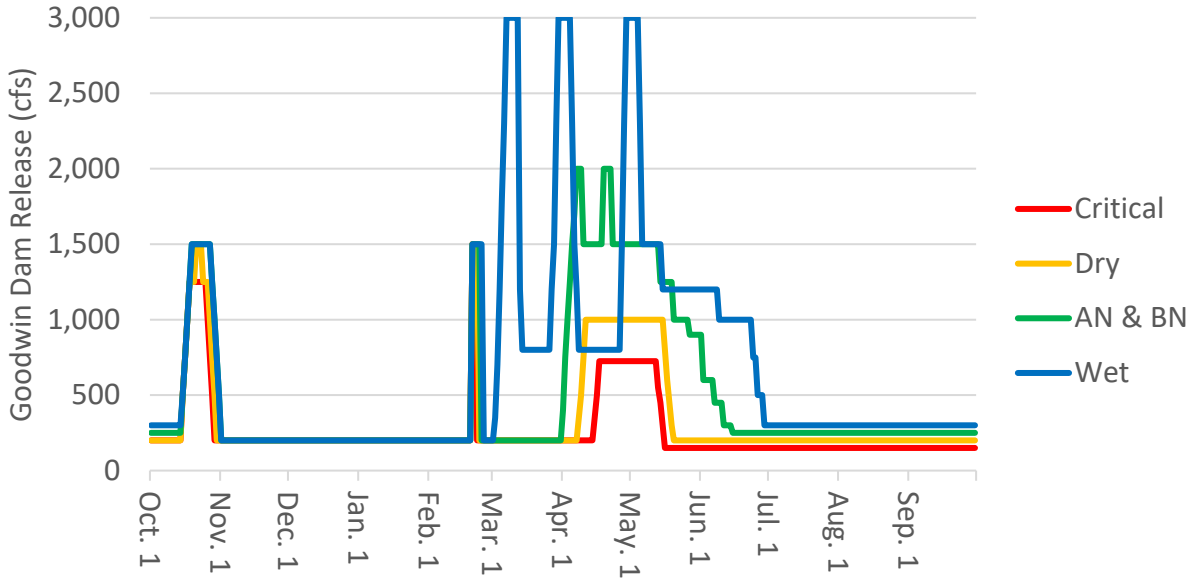


Figure E-18. 2023 New Melones Stepped Release Plan with Modified Winter Instability Flows.

For determining the water year type, Reclamation will use the 60-20-20 Index developed for D-1641 implementation and based on a 90% exceedance forecast. The 2023 SRP includes the ability to shape monthly and seasonal flow volumes as described below:

Winter Instability Flows

Reclamation releases additional flow in February, as provided in the 2023 SRP, to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats. Reclamation, through the SWT, schedules the winter instability flow volume. Whenever possible the pulse is scheduled to coincide with a natural storm event, which may naturally cue outmigration. In some years, natural rain events may provide sufficient natural variability in the hydrograph and an additional pulse may be determined to be necessary. Reclamation, through the SWT, will prepare an assessment when rain events meet the need for winter instability flows and not require additional releases.

Spring Pulse Flows

Reclamation will release additional flows starting as early as March through as late as June. Reclamation, through the SWT, will schedule spring pulse flow volumes consistent with volumes in the SRP.

Fall Pulse Flows

Fall pulse flows improve instream conditions and provide an attraction cue for adult salmonids returning to spawn. Reclamation will release additional flows in October and/or November. Reclamation, through the SWT, will schedule fall pulse flow volumes consistent with the volumes in the SRP and considering other system objectives.

E.5.9 San Joaquin River

Same as the No Action Alternative. Reclamation would continue implementation of the San Joaquin River Restoration Program as an independent related activity.

E.5.10 Monitoring

Same as Alternative 1.

E.5.11 Special Studies

Alternative 2 identifies special studies similar to the No Action Alternative and adds additional studies including:

Special studies address areas of scientific uncertainty on the reasonable balance among competing demands for water, including the requirements of fish and wildlife, M&I, agricultural, and power contractors. While special studies do not avoid, minimize, or mitigate adverse effects on federally listed species, over time they may inform the effectiveness of measures taken to avoid, minimize, or mitigate incidental take.

Reclamation would not rely on uncertain outcomes from a study but may require direct or incidental take to conduct the study.

E.5.11.1 Steelhead Juvenile Production Estimate

Reclamation and DWR will propose an expanded steelhead JPE framework for the San Joaquin and Sacramento River Basins. Based on data generated from the San Joaquin and Sacramento River Basins, JPE, and feedback from an independent review of progress after 2025, Reclamation and DWR will update the JPE framework including steelhead telemetry, steelhead lifecycle monitoring, and a steelhead JPE.

Steelhead Telemetry Research

Reclamation and DWR will implement steelhead telemetry research on routing and survival of hatchery- and wild-origin steelhead through the San Francisco Bay-Delta. This research will provide information on how CVP and SWP operations impact steelhead routing and survival through different routes, the facilities, and to Chipps Island. In addition, the steelhead telemetry research may enable through Delta survival estimates for juvenile steelhead tagged in the

Stanislaus River or Clear Creek as part of the life-cycle monitoring and JPE development in these tributaries.

Steelhead Lifecycle Monitoring

Reclamation will maintain the infrastructure supporting the Stanislaus River steelhead life cycle monitoring program and develop infrastructure that will support a life cycle monitoring program in Clear Creek. In addition, Reclamation and DWR will support genetic and age-structure monitoring of juvenile steelhead collected at state and federal salvage facilities to facilitate identification of brood year and natal origin. The goal of this research and monitoring in the San Joaquin and Sacramento Rivers is to provide the data necessary to develop a basin-specific steelhead JPE. In addition, the goal of this research and monitoring is to provide the basis for evaluating how actions related to stream flow enhancement, habitat restoration, and/or water export restrictions affect biological outcomes including juvenile and adult population abundance, age structure, growth and smoltification rates, and anadromy and adaptive potential in Sacramento- and San Joaquin-origin steelhead.

Steelhead JPE

Reclamation proposes to develop a steelhead JPE for tributaries with CVP facilities that will focus on the annual production of outmigrating juvenile steelhead. Data used in the JPE will inform the status and trends of Sacramento and San Joaquin basin steelhead and may also help inform actions that will increase steelhead abundance and improve steelhead survival through the Delta. Reclamation and DWR, in coordination with USFWS, NMFS, and CDFW, will create or use an existing technical team to use the Southern Sierra Nevada Diversity Group Steelhead Science Plan, which describes the JPE framework, to identify infrastructure and monitoring needs in tributaries with CVP or SWP facilities and a method for expanding the JPE framework from the tributary to basin levels.

Reclamation and DWR propose to conduct the first four-year independent panel review (2024) from data generated from the Stanislaus River steelhead life-cycle monitoring program. Reclamation and DWR anticipate the independent panel will provide feedback on the scientific merits of the JPE framework and recommendations for improving the JPE framework. Reclamation and DWR will work with the technical team to incorporate review panel feedback and recommendations on the JPE framework, as appropriate.

Beginning Fall 2025 and based upon incorporated 2024 review panel feedback and recommendations, Reclamation and DWR will work with the technical team to consider implementing an expanded JPE framework to the San Joaquin and Sacramento basins. By summer 2026, Reclamation and DWR will decide to address deficiencies in the JPE framework and/or expand the JPE framework to remaining CVP or SWP tributaries.

Reclamation and DWR propose to conduct the second four-year independent panel review (2028) from data generated from the San Joaquin and Sacramento basins JPE. Reclamation and DWR anticipate the independent panel will provide further feedback on the scientific merits of the JPE framework and further recommendations for improving the JPE framework. Reclamation and DWR will work with the technical team to incorporate review panel feedback and recommendations on the JPE framework, as appropriate.

E.5.11.2 Spring-Run Juvenile Production Estimate and Life-Cycle Model

Spring-run Chinook Salmon Juvenile Production Estimate

Reclamation and DWR will support continued development of a SR-JPE framework for CVP and SWP tributaries and the Delta, and propose a framework for implementation, including an approach for modeling a SR-JPE and the monitoring program to support that approach. The SR-JPE framework will incorporate independent review and will be the basis for consideration of updated entrainment minimization measures, including updating hatchery surrogate measures. The process to develop the framework will continue the ongoing effort to develop a SR-JPE initiated in 2020 and outlined in the SR-JPE Science Plan (DWR et al. 2020), the SR-JPE Interim Monitoring Plan (Allison et al. 2021), the SR-JPE Run Identification Research and Initial Monitoring Plan (Boro et al. 2023), the SR-JPE Data Management Strategy (Harvey et al. 2022), and the SR-JPE Decision Charter (Horndeski 2022). These plans describe the decision processes, research, monitoring, and data management infrastructure that will be needed to meet the goal of developing a SR-JPE ready for implementation in 2025, including guidance by an interagency Core Team using structured decision-making principles, rapid and coordinated reporting of new data onto a publicly accessible repository, routine and rapid genetic testing, and additions to existing and/or new monitoring programs at Delta entry and in representative spring-run streams: Clear Creek, Battle Creek, Mill Creek, Deer Creek, Butte Creek, Yuba River, and Feather River.

Spring-run Chinook Salmon Lifecycle Model

DWR and Reclamation will support the development of a spring-run Chinook salmon lifecycle model (SR-LCM) for the purpose of informing management actions to improve Central Valley spring-run Chinook salmon population status. DWR and Reclamation will assemble an interagency management team including representatives from Reclamation, DWR, CDFW, NMFS, and USFWS, to define the specific management issues and objectives to be addressed by the SR-LCM. Because of the close link between SR-LCM and SR-JPE development through a shared use of historical and newly generated data, the SR-JPE Core Team will be responsible for guiding the development of the SR-LCM to address the management objectives, and for determining whether the required modeling can be accomplished through an update of one or more existing Central Valley Chinook salmon modeling efforts, such as the SR-JPE, the NMFS spring-run lifecycle model, and the CVPIA Science Integration Team salmon lifecycle models. The Core Team will use structured decision-making principles when appropriate. The Core Team will develop and submit a modeling plan and timeline to the SR-LCM management team for approval, and guide implementation of the plan. To facilitate open communication between the lead life-cycle modeler and agency staff, a Lifecycle Model Subteam will be established. Throughout the process to develop and implement the SR-LCM, the lead lifecycle modeler will collaborate with the Lifecycle Model Subteam through regular meetings to solicit feedback and integrate that feedback into model development iteratively, in a manner similar to the SR-JPE Modeling Subteam described above.

Required actions in 2025:

1. Under the guidance of the Core Team, the Modeling Team will complete an initial JPE model based on available spring-run data and provide the model to the Core Team for review. The Core Team will recommend an SR-JPE framework, composed of the initial

SR-JPE model and the monitoring program required to provide data to calculate an annual JPE.

2. In coordination with the Adaptive Management Team, the Core Team will charter and convene an independent peer review panel to provide a written review of the recommended SR-JPE framework.

Required actions in 2026:

1. The Core Team will review the spring-run hatchery surrogate minimization measure.
2. DWR, CDFW, Reclamation, and NMFS will meet to contemplate development of a new or modified spring-run minimization measure informed by peer review panel input, historical spring-run data, new data obtained from SR-JPE monitoring program, Core Team review of the hatchery surrogate measure, and other relevant information (for example Georgiana Slough monitoring data). Any new minimization measure approach for spring-run will:
    - Take into account the limitations of the initial SR-JPE model
    - Be an interim approach to be refined as the SR-JPE model evolves and the spring-run life cycle model is completed
    - Anticipate future iterations and refinements of SR-JPE model
    - Rely less on salvage data and more on monitoring data (be more proactive, less reactive)
3. In collaboration with the Core Team, DWR and Reclamation will prepare a draft plan in collaboration with CDFW, NMFS and USFWS, that describes the approach to calculating a SR-JPE and the monitoring and special studies needed to collect the data to calculate a SR- JPE annually. The draft plan will be guided by the Core Team SDM process and SR-JPE framework recommendation, and by the independent peer review panel. DWR and Reclamation will submit the draft plan to the Core Team for review and work collaboratively to incorporate Core Team comments into the final draft. DWR and Reclamation will submit the final plan to CDFW and NMFS for approval no later than six months after the independent peer review and spring-run hatchery surrogate measure review are completed, whichever is later.
4. After the final SR-JPE Plan is approved by CDFW and NMFS, DWR and Reclamation will convene the Core Team and subteams to provide an annual SR-JPE estimate, implement the final Spring-run JPE Plan (including monitoring), and ensure all data obtained through long-term monitoring programs is stored in a publicly accessible repository.

Required actions in 2027:

1. If approved by NMFS and CDFW, Reclamation and DWR (respectively)will implement the new “interim” Spring-run Chinook salmon minimization measure based on the initial SR- JPE model.

2. DWR and Reclamation will implement changes to monitoring if recommended by the SDM process and approved by CDFW and NMFS, when appropriate take authorization for monitoring activities are obtained and contingent on stakeholder participation from non-CVP or SWP tributaries.

The Modeling Subteam will continue to develop and refine the SR-JPE model by integrating new data as it becomes available and adjusting the modeling approach in collaboration with the Core Team and in response to SDM processes conducted by the Core Team.

E.5.11.3 Tidal Habitat Restoration Effectiveness

DWR and Reclamation will use the adaptive management program to evaluate and identify actions that may improve the effectiveness of its restoration projects. Adaptive management actions will be focused on a comprehensive understanding of how all restoration projects function across the landscape and in consideration of other conservation measures (e.g., Yolo Notch Project). that may enhance food web production and rearing habitat for Delta smelt.

E.5.11.4 Tributary Habitat Restoration Effectiveness

The Upper Sacramento River Anadromous Fish Habitat Restoration Project Monitoring Plan and Protocols (2017) are designed to determine the effectiveness of the Upper Sacramento River Anadromous Fish Habitat Restoration Project in meeting identified objectives and to validate the linkage between restoration actions and the biologic response to those actions. This monitoring plan follows the framework for detecting biological responses to flow management described by Souchon et al. (2008). Monitoring methods structured as field protocols are described in the Plan and Protocols including control site selection, longitudinal profile and cross sections, juvenile habitat mapping protocols, snorkel survey protocols, seining, enclosure studies, invertebrate drift sampling, redd surveys, and stream temperatures. The existing CVPIA Upper Sacramento River Habitat Restoration Technical Team includes Reclamation, USFWS, NMFS, CDFW, consultants (e.g., Chico State University, PSMFC), and recipients of competitive funding for habitat restoration will be utilized as the AMT for this action.

E.5.11.5 Winter-run Early Life Stage Studies

Sacramento River winter-run Chinook salmon (winter-run) are exposed to a variety of stressors throughout their lifecycle that impair their survival, reproduction, and the ability of the population to rebound from periods of low abundance. Survival during early life stages—spawning success, egg incubation, emergence, and juvenile rearing and migration—is affected by various environmental factors. Understanding the relative contribution of different stressors, particularly those that we can manage through water operations and other actions, will improve our ability to manage water and improve winter-run early life stage survival.

The Early Life Stage Survival Science Action aims to address two distinct knowledge gaps:

1. Reducing uncertainty around the effects of water temperature and other factors (e.g. dissolved oxygen, spawning habitat and flow) on egg-fry-survival
2. Improving understanding of juvenile survival during rearing and migration, including reducing uncertainties in the field monitoring data

E.5.11.6 Shasta Spring Pulse Studies

Reclamation and DWR, through the SRG, will support hindcast evaluation of action effectiveness that includes technical review of the functional elements of the pulse flow (i.e., timing, magnitude, duration, and frequency) as well as an evaluation of criteria used to support beneficial use decisions.

E.5.11.7 Delta Route Selection and Survival

These studies involve an acoustic receiver network and associated real-time and retrospective modeling of the data. The objectives are to provide real-time estimates of reach-specific survival and route entrainment for juvenile salmonids in the Sacramento River and Delta.

E.5.11.8 Delta Smelt Summer and Fall Habitat

DWR and Reclamation will consider food subsidy measures to augment the SFHA. Food subsidy actions are hypothesized to increase localized prey availability for Delta smelt in the north Delta and Suisun Marsh, resulting in opportunities for higher growth and survival of juvenile and sub-adult life stages. DWR and Reclamation will decide which of the following food subsidy actions are most appropriate given hydrologic conditions (i.e., water year type), logistical constraints, and information needs: one of several variations of the North Delta Food Subsidy Action, one of several variations of Managed Wetland reoperation in Suisun Marsh, and/or the Sacramento Deepwater Ship Channel Food Subsidy Action. For any year when one or more of the food subsidy actions is implemented, an action plan, science and monitoring plan, and monitoring report will be produced to evaluate action effectiveness. Monitoring plans and reports will also be produced in years actions are not implemented to serve as contrasts to baseline conditions. Food subsidy action plans, monitoring plans, and reports will be developed in collaboration with, and reviewed by the DCG. Food subsidy action research results will be included in seasonal reporting and adaptive management reviews of the SFHA to evaluate the science and monitoring, efficacy of actions, hypothetical alternative strategies and/or actions, and potential inclusion of food subsidy actions as potential permanent action elements of the SFHA, or if appropriate, termination of actions deemed ineffective.

E.5.11.9 Longfin Smelt Science Plan

DWR and Reclamation will implement science activities as described in the 2020 Incidental Take Permit Longfin Smelt Science Plan; including the development of mathematical life cycle model. The life cycle model will be used as a quantitative tool to characterize the effects of abiotic and biotic factors on longfin smelt populations. Additional longfin smelt science and monitoring informed by the life cycle modeling efforts will be implemented as needed through the Adaptive Management process.

Longfin Smelt Science and Monitoring Initiatives

DWR and Reclamation will support the implementation of the Longfin Smelt Science Plan (LFSSP). DWR and CDFW, in collaboration with the State Water Contractors and the US Fish and Wildlife Service, developed the LFSSP to meet a requirement in the 2020 ITP, and the LFSSP was finalized on December 8, 2020. The purpose of the LFSSP is to provide a framework for Longfin Smelt science investments through 2030, including seven key priority areas. Longfin Smelt science and monitoring informed by the life cycle modeling efforts will continue beyond 2030, as appropriate.

Science priority areas in the LFSSP:

1. Life cycle modeling
2. Factors affecting abundance, growth, and survival
3. Improved distribution monitoring
4. Improved larval entrainment monitoring
5. Longfin Smelt culture
6. Fish migration and movements
7. Spawning and rearing habitats for Longfin Smelt

The Longfin Smelt Technical Team is charged with the implementation and refinement of the science conducted under the LFSSP. Additionally, the Longfin Smelt life cycle model, prioritized in the LFSSP and currently under development, will highlight critical gaps in our current understanding of Longfin Smelt ecology and will guide implementation of core elements of the LFSSP, particularly with respect to new and expanded monitoring.

E.5.12 Management of Winter-run Spawning Location and Timing

Reclamation will study how flow and temperatures can be used to manage SRWC spawning on the Sacramento River. The goal of this management action is to ensure a resilient portfolio of life history strategies by supporting a diversity of spawn timings and locations in the population.

Modeling indicates that the peak spawn timing of SRWC may be influenced by water management decisions that are intended to conserve cold water for use during the summer temperature management season (Johnson et al. 2017; Windell et al. 2017). Annually, the start timing of SRWC spawning is relatively constant while the peak varies year to year – with cool springtime water temperatures associated with earlier peak spawning, and warm springtime temperatures associated with later peak spawning (Hendrix et al. 2017, Jennings and Hendrix 2020). Specifically, there is evidence that higher April and May water temperatures correspond to increased and delayed peak spawning in July and August. The model using both April and May temperatures as cofactors had the best fit to the observed female spawner data (Jennings and Hendrix 2020). In their historic spring-fed stream habitat, cool spring temperatures are hypothesized to trigger earlier peak in spawning to ensure sufficient time for egg maturation. Conversely, historically (pre-dam), later peak spawning in warm years could have resulted in later peak emergence; this could mean the juvenile fish experienced lower temperatures upon emergence reducing egg and alevin mortality.

However, a cause-and-effect relationship between water temperatures during pre-spawn staging and the timing of peak spawning has not been demonstrated. Randomized experimentation should be used to determine whether manageable changes in water temperatures during the period of pre-spawn staging directly cause changes in the spawn timing of winter-run Chinook salmon and, if so, the level of covariation between these variables. Findings from these investigations may explain a direct linkage between temperature management and SRWC reproductive performance on the Upper Sacramento River (NMFS 2014, Reclamation 2019), as evidence suggests reproductive success is variable (Blankenship et al. 2020). In light of this

potential relationship, two possible management strategies are suggested by Jennings and Hendrix (2020):

To mitigate winter-run Chinook Salmon egg and alevin mortality during drought years, two possible strategies for cool-water management are: (1) release cool water early (April-May) to drive the peak of winter-run spawning earlier in an attempt to achieve emergence from gravel before temperatures increase; or (2) hold cool water until later in the season, when the bulk of spawners begin to deposit eggs… ultimately, models that combine reservoir management dynamics with SRWC spawning and egg incubation will be necessary to understand how reservoir management might affect spawn timing, egg and alevin development, and egg-to-fry survival under various climate conditions.

This research strategy recommends a phased approach to better understanding the relationship between water temperatures during winter-run Chinook salmon staging and the timing of peak spawning.

1. Implement necessary studies to determine whether a functional (cause and effect) relationship exists and what is the nature and strength (variability) of that relationship.
2. Develop analytical tools to evaluate potential management opportunities that could use the functional relationship (if it exists) to benefit the reproductive success of winter-run Chinook salmon. This phase of the investigation may involve assessments of the interaction between multiple life stages runs, and species with different water operation scenarios. For example, early warm water could also affect *O. mykiss* egg survival or influence the distribution of spring run Chinook Salmon by altering the river's temperature relative to that of Clear Creek.

The first phase of the research strategy could include a literature review or analysis of temperature data and information to assess effects to Chinook Salmon migration timing. Another initial step could include manipulative, randomized experimentation to evaluate the relationship between water temps during adult staging and spawn timing. Such a study's objective would be to demonstrate a cause-and-effect relationship through a controlled, manipulative experimentation in a captive environment, such as a hatchery, where individual fish can be randomly assigned to treatment groups consisting of different water temperatures.

The second strategy was implemented in the river in 2021 when we bypassed power production to release warmer water in April and May, saving the cooler water till later in the season. The effectiveness of this action can still be evaluated using the data collected over that season.

Modeling will be an important tool for the second phase of the proposed research strategy. Modeling operational scenarios will help plan the action by estimating the potential effect(s) of operational actions on smolts survival across different hydrological conditions. Modeling will also be used to evaluate any potential increases to winter-run Chinook Salmon temperature-dependent mortality (TDM) and estimate potential decreases in the Shasta Reservoir Cold Water Pool (CWP) as a result of different operational actions. The modeling may also consider possible impacts to pre-spawn mortality from running warmer earlier in the season. An evaluation of the modelling tools will be assessed by comparing predictions with monitoring data which will be

documented in Reclamation's Shasta Cold Water Pool Seasonal Report or/and Shasta Storage Rebuilding Seasonal Report.

During the second phase of the research strategy, hypothetical tradeoff scenarios may include preserving cold water until peak spawning and emergence occurs to reduce TDM impacts to early life stages. At certain warm temperatures, pre-spawn mortality may occur.

Annually, real-time operations monitoring will be implemented to measure biological and operational responses relevant to evaluating the relationship between spring water temperatures and spawning timing and location. These include spawning timing, spawner condition, redd location, water temperatures, and egg-to-fry survival.

Reports as part of this multiyear Research Strategy will communicate the operational effects of the water and temperature management actions taken for managing WRC spawning and other observed biological and ecological responses. Modeling and decision support tools can highlight the magnitude of uncertainty related to mechanisms behind spawn timing that may warrant experiments to better understand the potential impacts of managing spawning behavior.

The primary objective of these activities will determine if keeping water colder earlier induces earlier spawning, or if keeping April/May Sacramento River temperatures warmer induces later spawning. It would be valuable to be able to identify and quantify if spawning timing contributes to or limits reproductive success to better assess proportional sources of mortality by separating pre-spawning water temperature effects from other variables (e.g., thiamine deficiency, incubation temperatures, redd superimposition, habitat restoration, water quality, hatchery effects, etc.). The research strategy may support learning about reproductive success, more broadly, as an additional objective.

No later than one year after completion of consultation, Reclamation will submit to NMFS for approval a report that identifies technical team membership, provide a final list of study topics and alternatives for agency management review, to implement the action. When research actions are completed, Reclamation will report the result to the SRTTG for potential implementation into temperature management.

Potential research actions may include:

- Summarize available literature on thermal tolerance for adult SRWC to understand drivers of spawning behavior, gamete viability, epigenetics, and prespawning stress/mortality.
- Controlled experimentation (e.g. in a laboratory or hatchery setting) to evaluate effects of water temperatures on spawning timing of winter-run Chinook salmon.
- Review available data and/or measure historic Shasta spring operations effects of temperatures on adult Chinook salmon (e.g., pre-spawning stress/mortality, changes in spatial and temporal spawning distribution). May include acoustic telemetry study of adult behavior or observations from carcass survey. " Analyze spawn timing has shifted in the past 20 or so years and how that relates to flows before and during spawning to determine if management recently has shifted spawning behavior.

- Calculate SRWCS birth date distributions, which could be accomplished by otolith analyses of juvenile Chinook salmon collected at Red Bluff Diversion Dam (RBDD). This would provide information on whether there was disproportionate survival of progeny from the temporal distribution of adult spawners (e.g., early vs. late spawning). Genetic method could also help test for disproportionate survival of progeny from early vs late spawning females.
- Genetic analyses (i.e., parentage and relatedness approaches of adults and juveniles) to see which juveniles survive from which spawning adults (specifically associated with spawning location, time, sex, and origin).
- Reconstruction of temperature histories of juveniles at RBDD or returning adults to assess the temperatures individuals experienced at emergence. Oxygen isotope measurements in otoliths can provide this temperature reconstruction. Paired with thermal landscapes, one can assess mortality (lack of representation) of individuals sampled at a later point in time.

Previous efforts for this action are described in the Spring Management of Spawning Locations Research Strategy (cite TBD).

E.5.13 Alternative Loss Estimation Pilot Study

DWR, in coordination with Reclamation has completed a draft updated Alternative Loss Equation (ALE-22) software tool for estimating losses at the SWP and CVP export facilities to quantify incidental take of winter-run and spring-run Chinook Salmon, and Central Valley steelhead. DWR, in coordination with Reclamation proposes to further refine the parameters of this tool by developing an Alternative Loss Pilot Study Implementation Plan (ALPS-IP) to implement this tool in parallel with current loss estimation methods. The goal of this pilot study is to provide a more accurate estimates of loss, and loss parameters, at the SWP and CVP export facilities while understanding the utility of the new alternative method relative to the existing method.

DWR and Reclamation propose to collaborate on the following actions:

- Within 6 months of the latest effective date of the ROD or ITP, DWR in collaboration with Reclamation shall conduct a knowledge transfer and methods workshop for the ALE-22 tool. Participants may include representatives from NMFS, USFWS, CDFW, DWR, State and Central Valley Water Contractor representatives, and Reclamation.
- Within 6 months of the completed ALE-22 workshop DWR, in collaboration with Reclamation, shall convene the ALE Technical Team (ALE-TT), a sub-team of the Central Valley Fish Facilities Review Team (CVFFRT), and DWR shall submit a draft ALPS-IP to the ALE-TT for review and comment.
    - The draft ALPS-IP shall include:
        - Structured Decision Making (SDM) process outline
        - Interim, draft, and final reporting protocols

        - Pilot Study design
        - Procedures, and timelines (e.g., start and stop dates)
        - Target species (e.g., winter-run and spring-run Chinook Salmon, and California Central Valley steelhead)
        - Assessment of multiple parameters to account for losses including, but not limited to: salvage facility outages during louver cleaning or mechanical failure; post release survival on salvaged fish
- Within 4 months of receiving ALE-TT review comments DWR would submit the final draft ALPS-IP to the CVFFRT, SaMT, and the agency sub-directors for comment/approval.
- Within 1 month of receiving CVFFRT, SaMT review, and subsequent agency sub-director comments/approval DWR would finalize the ALPS-IP.
- Within 1 year of the finalization of the ALPS-PS DWR would utilize the ALE-TT and the defined SDM procedures to complete a prioritization of the ALPS-IP recommendations for further implementation.
    - The ALE-TT may utilize an independent science panel review to further enhance the SDM prioritization process.
- Within 4 months of completing the prioritized ALPS-IP final recommendations DWR shall submit them to the agency sub-directors for approval.

E.5.14 Georgiana Slough Migratory Barrier Effectiveness

Operation of the salmonid migratory barrier should improve the seasonally averaged through-Delta survival probability to Chipps Island compared with survival probability if the salmonid barrier were not in operation. Barrier operations and monitoring details are defined in the Georgiana Slough Salmonid Migratory Barrier (GSSMB) Operations and Monitoring Plans developed by the GSSMB Coordination Group. To further maximize seasonal survival benefits to migrating salmonids, DWR and Reclamation will continue leading the GSSMB Coordination Group, with membership comprised of DWR, Reclamation, CDFW, USFWS, NMFS, and State/Federal Water Contractors representatives. DWR and Reclamation, working with the GSSMB Coordination Group, will provide at least a triennial report and review and update, as necessary, the GSSMB Operations and Monitoring Plans.

E.5.15 Drought

Starting each October, Reclamation and DWR, through the Drought Relief Year (DRY) Team, will meet at least monthly to determine whether it would be appropriate to pursue actions to respond to current or anticipated drought and dry year conditions. At each meeting, Reclamation and DWR will review the actions in the drought toolkit, and determine if it would be appropriate to pursue any of them, and evaluate the effectiveness of those actions. The drought toolkit will list the minimum decisions required each month and Reclamation and DWR expect a more focused review of the drought toolkit in times when resources to meet required operations and goals are limited. These limited resources may include, but are not limited to hydrology, current

and projected reservoir storages, facility limitations and fish conditions. These decisions will be documented monthly or more often if necessary in the WOMT notes.

Reclamation and DWR, through the DRY Team, may update the drought toolkit. Reclamation and DWR, through the DRY Team, will evaluate drought actions taken to reduce drought impacts related to CVP and SWP operations described in the drought toolkit. This evaluation will provide additional information on the effectiveness of drought response so as to support updates to the drought toolkit. This evaluation will be included in the annual Drought Report.

E.5.16 Governance

CVP/SWP Governance

CVP/SWP Governance identifies ongoing engagement by participating State and Federal Agencies (collectively the "Agencies"), interested parties, and/or the public following completion of the Biological Opinions and Record of Decision. Governance describes the system-wide organization of technical groups, group membership, activities that are subject to governance, and decision-making approaches and protocols.

The purposes of CVP/SWP Governance are to:

- Identify the roles and responsibilities of the agencies that are part of real time operations
- Establish that the agencies will work together in good faith
- Identify the governance principles agreed to by the participating agencies
- Identify operations that are subject to Governance
- Identify the implementation teams that are part of governance, and processes for technical collaboration and elevating issues for resolution
- Incorporate learning and adopt new technologies from monitoring, adaptive management and ongoing science
- Describe relationships between technical and policy groups
- Describe Reporting and Outreach

The Agencies are committed to communicate each organization's respective interests and recognize the intent to work together in a good faith effort to resolve issues through the groups described in this governance document. Every member is committed to identifying potential issues and communicating these issues to the relevant technical or policy team as soon as possible. Representatives who participate on technical and policy teams are clear about their ability to represent agency decisions. Representatives who participated on technical and policy teams are empowered to represent their agency and make decisions appropriate for that level. Each representative is representing the science, policy and management positions of their agency based on the best of their ability and current knowledge. Representatives participate understanding their authority (not agency authority but representatives' authority). Representatives are aware and clear about their role with other members. Representatives will

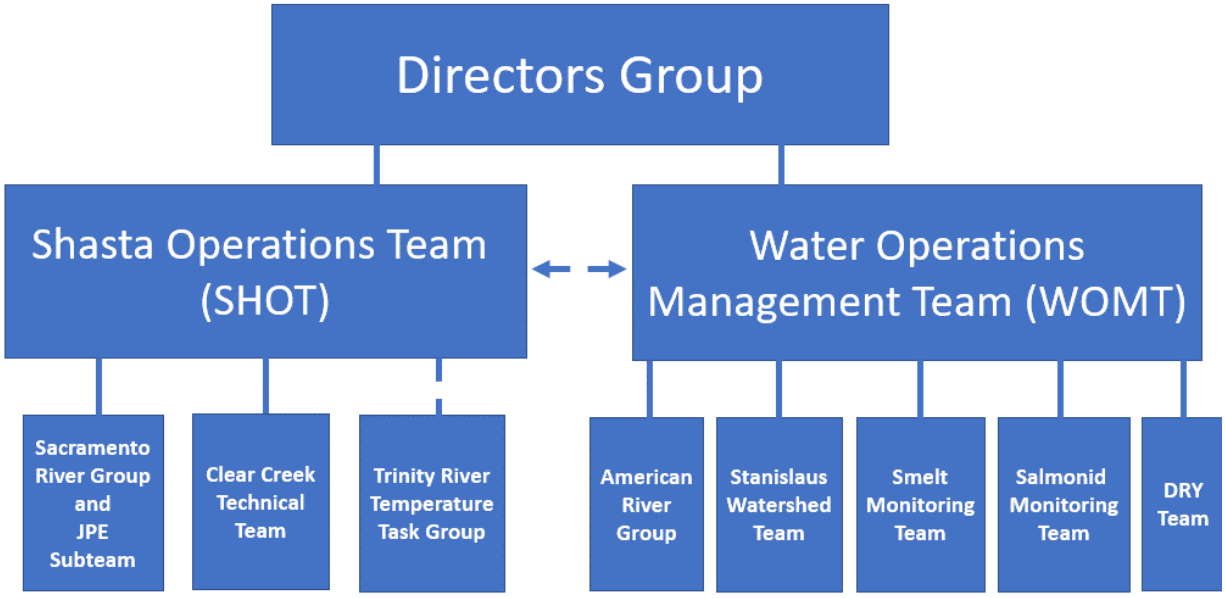
either be able to make decisions on other parts of the system or have an avenue for doing that quickly.

CVP/SWP Governance is framed around the following principles:

- **Collaboration:** The leading principle of CVP/SWP Governance is collaborative, science-based decision making. CVP/SWP governance is structured to seek consensus across scientific, technical and policy levels, with elevation and decision-making processes in place when consensus cannot be reached.
- **Effectiveness:** It is workable and efficient. Effectiveness considers what information is available and when. Effective CVP/SWP governance recognizes that there is more uncertainty early in the year and that uncertainty may change as the year progresses.
- **Accountability:** Operational, regulatory, proactive, and addresses long-term planning.
- **Inclusiveness:** Collaborative and cooperative. The elevation and decision-making structure maintains accountability at all levels.
- **Transparency:** The processes are not ambiguous. They are open for others to see and understand through implementation of a communication plan.
- **Communication:** Be aware and clear about roles. If you spot a potential issue, communicate it.

E.5.16.1 Organizational Structure and Description of Collaborative Teams by Division

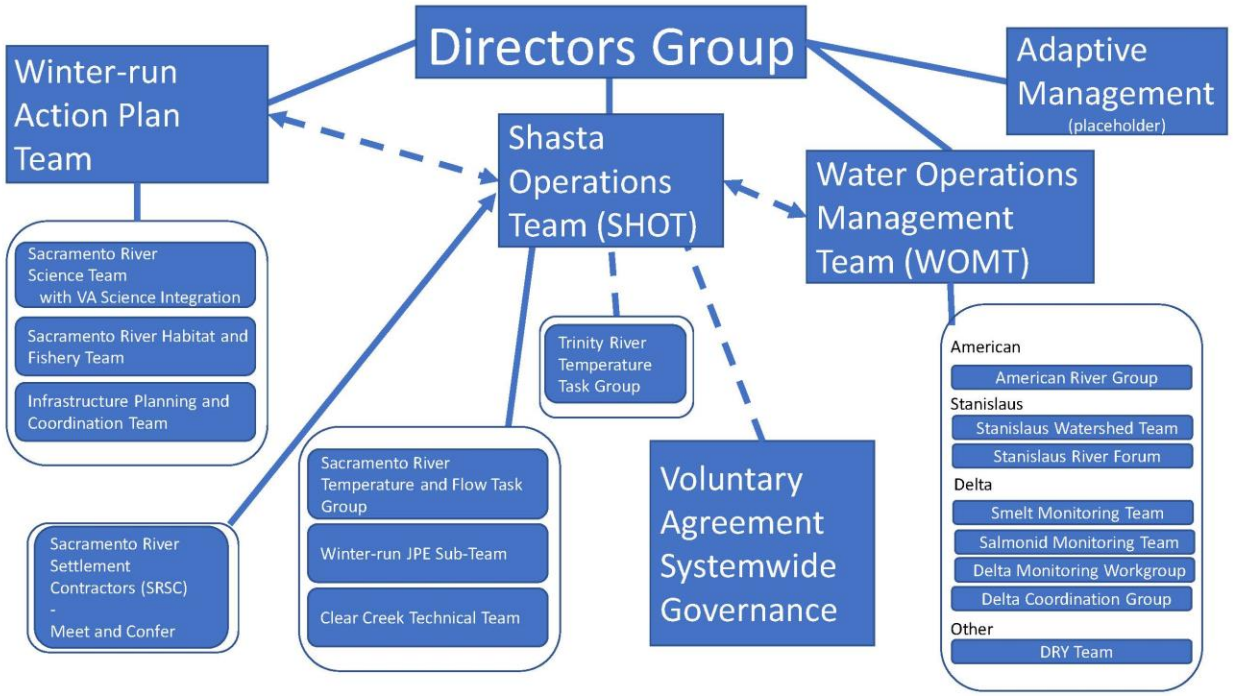
CVP/SWP Governance is structured such that a 5 Agency Directors Group oversees the ongoing authorities of each respective agency and serves as the final decision-making body for operational matters. The Directors Group directly interfaces with two management and policy level groups (SHOT and WOMT), whose Federal and State agency representatives discuss the actions in Alternative 2 when implementation may have biological, system conditions or water supply impacts or tradeoffs. These policy groups work with numerous technical groups that coordinate on seasonal and real-time operations for specific divisions or watersheds. Figure Figure E-19 illustrates the CVP/SWP structure for water operations.



Solid lines indicate a direct relationship for elevation and decision making, the dashed arrow between WOMT and SHOT indicates a direct line of communication and regular coordination, the dashed line between SHOT and the Trinity River Temperature Task Group indicates seasonal communication and coordination on an as-needed basis.

Figure E-19. CVP/SWP Structure for Water Operations

Figure E-20 illustrates the more specific governance structure for Shasta and Sacramento River activities, including direct coordination between SHOT and WOMT. The organizational structure for Shasta and Sacramento River activities integrates the Winter-run Action Plan to advance specific science, habitat and infrastructure initiatives.



Solid lines indicate a direct relationship for elevation and decision making, the dashed arrow between Winter-run Action Plan Team and SHOT indicates a direct line of communication and regular coordination, the dashed arrow between WOMT and SHOT indicates a direct line of communication and regular coordination, the dashed line between SHOT and the Trinity River Temperature Task Group indicates seasonal communication and coordination on an as-needed basis. The solid arrow between SHOT and the SRS Contractors indicates SRS Contractor integration into SHOT.

Figure E-20. Governance Structure for Shasta and Sacramento River Activities.

E.5.16.2 Chartering Teams

Teams and groups involved in planning and providing input regarding water operations are described below for each division of the CVP and SWP. Team membership, roles, and processes will be described in team charters, as specified for each division below. Some teams may already have charters in place which will continue to be followed until and if replaced in the future. These charters may be supplemented by guidance documents which further elaborate roles, responsibilities, and process for these teams. These guidance documents will be updated as needed by mutual agreement.

External participants are also included in many of the Collaborative Teams to provide technical expertise and allow sharing and communication of operational decisions. The expectations and group norms for the external participants will be described in team charters.

Sacramento River Division – Water Operations

For the Sacramento River and Shasta Reservoir water operations there are three main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the SHOT, SRG, and the Winter-run JPE Subteam. The SHOT is a policy level group that discusses water operations actions described in this alternative when implementation may have

biological, system conditions or water supply impacts or tradeoffs. The SHOT also discusses activities from the Winter-run Action Plan Team that may affect water operations. It is composed of management and policy staff from participating agencies including the SRS Contractors. The SRG is a technical group to discuss pulse flow shaping, temperature management, fall flow smoothing and fall/winter base flows. It is composed of technical staff from Reclamation, DWR, NMFS, USFWS, CDFW, SRS Contractors, Western Area Power Administration, SWRCB and Native American Tribes. The Winter-run JPE Subteam is a technical group tasked with development of the winter-run JPE each year and the winter-run broodstock assessment. It is composed of technical staff from the 5 Agencies. Generally, topics will be discussed at a technical level through SRG with agency feedback provided prior to being discussed at the SHOT. The SHOT will coordinate regularly with WOMT and other work groups as appropriate. Sacramento River Governance will use a collaborative approach to planning and decision-making.

Shasta Operations Team

A SHOT consisting of Agency subdirectors and managers will serve as the management and policy group for decisions related to Shasta Reservoir operations. The team will develop a charter to describe membership and process. The purpose of the SHOT is to ensure agency interaction and coordination on the Sacramento River and also with the broader CVP/SWP system, including downstream demands that affect Shasta Dam releases.

The SHOT Team will coordinate with WOMT as needed on operational issues and decisions that have implications for both of their respective purviews, including but not limited to drought toolkit implementation and Voluntary Agreement asset management. A summary of Shasta Reservoir operations will be communicated at WOMT meetings and documented in WOMT meeting notes.

The SHOT will meet year-round and hold monthly meetings, or as needed to coordinate on Shasta Reservoir operations and potential system-wide management actions and risks. Reclamation will provide operational outlooks and the applicable drought and dry year actions from the drought toolkit or other relevant drought planning documents. The SHOT may convene relevant technical teams to support Shasta or system-wide policy decisions. Reclamation will provide updates from the SHOT relevant technical teams. Each of the 5 Agencies is responsible for being informed of conditions and communicating with their respective representatives on other teams.

Consistent with the Shasta Division part of Alternative 2, the SHOT will work together, with input from the Sacramento River Temperature and Flow Task Group (SRG), to manage Sacramento River Basin VA assets. Relevant operational actions that VA assets are intended to support include Shasta Reservoir coldwater pool management, seasonal pulse flows planning and fall flow management. The SHOT will consider the contribution of these assets to conditions that contribute toward maintaining flows and temperatures that support viable Chinook salmon populations by enhancing spawning, rearing, growth and migration corridors and make decisions about their deployment.

Sacramento River Temperature and Flow Technical Group

The Sacramento River Temperature and Flow Technical Group (SRG) is a multiagency and stakeholder group established to provide technical and scientific information regarding temperature management and instream flows. The SRG will be composed of representatives from Reclamation, DWR, USFWS, CDFW, NMFS Central Valley Office, NMFS Southwest Fisheries Science Center, the SWRCB, Western Area Power Administration, the Yurok Tribe, the Hoopa Tribe and the SRS Contractors. The team will develop a charter to describe membership and process. The SRG develops temperature and flow plans for implementation of temperature management, fall and winter refill and redd maintenance actions, flow smoothing for rice decomposition, spring and seasonal pulse flows, winter base flow management, ramping rates, Shasta Reservoir storage planning and relevant fishery monitoring. The SRG will work closely with Reclamation and the SHOT and will use the best available science including current hydrologic forecasts, operational outlooks, fishery information, and modeling information.

The SRG will begin meeting no later than March to develop a Draft Sacramento River TMP and will meet at least monthly through the temperature management and the winter-run Chinook salmon redd maintenance season to coordinate during implementation. The SRG may update the Final TMP at the request of the SHOT. At the conclusion of the water temperature management season, the SRG will develop a summary report pursuant to seasonal and annual reporting requirements for fall and winter refill and redd maintenance actions, flow smoothing for rice decomposition, spring or other seasonal pulse flows, winter base flow management, ramping rates and relevant fishery monitoring.

Reclamation will coordinate through SRG to develop a protocol for agency collaboration regarding temperature and flow models and will strive to create shared understanding of model constraints, uncertainties, limitations, applied assumptions and interpretations; develop management questions and scenarios that may benefit from modeling support; develop and review early season operational scenarios to support temperature management and flow planning.

Meet and Confer Group

The SRS Contractors approved “A Resolution Regarding Salmon Recovery Projects in the Sacramento River Watershed, Actions Related to Shasta Reservoir Annual Operations, and Engagement in the Ongoing Collaborative Sacramento River Science Partnership Effort” (June 12, 2019). Pursuant to the resolution, during drier water years, the SRS Contractors will meet and confer with Reclamation, NMFS, and other agencies, as appropriate, to determine if there is any role for the SRS Contractors in connection with Reclamation’s operational decision-making for Shasta Reservoir annual operations in those years. This determination will include consideration of what actions are feasible, consistent with the terms of the SRS Contracts. In addition to the 25% reduction during Shasta critical years as set forth in the SRS Contracts, the types of actions that may be considered include, but are not necessarily limited to: (1) the scheduling of spring diversions by the SRS Contractors; (2) voluntary, compensated water transfers by the SRS Contractors subject to Reclamation approval; and (3) delayed SRS Contractor diversion for rice straw decomposition during the fall months. Any mutually agreeable operations resulting from meet and confer discussions must be consistent with the terms of the SRS Contracts and may also be subject to other regulatory approvals.

The Meet and Confer group will be convened at the request of Reclamation, NMFS or the SRS Contractors at any time during the winter or spring months. According to the SRS Contractor's resolution, this group may agree to invite the USFWS, CDFW, and/or the SWRCB at their discretion. As part of Upper Sacramento River Governance, SHOT managers will represent the agencies at Meet and Confer meetings. The group will establish their own meeting frequency. Agency representatives from the Meet and Confer Group will communicate discussions and voluntary SRS Contractor actions with the SRG.

Sacramento River Division – Winter-run Action Plan

For the Winter-run Action Plan, there are four main coordination forums that will meet regularly to discuss the following collaborative science, habitat and fisheries and infrastructure programs:

- The Winter-run Action Plan Team is a policy level group that discusses and coordinates the actions and milestones for the three key programs of the Winter-run Action Plan. The Winter-run Action Plan Team will also coordinate with the SHOT on science, habitat and fisheries and infrastructure actions that may affect water operations.
- The Sacramento River Science Team will work collaboratively to advance science actions identified as highest priority to be included in a science plan.
- The Sacramento River Habitat and Fishery Team will work collaboratively to advance key fishery and habitat restoration actions.
- The Infrastructure and Planning Team will work collaboratively to engage in planning and implementing key infrastructure improvements at Shasta Dam and the Livingston Stone NFH.

Trinity River Division – Clear Creek

The Clear Creek component of the Trinity River Division includes the CCTT and SHOT. The CCTT will provide technical input to Reclamation on habitat restoration, the shaping and timing of flows released from Whiskeytown Dam to optimize biological benefits downstream, and providing recommendations on operations to meet temperature criteria. SHOT will coordinate with the CCTT, as needed regarding Clear Creek operations that affect Shasta Operations. Trinity River Governance on Clear Creek will use a collaborative approach to planning and decision-making.

Clear Creek Technical Team

The CCTT is comprised of a group of agency representatives and interested parties who will use the best available science to provide technical input to Reclamation on habitat restoration, the shaping and timing of flows released from Whiskeytown Dam to optimize biological benefits downstream, and providing recommendations on operations to meet temperature criteria. The CCTT meets quarterly, or more frequently as needed. The CCTT develops a flow schedule every year, and may adjust the schedule using recent monitoring information.

Delta Division

For the Delta Division water operations there are three main agency coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the WOMT, SMT

and SaMT. WOMT is a policy level group that discusses the operations actions in the Delta, American River Division and the Stanislaus/East Side Division. The SMT is a technical group that discusses Delta Operations and smelt protections. The SaMT is a technical group that discusses Delta Operations and salmon and steelhead protections. WOMT will coordinate regularly with SHOT and other work groups as appropriate. Delta Governance will use a collaborative approach to planning and decision-making.

Water Operations Management Team

A WOMT will coordinate on overall water operations to oversee the implementation of various real-time provisions for the Delta and the tributaries. The purpose of WOMT is to discuss and resolve operational questions and technical issues, as requested or elevated from Delta and tributary technical teams, and to elevate unresolved operational issues to the Directors Group. The team will develop a charter to describe membership and process. The WOMT will coordinate with the SHOT as needed on operational issues and decisions that have implications for both of their respective purviews, including but not limited to drought toolkit implementation and Voluntary Agreement asset management.

WOMT will meet weekly during the OMR Flow Management season (October through June), and otherwise as needed. Any agency can request a WOMT meeting outside of the OMR season for discussion or elevation items. For OMR management, Reclamation will provide operational outlooks and assessments on a weekly basis to WOMT, the SMT and the SaMT. WOMT will be provided the opportunity to review and discuss any applicable drought and dry year actions from the drought toolkit or other relevant drought planning documents. For all other assessments or elevation issues, supporting materials will be provided to WOMT by designated representatives of the applicable technical teams.

Smelt and Salmon Monitoring Teams

The SMT and SaMT includes participants from Reclamation, USFWS, NMFS, DWR, CDFW, and SWRCB. The SMT and SaMT review hydrologic, operational, fishery, and water quality data, and provide opportunities for engagement and discussion among biologist and operators on relevant information and issues associated with Alternative 2 and risk assessments.

Agency team leads: (1) notify their agency's WOMT representative(s) if a Proposed Action/Incidental Take Permit identified trigger/threshold is or will be met; (2) provide input on the assessment and advice on the Incidental Take Permit risk assessment: and (3) discuss and document differing perspectives (i.e., non-consensus) on the relevant assessments.

In addition, there are also two additional groups that discuss operations that include other interested parties:

- **Delta Monitoring Workgroup:** The DMW will include technical representatives from federal and state agencies and stakeholders who can provide information to DWR and Reclamation on species abundance, species distribution, life stage transitions, and relevant physical parameters. The federal and state participants will be the agency leads and/or alternates from the SaMT and SMT. Similar to the federal and state agencies, the SWP and CVP contractors shall identify a lead and alternate participant, who are knowledgeable and have expertise in water operations, monitoring, and fish biology. The

main focus of the DMW meetings is to: 1) review hydrologic, operational, fishery, and water quality data; 2) provide opportunities for engagement and discussion among biologist and operators on relevant information and issues; and, 3) review the Assessment and Incidental Take Permit Risk Assessment. The results of the DMW discussions will be captured in meeting notes for consideration by DWR and Reclamation.

- **Delta Coordination Group:** The DCG is comprised of two representatives each from Reclamation, NMFS, USFWS, DWR and CDFW, and one representative each from the CVP water contractors and SWP water contractors. The DCG may prepare an assessment to propose an alternative gate operation to the SMSCG action and will develop an annual monitoring plan for the action. The DCG will participate in the development of food subsidy action plans, monitoring plans, and reports.

American River Division

For the American River Division water operations there are two main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the WOMT and the ARG. The ARG is a technical group that discusses reservoir and storage planning, forecasting and seasonal operations, flow and water temperature management and monitoring programs. American River Governance will use a collaborative approach to planning and decision-making.

American River Group

A group of federal, state, and local agencies, water users, and NGOs makes up the ARG to coordinate the shaping of releases including spring pulse flow timing and longevity, communicate upcoming releases, discuss water operations, fisheries, and other environmental concerns and to share operational and biological information with the goal of improving the technical understanding of Lower American River temperature needs and operational constraints and considerations.

The ARG meets monthly, or more frequently as needed. The ARG will (a) evaluate the equations used to calculate the MRRs in November through December to consider whether an adjustment to the maximum MRR is warranted based on habitat improvements and other relevant information, and (b) submit a recommendation to Reclamation. The ARG will provide technical input on shaping Flow volumes, with the final timing determined by CDFW, USFWS, and NMFS. The ARG will provide technical input on shaping Redd Dewatering Projective Adjustments. The draft TMP will be shared with the ARG, and Reclamation will consider feedback from ARG participants before finalizing the plan by June 15. During plan implementation, if the water temperature threshold is exceeded for three consecutive days, or is exceeded by more than 3°F for a single day, Reclamation will notify NMFS and the ARG, and outline steps being taken to bring the water temperature back into compliance.

East Side Division – Stanislaus River

For the East Side Division – Stanislaus River there are two main coordination forums that will meet regularly to discuss seasonal and real-time operations. These include the WOMT and the SWT. The SWT is a technical group that discusses reservoir and storage planning, forecasting and seasonal operations, flow and water temperature management and monitoring programs. The SWT will coordinate with other groups as appropriate. East Side - Stanislaus River Governance will use a collaborative approach to planning and decision-making.

Stanislaus Watershed Team

The SWT is a group of agency representatives and local interested parties (including conservation groups and other organizations working directly on Stanislaus River issues) having direct interest on the Stanislaus River. The SWT will provide technical input to Reclamation on the shaping and timing of monthly or seasonal flow volumes to optimize biological benefits. The SWT will meet at least monthly to share operational information and improve technical dialogue on the implementation of the New Melones SRP.

In addition, there is one additional group that discusses operations that includes other interested parties:

- **Stanislaus River Forum:** The Stanislaus River Forum (SRF) is an open forum for all interested stakeholders to receive Stanislaus River Operations updates and to provide feedback for SWT and Reclamation consideration. The SRF will meet at least monthly and prior to the SWT meeting to share operational information and improve technical dialogue on the implementation of the New Melones SRP.

E.5.16.3 Collaborative Decision Making

This section describes the representatives and the process for elevation, decision making, and communication. More information on the types of decisions and process for each Division can be found in the corresponding section of this alternative.

Directors

Directors from Reclamation, DWR, USFWS, NMFS and CDFW will meet as requested by the WOMT or the SHOT when consensus cannot be reached on operations. The team that is the lead for the elevation issue will notify the other team prior to elevating to the Directors to ensure full transparency.

Director Decision Making for Shasta and Tributaries

The Regional Director for Reclamation will confer with the other Directors to determine if there is an alternative action that will be mutually agreeable. If consensus is reached, Reclamation will implement the alternative action. If the Directors do not reach a resolution on operations, Reclamation will make a decision and notify the other Directors in writing. Any Director has the opportunity to dispute a decision within 2 days, providing a written explanation of the nature of the dispute. Reclamation will respond in writing within 2 days after receiving the explanation for the disputed action and before taking an action. Any Director may request a follow-up Directors meeting if necessary.

If there is disagreement on an operational action that Reclamation determines may create a potentially high risk to CVP infrastructure or liability to the United States, then Reclamation will make the final decision as to whether or not to implement that action.

Director Decision Making for the Delta

The Regional Director of Reclamation or DWR (proposing agency or agencies) will confer with the fish agency Directors/Regional Administrator to determine if there is an alternative action that will be mutually agreeable for specific areas that rely on a risk assessment, following

elevation by WOMT. If consensus is reached, the proposing agencies will implement the alternative action. If the Directors do not reach a resolution on operations, the proposing agencies will meet and confer to prioritize alignment between the SWP and CVP operations, in consideration of operational and regulatory constraints affecting either project, will make a decision and notify the other Directors in writing. Any Director has opportunity to dispute a decision within two days, providing a written explanation of the nature of the dispute. The proposing agencies will respond in writing within two days after receiving the explanation for the disputed action and before taking an action. Any Director may request a follow-up Directors meeting if necessary.

If there is disagreement on an operational action that the proposing agency determines may create a potentially high risk to Project infrastructure or liability to the United States or State or California, then the proposing agency will make the final decision as to whether or not to implement that action.

Once a decision has been resolved following any of the procedures described above, the Directors will designate a representative or representatives to communicate the decision to relevant parties, including operators, technical team representatives, and/or other interested parties.

Water Operations Management Team

Each agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If issues that are elevated to WOMT are resolved by WOMT, an agency representative will be designated by WOMT to communicate the decision via email to relevant technical team representatives. If the WOMT cannot reach consensus on an operational issue, the issue will be elevated to the Directors through the subdirectors. Similarly, if the SHOT or WOMT have an operational disagreement, the issue will be elevated to the Directors through the subdirectors. The elevation process will be managed collaboratively by the WOMT.

Shasta Water Operations Team

Each agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If issues that are elevated to SHOT are resolved by SHOT, an agency representative will be designated to communicate the decision via email to relevant technical team representatives. If the SHOT cannot reach consensus on an operational issue, the issue will be elevated to the Directors through the subdirectors. Similarly, if the SHOT or WOMT have an operational disagreement, the issue will be elevated to the Directors through the subdirectors. The elevation process will be managed collaboratively by the SHOT.

The SHOT will work together, with input from the SRS Contractors, to manage Sacramento River Basin VA assets. The SHOT will consider the contribution of these assets to conditions that contribute toward maintaining flows and temperatures to support viable Chinook salmon populations by enhancing spawning, rearing, growth and migration corridors. Relevant operational actions that VA assets will support include, but are not limited to, Shasta coldwater pool management, seasonal pulse flows and fall flow management. Fish agencies will be the final decision makers on deployment of VA assets based on what provides the best protection for the species.

Sacramento River Temperature and Flow Technical Group

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. SRG will seek to reach consensus. If consensus is not reached, at the close of SRG meetings, there will be an Agency resolution session to discuss and compose an e-mail to SHOT, summarizing the elevation topic and any supporting information and recommendation, and report the details of the elevation issue to SHOT. Each of the five agency representatives are individually responsible for communicating the issue and any background information to their SHOT representative. The decision-making process will then follow the procedure described in *Shasta Water Operations Team*, and, if necessary, the procedure in *Directors*.

Winter-run Action Plan Team

Reclamation is committed to support a separate Winter-Run Action Plan with NMFS, FWS, CDFW, DWR and SRSCs to pursue a science and monitoring plan, winter-run habitat and infrastructure actions, and water operations.

Clear Creek Technical Team

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. CCTT proposed flows will be routed to Central Valley Operations, who will implement the flows as proposed. If there is an operational issue that the CCTT cannot resolve, the Agency representatives will compose an e-mail to SHOT, summarizing the elevation topic and any supporting information and recommendations. Each of the agency representatives are individually responsible for communicating the issue and any background information to their SHOT representative. The decision-making process will then follow the procedure described in *Shasta Water Operations Team*, and, if necessary, the procedure in *Directors*.

American River Group

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If there is an operational issue that the ARG cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in*Water Operations Management Team*, and, if necessary, the procedure in *Directors*.

Smelt and Salmon Monitoring Teams

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. Agency team leads: (1) notify their agency's WOMT representative(s) if an identified trigger/threshold is or will be met; (2) provide input on the assessment and advice on the Incidental Take Permit risk assessment: and (3) discuss and document differing perspectives (i.e., non-consensus) on the relevant assessments. If there is an operational issue that the team cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for

communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in *Water Operations Management Team*, and, if necessary, the procedure in *Directors*.

Stanislaus Watershed Team

Each participating agency is responsible for being informed of conditions and communicating with their respective representatives on other teams. If there is an operational issue that the SWT cannot resolve, the Agency representatives will compose an e-mail to WOMT, summarizing the elevation topic and any supporting information and recommendations. Each of the Agency representatives are individually responsible for communicating the issues and any background information to their WOMT representative. The decision-making process will follow the procedure described in *Water Operations Management Team*, and, if necessary, the procedure in *Directors*.

E.5.17 Adaptive Management

Adaptive management is a structured, iterative process for decision making when confronted with uncertainty. It emphasizes learning through management where knowledge is incomplete and provides a process for building knowledge through monitoring and science, reducing uncertainty, and improving management over time in a goal-oriented and structured way. Key components of adaptive management are establishing clear and measurable objectives, identifying action goals, and determining management options for best achieving those desired goals.

Decision support tools can be used within the adaptive management framework to identify the uncertainties that are most influential in a decision-making process (management), which in turn can guide the scientific approaches deployed to reduce those uncertainties and allow better informed subsequent decisions. When correctly designed and executed, adaptive management provides a means to develop and evaluate the expected outcomes of proposed management actions, to compare actual outcomes of actions to those expectations, and to make evidence-based adjustments to future actions to improve their effectiveness if warranted. The adaptive management approach can provide a transparent and documented scientific basis for continuing, modifying, or implementing an alternative action.

The Department of Water Resources (DWR), the Department of Fish and Wildlife (CDFW), Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) (collectively, “the Implementing Entities”) intend to utilize adaptive management to inform the long-term operations of the State Water Project (SWP) and the Central Valley Project (CVP) and related activities described herein. The Implementing Entities will approach adaptive management in an open, participatory framework. The Implementing Entities will establish the Adaptive Management Steering Committee (AMSC) to coordinate through individual Adaptive Management Teams (AMT) responsible for evaluating each Adaptive Management Action, utilizing decision support tools such as structured decision making.

Working through the collaborative process outlined in this document, the Implementing Entities commit to reach consensus within the AMSC to the maximum extent possible, while still retaining individual agency discretion to make decisions (as appropriate). To that end, the

Implementing Entities seek to use the potential flexibility provided by an adaptive management approach in a way that balances gaining knowledge to improve future management decisions while taking actions in the face of uncertainty to improve the operation of the CVP and SWP for their project purposes.

The Adaptive Management Program is described in Appendix X of the document. Appendix A to the AMP describes the steps required to implement the adaptive management process and explains how the process links to the operations of the SWP and CVP. Appendix B to the AMP includes a list of actions and programs in the Proposed Action (listed below), and additional details regarding the timeframe of evaluation of each action and the AMT responsible for implementing them:

- Winter-run Chinook Salmon OMR Management
- Spring-run Chinook Salmon OMR Management
- Larval and Juvenile Delta Smelt OMR Management
- Larval and Juvenile Longfin Smelt OMR Management
- Summer-Fall Habitat Action for Delta Smelt
- Tidal Habitat Restoration Effectiveness for Smelt Fishes
- Tributary Habitat Restoration Effectiveness for Salmonid Fishes
- Shasta Spring Pulse Flow Studies
- Winter-run Chinook Salmon Through Delta Survival Targets
- Longfin Smelt Science Plan Actions
- Delta Smelt Supplementation
- Steelhead JPE
- Alternative Salmonid Loss Estimation Pilot Study
- Shasta Cold Water Pool Management
- Georgiana Slough Migratory Barrier Effectiveness for Salmonid Fishes
- Spring Outflow
- Clear Creek

E.5.18 Framework Programmatic Outline for Sites Reservoir Project and Delta Conveyance Project

The Long-Term-Operations consultation (LTO) is a mixed programmatic action, as defined in 50 CFR 402.02[1]. This consultation includes a mix of standard consultation and programmatic consultation (which can include an Incidental Take Statement (ITS) or defer the ITS to a later time associated with subsequent Federal actions). All activities addressed programmatically will be subject to a subsequent consultation in order to proceed. Additionally, some project elements and their effects on listed species or critical habitat may change as Reclamation and DWR continue to develop the Proposed Action for the programmatic elements and may require reinitiation of consultation.

This alternative provides a framework for the development of future Federal actions that will be authorized, funded, or carried out at a later time and will be subject to future project-specific consultations because of these subsequent Federal actions. Reclamation will initiate these future consultations and will provide sufficient information as outlined in 50 CFR 402.12(t). The Services will complete these future consultations and that additional review will be informed by sufficient detail to allow the development of incidental take statements for each of these activities.

This alternative includes a programmatic framework consultation for the operations of the Sites Reservoir Project (Sites) and the operations of the proposed Delta Conveyance Project (DCP). The use of a mixed programmatic framework consultation for these two projects provides information, to the extent possible given the information available today, to assess how these projects would operate in the context of Alternative 2 along with broadly assessing the impacts of the operations of these projects in the context of the LTO. The use of a mixed programmatic framework consultation for these two projects provides information, to the extent possible, on how these key projects would be implemented, if approved after completing compliance with the California Environmental Quality Act (CEQA), in conjunction with the LTO operations in the future and will support subsequent regulatory processes and coordinated operations planning.

E.5.19 Qualitative Project Descriptions

Qualitative descriptions of the proposed projects and potential operational effects for both Sites and DCP individually, as well as combined, are included in this framework. The qualitative analysis serving this EIS for DCP can be found in Appendix Z, and Sites analysis is in Appendix AA. Potential for effects on storage in upstream reservoirs, potential for changes in flows and temperatures upstream of Sites and DCP, changes in flows adjacent to Sites and DCP facilities, and changes in flows and hydrodynamics through, and downstream of, the Delta are all addressed at a programmatic level. These operationally driven changes in flows will be

[1] Mixed programmatic action means, for purposes of an incidental take statement, a Federal action that approves action(s) that will not be subject to further section 7 consultation, and also approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further section 7 consultation.

considered in the context of the Sacramento River, Delta, and downstream aquatic ecosystems, and specifically in relation to ESA listed species and critical habitat.

E.5.19.1 Sites Reservoir

Sites would involve the construction, operation, and maintenance of a 1.5 million acre-foot 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 project components would be located in Tehama, Glenn, Colusa, and Yolo counties.

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 offstream reservoir west of the community of Maxwell, California. New and existing facilities would move water into and out of the reservoir. Releases from Sites Reservoir would be used locally, be conveyed to the Yolo Bypass for ecosystem benefits, or ultimately return to the Sacramento River system via existing canals and a new pipeline located near Dunnigan. Water released from the 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.

The Authority would own and operate all newly constructed project facilities that are not already owned by another entity. There are currently 22 Storage Partners representing local and regional water delivery agencies that serve over 24.5 million people and over 500,000 acres of farmland that are paying for the Project and would receive the resulting water supply benefits. In addition, the State of California, through the California Water Commission, and Reclamation are also envisioned to be Storage Partners and receive water supply benefits.

The objectives of the project are as follows:

- Improve water supply reliability and resiliency to meet Storage Partners' agricultural and municipal long-term average annual water demand in a cost-effective manner for all Storage Partners, including those that are the most cost sensitive.
- Provide public benefits consistent with Proposition 1 of 2014 and use WSIP funds to improve statewide surface water supply reliability and flexibility to enhance opportunities for habitat and fisheries management for the public benefit through a designated long-term average annual water supply.
- Provide public benefits consistent with the Water Infrastructure Improvements for the Nation Act (WIIN Act) by using federal funds, if available, provided by Reclamation to improve CVP operational flexibility in meeting CVP environmental and contractual water supply needs and improving cold water pool management in Shasta Lake to benefit anadromous fish.
- Provide surface water to convey biomass from the floodplain to the Delta to enhance the Delta ecosystem for the benefit of pelagic fishes in the north Delta (e.g., Cache Slough).

- Provide local and regional amenities, such as developing recreational facilities, reducing local flood damage, and maintaining transportation connectivity through roadway modifications.

Reclamation's role in the Sites Reservoir Project is as a funding partner. Reclamation would acquire a water storage account in Sites Reservoir and an additional water supply it may use to supplement its existing supplies. Reclamation's purposes for the project include the following:

- Increased water supply and improved reliability of water deliveries
- Increased CVP operational flexibility
- Benefits to anadromous fish by improving CVP operations consistent with the laws, regulations, and requirements in effect at the time of operation
- Incremental Level 4 water supply for CVP Improvement Act refuges
- Delta ecosystem enhancement by providing water to convey food resources

The operational components of the Sites Project are listed in Table E-17. The Sites Project is sufficiently developed for consideration at a framework level consistent with the 1992 CVPIA and 2016 WIIN Act. Reclamation and the Sites Project Authority recently completed the Sites Reservoir Project Final Environmental Impact Report/Environmental Impact Statement (Available at sitesproject.org) that analyzes the impacts of the project and is included in this Biological Assessment by reference.

Table E-17. Operational Programmatic Components of Proposed Sites Project

Sites Project Activity	Description
Diversions to Sites Reservoir, Operating Criteria, and Diversion Criteria	All aspects of diversion of water at Red Bluff Pumping Plant, Hamilton City Pump Station, Stone Corral Creek, and Funks Creek, including the use of excess capacity in the Tehama-Colusa Canal and Glenn-Colusa Irrigation District Main Canal to convey water to the reservoir and storage of water in Sites Reservoir. Specific descriptions of pulse protection at Bend Bridge, bypass flows at Red Bluff, Hamilton City and Wilkins Slough, and other diversion criteria are specified in Chapter 2, Section 2.5.2.1, page 2-78 through page 2-86 of the Sites Project Final EIR/EIS.
Water Conveyance and Releases from Sites Reservoir	Releases of water from Sites Reservoir into the Tehama-Colusa Canal, Glenn-Colusa Irrigation District Main Canal, Stone Corral Creek, and Funks Creek. Conveyance of water from the Tehama-Colusa Canal into the Dunnigan Pipeline and subsequent release into the Colusa Basin Drain and ultimately into the Sacramento River or Yolo Bypass. Releases from Sites Reservoir are described in Chapter 2, Section 2.5.2.1, page 2-86 through 2-88 and page 2-90 through 2-91 of the Sites Project Final EIR/EIS.
Coordination with CVP and SWP	Exchanges with Shasta Lake and Lake Oroville, including Reclamation's investment in Sites Reservoir as described in Chapter 2, Section 2.5.2.1, page 2-88 through 2-90 of the Sites Project Final EIR/EIS.

Sites Project Activity	Description
Flood Control	Flood control benefits to the communities of Maxwell and Colusa, local agricultural lands, rural residences, and Interstate 5 by impounding Funks Creek and Stone Corral Creeks as described in Chapter 2, Section 2.5.2.1, page 2-91 through 2-92 of the Sites Project Final EIR/EIS
Emergency Releases	Operation of facilities to meet Division of Safety of Dams criteria and requirements for emergency reservoir drawdown as described in Chapter 2, Section 2.5.2.1, page 2-92 of the Sites Project Final EIR/EIS
Energy Generation and Energy Use	The as described in Chapter 2, Section 2.5.2.2, page 2-92 through 2-93 of the Sites Project Final EIR/EIS generation of energy in operations and use of energy for operations
Aquatic Monitoring and Adaptive Management	Implementation of an aquatics monitoring and adaptive management plan to (1) integrate the Project's adaptive management program with existing monitoring and science programs; (2) provide the proposed framework and governance, and (3) include the process for adaptive management, including operational criteria and conservation measures as described in various spots in Chapter 2 and Appendix 2D (2D.4, 2D.5, 2D.6) of the Sites Project Final EIR/EIS
Compensatory Mitigation for Temporary and Permanent Impacts	Species-specific compensatory mitigation actions that would be completed prior to operations as may be required in the projects permits and approvals

Construction of Sites Reservoir is expected to take approximately 7 years, beginning in 2026 and concluding in 2032. Currently, the reservoir is expected to be substantially completed in 2032 with filling beginning in 2033. The amount of time it would take to fill Sites Reservoir would depend greatly on hydrology and how Storage Partners choose to use their water during initial filling. Initial filling could range from approximately 2 years to over 10 years.

E.5.19.2 Delta Conveyance Project

On April 29, 2019, Governor Newsom signed Executive Order N-10-19 directing the California Natural Resources Agency, California Environmental Protection Agency, and California Department of Food and Agriculture to develop a comprehensive strategy to build a climate-resilient water system and ensure healthy waterways through the twenty-first century. After a public input period, Governor Newsom released the California Water Resilience Portfolio on July 28, 2020. The Water Resilience Portfolio identifies a suite of complementary actions to ensure safe and resilient water supplies, flood protection and healthy waterways for the state's communities, economy, and environment. One of the projects identified in the portfolio is new diversion and conveyance facilities in the Delta to safeguard the SWP, which is now proposed as the Delta Conveyance Project. DWR proposed and evaluated the project consistent with the portfolio approach and reviewed the proposed project under CEQA with a Final Environmental Impact Report and decision on approval mid-2024.

DWR's fundamental purpose in proposing the DCP is to develop new intake and conveyance facilities in the Delta is to restore and protect the reliability of SWP water deliveries and, potentially, CVP water deliveries south of the Delta, consistent with the State's Water Resilience

Portfolio in a cost-effective manner. This purpose, in turn, gives rise to the following project objectives.

- To help address anticipated rising sea levels and other reasonably foreseeable consequences of climate change and extreme weather events.
- To minimize the potential for public health and safety impacts from reduced quantity and quality of SWP water deliveries, and potentially CVP water deliveries, south of the Delta as a result of a major earthquake that could cause breaching of Delta levees and the inundation of brackish water into the areas where existing SWP and CVP pumping plants operate in the southern Delta.
- To protect the ability of the SWP, and potentially the CVP, to deliver water when hydrologic conditions result in the availability of sufficient amounts of water, consistent with the requirements of state and federal law, including the CESA and ESA and Delta Reform Act, as well as the terms and conditions of water delivery contracts and other existing applicable agreements.
- To provide operational flexibility to improve aquatic conditions in the Delta and better manage risks of further regulatory constraints on project operations.

The proposed DCP project includes the construction and operation of new water intake facilities on the Sacramento River in the north Delta and a single main tunnel to divert and move water entering the north Delta from the Sacramento Valley watershed to existing SWP facilities in the south Delta, which would result in a dual conveyance system for the SWP in the Delta (see Table E-18 for additional details on operations of the proposed project [i.e., DCP Public Draft EIR Alternative 5, Bethany Reservoir Alignment]). DWR is not seeking to increase its existing water rights, nor is it proposing any operational changes upstream of the Delta. The DCP, if approved, would be a part of the SWP's integrated water delivery system and, therefore, would be considered within the SWP and CVP Long-Term-Operations. If the DCP is approved and implemented by DWR, it would be a part of the SWP Delta operations and subject to Reclamation and DWR COA.

DWR would implement "dual conveyance" by operating the proposed north Delta diversion in conjunction with the existing south Delta diversion system for the SWP. During winter and spring, operations of existing south Delta water export facilities would be prioritized up to what is permitted under the existing water rights and all applicable state and federal law and regulations, before operating the proposed north Delta intakes. During summer/fall, operations would be focused on more efficient Delta salinity management. The south Delta exports and the north Delta diversions would be balanced and adjusted to meet the State Water Board D-1641 salinity requirements at the western Delta stations on the Sacramento and San Joaquin Rivers (e.g., increasing salinity at Jersey Point would cause a shift in diversions from south Delta to north Delta, whereas increasing salinity at Emmaton would cause a shift from north Delta to south Delta). This operation is expected to result in a more efficient system operation.

For purposes of the USACE DCP Biological Assessment, project-specific effects associated with construction and placement of DCP facilities, including in-water work, as well as both temporary and permanent impacts, will be covered under the USACE's section 7 consultation. All effects

associated with the north Delta diversion intake operations, including near- and far-field effects within the river as well as potential associated effects on aquatic biological resources, are assessed through the Programmatic LTO analysis. Table E-18 describes key operational programmatic components of the Proposed Project.

Table E-18. Operational Programmatic Components of Delta Conveyance Project

DCP Project Activity	Description
North Delta Intake Diversions	The proposed intakes would augment the ability to capture excess flows and improve the flexibility of SWP operations (e.g., improved salinity management during the summer/fall). New operational criteria would govern the diversions at the proposed north Delta intakes to minimize effects near and downstream of the new intakes. See Section 3.16 of the DCP Public Draft EIR for additional details on project operations.
SWP Integration	The north Delta intakes would operate in conjunction with the existing SWP south Delta intakes. For example, during the winter and spring, the SWP would first use south Delta facilities to export water up to what is permitted under the existing water rights and all applicable state and federal law and regulations before diverting from the new north Delta intakes. Upstream SWP storage operations would continue to be managed to the existing and future regulatory and contractual obligations of the SWP in determining the amount of stored water available for exports. The DCP would not change operational criteria associated with upstream reservoirs (Section 3.16.3, DCP Public Draft EIR).
Coordination with CVP	Continued SWP coordination with CVP through the Coordinated Operations Agreement, consistent with applicable regulatory requirements (Section 3.16, DCP Public Draft EIR).
Adaptive Management and Monitoring Program	The Adaptive Management and Monitoring Program would be used to evaluate and consider changes in operational criteria, if necessary, based on information gained before and after the new facilities become operational. This program would be used to consider and address scientific uncertainty regarding the Delta ecosystem and potential effects of the project. In addition, an adaptive management and monitoring plan would be prepared for each mitigation site to help ensure habitat creation goals are met. (Section 3.18, DCP Public Draft EIR).
Conservation Measures	Included to avoid, minimize, and offset effects of the proposed action on listed species. This includes compensatory mitigation to be completed prior to operations at the acreages identified for each species. (Appendix 3F, DCP Public Draft EIR).

E.5.19.3 Combined Qualitative Description

Both DCP and Sites are designed to improve water management capabilities for SWP and CVP and collectively respond to challenges associated with future climate change. In particular, the projects would provide for facility updates and improve the ability for SWP and CVP to respond to more extreme weather, driven by climate change, by improving the ability to capture, store,

and convey water associated with flashier flow events, as well as a predicted general shift in hydrograph with relatively higher flows in winter months and reductions in the spring. As described qualitatively above, both DCP and Sites incorporate operational criteria to minimize potential effects on the environment and aquatic resources both at the facilities (near-field) as well as downstream (far-field). While these criteria have been designed to integrate with existing regulations and reduce potential effects of each project individually, there are potential interactive effects which are important to further investigate and account for, mainly associated with changes to Sacramento River flows upstream of, in, and through the Delta. Potential effects on aquatic resources associated with these changes include:

- Changes to timing, magnitude, and duration of flows along the Sacramento River/Delta corridor.
- Subsequent changes to important aquatic constituents (e.g., suspended sediment, nutrients, lower trophic production) associated with the flow modifications.
- Potential changes to quantity/quality of habitat supporting listed species spawning, rearing, and migration.
- Potential changes in production of listed aquatic species.

Additionally, upstream changes (i.e., Shasta reservoir storage, upper Sacramento River flows – for Sites; Oroville reservoir storage, upper Feather River flows – indirectly for DCP) may have non-intuitive interactive effects of the combined projects and will also be explored. Generally, the effects on these locations would be improvements in upstream storage and cold water flexibility, relative to the No Action Alternative, based on the projects' objectives.

E.5.19.4 Quantitative Project Descriptions

This section contains quantitative descriptions of the modeled results comparing Sites and DCP operational effects relative to the updated LTO. The quantitative effects analysis will focus on key indicators of biological/ecological relevance such as storage, flows, and temperatures at key locations on the Sacramento River, as well as through and downstream of the Delta.

E.5.19.5 Analysis and Comparative Modeling Results

Sites and DCP have assessed their operations as part of their CEQA (and also the National Environmental Policy Act for Sites) compliance efforts. This quantitative information helps inform the programmatic consideration of this framework. These analyses have led to the development of detailed operational criteria to reduce or avoid operational effects on sensitive species, and these criteria are described further below.

Sites Reservoir

Sites Reservoir would be filled through the diversion of Sacramento River water that generally originates from unregulated tributaries to the Sacramento River downstream from Keswick Dam. Diversions to Sites Reservoir could also come from flood releases from Shasta Lake. Diversions to Sites Reservoir would be made from the Sacramento River at the existing Red Bluff Pumping Plant (RBPP) (RM 243) near Red Bluff into the Tehama-Colusa Canal and at the existing Glenn-Colusa Irrigation District (GCID) Hamilton City Pump Station (RM 205) near Hamilton City

into the GCID Main Canal. Water could be diverted to storage in Sites Reservoir from September 1 to June 14. Diversions would occur only when all of the following conditions are met:

- Flows in the Sacramento River exceed the minimum diversion criteria (described in Table E-19 below);
- The Delta is in "excess" conditions as determined by Reclamation and DWR and would remain in excess conditions during diversions;
- Senior downstream water rights, existing CVP and SWP and other water rights diversions including Section 215 of the Reclamation Reform Act of 1992, Article 3(f) water, and SWP Article 21 (interruptible supply), and other more senior flow priorities have been satisfied;
- Flows are available for diversion above flows needed to meet all applicable laws, regulations, biological opinions and incidental take permits, and court orders in place at the time that diversion occurs. This would include but is not limited to any flow requirements in Water Right Decision 1641 (State Water Resources Control Board 2000), the 2019 biological opinions for the reinitiation of consultation on coordinated long-term operations of the CVP and SWP (ROC on LTO BiOps) (U.S. Fish and Wildlife Service 2019; National Marine Fisheries Service 2019) and any future related BiOps, and the State incidental take permit (California Department of Fish and Wildlife 2020); and
- There is available capacity at the RBPP and in the Tehama-Colusa Canal and GCID facilities to divert and convey water to Sites Reservoir, above the capacity needed for deliveries to existing Tehama-Colusa Canal users and within the GCID service area.

The RBPP would serve as the primary diversion location and would divert water from the Sacramento River to Funks Reservoir through the Tehama-Colusa Canal and into the Sites Reservoir through the Funks Pumping and Generating Plant and the Inlet/Outlet Works. A maximum of approximately 2,120 cfs would be diverted at the RBPP for the project. The Hamilton City Pump Station would serve as the secondary diversion location and would divert water from the Sacramento River to the new Terminal Regulating Reservoir through the GCID Main Canal and into the Sites Reservoir through the Terminal Regulating Reservoir Pumping and Generating Plant and the Inlet/Outlet Works. A maximum of approximately 2,070 cfs would be diverted at the Hamilton City Pump Station for the project. Although the RBPP would be the primary diversion point, both diversion facilities would be operated simultaneously when river conditions and capacity are available for a maximum combined diversion rate of about 4,200 cfs (3,900 cfs, plus losses). Table E-19 provides a summary of the Sites project minimum diversion criteria.

Table E-19. Summary of Project Diversion Criteria (this is Table 2-5 from the Final EIR/EIS)

Location (Listed from North to South)	**Criteria**
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 predicted

Location (Listed from North to South)	Criteria
	hydrology and monitoring. A criterion based on the detection of migrating fish may be added if a fish monitoring method can be demonstrated as effective and reliable. A qualified precipitation-generated pulse event is determined based on forecasted flows, and pulse protection may cease after 7 days or earlier 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
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
Minimum Bypass Flows in the Sacramento River at Wilkins Slough	10,700 cfs from October 1 to June 14; 5,000 cfs in September (no diversions to Sites Reservoir from June 15 to August 31)
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

cfs = cubic feet per second; RBPP = Red Bluff Pumping Plant.

The Sites project diversion criteria have been analyzed extensively and are not expected to change substantially. However, criteria may be refined in actual project operations through adaptive management and in coordination with the fisheries agencies. In particular, adaptive management actions would focus on the following: Bend Bridge Pulse Protection; the Minimum Bypass Flows in the Sacramento River at Wilkins Slough; Fremont Weir Notch Protections (Big Notch Project); sediment monitoring, modeling and reintroduction; and fish monitoring and technical studies related to near-field effects.

Delta Conveyance Project

As described in the qualitative discussion, the DCP would function as a dual-conveyance SWP facility in conjunction with existing SWP Delta facilities through construction and operation of two new north Delta intakes with a combined diversion capacity of 6,000 cfs on the Sacramento River near the town of Hood. The north Delta diversion (NDD) would not alter operating criteria for existing facilities (e.g., upstream reservoirs or south Delta diversions), would be subject to existing and updated Delta water quality requirements (e.g., D-1641), and would not alter SWP/CVP water right permits (beyond the addition of new points of diversions). Existing south Delta diversions would be operated preferentially, with use of the NDD focused on periods of excess flow conditions in the Delta and to optimize salinity management in the summer and fall. Specific operational criteria focusing on minimizing potential effects on aquatic resources and listed fish would further govern NDD operations. Tables Table E-20, Table E-21, and Table E-22 describe the proposed DCP operational criteria.

Table E-20. Delta Conveyance Project Preliminary Proposed Operations Criteria (North Delta Diversion Operations)

Parameter	Delta Conveyance Project Criteria
Bypass Flow [a] (specifies bypass flow required to remain downstream of the north Delta intakes)	• October through November: Minimum flow of 7,000 cfs required in river after diverting at the north Delta intakes. • December through June: Once the pulse protection (see below) ends, north Delta diversions would not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3. If those criteria are met, operations can proceed as defined in the following table. Allowable diversion would be the greater of the following options: low-level pumping or the diversion allowed by the bypass flow rules in the following table. • July through September: Minimum flow of 5,000 cfs required in river after diverting at the north Delta intakes.
Pulse Protection (October through June)	• Low-level pumping is allowed when river conditions are adequate during the pulse protection period. • Definition: Low-level pumping of up to 6% of total Sacramento River flow at Freeport such that diversions would not reduce bypass flow below 5,000 cfs. No more than a total of 900 cfs can be diverted by all the intakes combined. Low-level pumping can occur in October–November during a pulse protection event and in December–June as defined in the following table. In addition, north Delta diversion levels at all the intakes would be subject to a maximum approach velocity of 0.2 feet per second and a minimum sweeping velocity of 0.4 feet per second at the proposed fish screens. Velocity compliance would be informed by real-time hydrological data measured at the intake locations. • Pulse triggering, duration, and conclusion is determined based on the criteria defined in the following table. • If the initial pulse begins before December 1, the bypass flow criteria for the month (October and November) when the pulse occurred would take effect, following a pulse protection period. On December 1, the Level 1 rules defined in the following table apply unless a second pulse occurs.
Real-Time Operations	• The proposed operations criteria and tidal restoration mitigation are intended to minimize and fully mitigate the potential impacts of the NDD operations. The real time decision making specific to the NDD operations would be mainly associated with reviewing real-time abiotic and fish monitoring data and ensuring proposed weekly, daily and sub-daily operations are consistent with the permitted criteria and within the effects analyzed in the permits.
Adaptive Management	• The Operations Adaptive Management and Monitoring Program would be used to evaluate and consider changes in operational criteria based on information gained before and after the new facilities become operational. This program would be used to consider and address scientific uncertainty regarding the Delta ecosystem and to inform project operations.

cfs = cubic feet per second; NDD = north Delta diversion.

[a] Sacramento River flow upstream of the intakes to be measured flow at Freeport. Bypass flow is the 3-day tidally averaged Sacramento River flow computed as flow measured at Freeport minus the diversion rate. Sub-daily north Delta intakes' diversion operations would maintain fish screen approach and sweeping velocity criteria.

Table E-21. Proposed North Delta Diversion Bypass Flow and Pulse Protection Requirements

Parameter	Criteria
Pulse Protection	• Low-level pumping would be allowed when river conditions are adequate during the pulse protection period. Initiation of the pulse protection is defined by the following criteria: (1) Sacramento River daily average flow at Wilkins Slough increase by more than 45% within a 5-day period and (2) flow on the 5th day greater than 12,000 cfs. • The pulse protection continues until either (1) Sacramento River flow at Wilkins Slough returns to pre-pulse flow level (flow on first day of 5-day increase), or (2) Sacramento River flow at Wilkins Slough decreases for 5 consecutive days, or (3) Sacramento River flow at Wilkins Slough is greater than 20,000 cfs for 10 consecutive days. After pulse period has ended, operations would return to the bypass flow table (Table E-22). • If the initial pulse period begins before Dec 1, then any second pulse that may occur during December through June would receive the same protection, i.e., low-level pumping, resulting in up to two pulses which would receive this protection per water year.
Bypass Flow Criteria	• After initial pulse(s), allowable diversion would be subject to Level 1 bypass flow criteria (Table E-22) until 15 total days of bypass flows above 20,000 cfs occur. Then allowable diversion would be subject to the Level 2 bypass flow criteria until 30 total days of bypass flows above 20,000 cfs occur. Then allowable diversion would be subject to the Level 3 bypass flow criteria

Table E-22. North Delta Diversion Bypass Flow Criteria

Period	Level [a]	If Sacramento River flow		The bypass is…
		Is over…	But not over…	
December through April [b]	1	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	15,000 cfs	Flows remaining after low-level pumping
		15,000 cfs	17,000 cfs	15,000 cfs plus 80% of the amount over 15,000 cfs
		17,000 cfs	20,000 cfs	16,600 cfs plus 60% of the amount over 17,000 cfs
		20,000 cfs	no limit	18,400 cfs plus 30% of the amount over 20,000 cfs
	2	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	11,000 cfs	Flows remaining after low-level pumping
		11,000 cfs	15,000 cfs	11,000 cfs plus 60% of the amount over 11,000 cfs
		15,000 cfs	20,000 cfs	13,400 cfs plus 50% of the amount over 15,000 cfs
		20,000 cfs	no limit	15,900 cfs plus 20% of the amount over 20,000 cfs

Period	Level [a]	If Sacramento River flow		The bypass is...
		Is over...	But not over...	
	3	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
		9,000 cfs	15,000 cfs	9,000 cfs plus 50% of the amount over 9,000 cfs
		15,000 cfs	20,000 cfs	12,000 cfs plus 20% of the amount over 15,000 cfs
		20,000 cfs	no limit	13,000 cfs plus 0% of the amount over 20,000 cfs
May [b]	1	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	15,000 cfs	Flows remaining after low-level pumping
		15,000 cfs	17,000 cfs	15,000 cfs plus 70% of the amount over 15,000 cfs
		17,000 cfs	20,000 cfs	16,400 cfs plus 50% of the amount over 17,000 cfs
		20,000 cfs	no limit	17,900 cfs plus 20% of the amount over 20,000 cfs
	2	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	11,000 cfs	Flows remaining after low-level pumping
		11,000 cfs	15,000 cfs	11,000 cfs plus 50% of the amount over 11,000 cfs
		15,000 cfs	20,000 cfs	13,000 cfs plus 35% of the amount over 15,000 cfs
		20,000 cfs	no limit	14,750 cfs plus 20% of the amount over 20,000 cfs
	3	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
		9,000 cfs	15,000 cfs	9,000 cfs plus 40% of the amount over 9,000 cfs
		15,000 cfs	20,000 cfs	11,400 cfs plus 20% of the amount over 15,000 cfs
		20,000 cfs	no limit	12,400 cfs plus 0% of the amount over 20,000 cfs
June [b]	1	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	15,000 cfs	Flows remaining after low-level pumping
		15,000 cfs	17,000 cfs	15,000 cfs plus 60% of the amount over 15,000 cfs
		17,000 cfs	20,000 cfs	16,200 cfs plus 40% of the amount over 17,000 cfs
		20,000 cfs	no limit	17,400 cfs plus 20% of the amount over 20,000 cfs
	2	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	11,000 cfs	Flows remaining after low-level pumping
		11,000 cfs	15,000 cfs	11,000 cfs plus 40% of the amount over 11,000 cfs
		15,000 cfs	20,000 cfs	12,600 cfs plus 20% of the amount over 15,000 cfs
		20,000 cfs	no limit	13,600 cfs plus 20% of the amount over 20,000 cfs
	3	0 cfs	5,000 cfs	100% of the amount over 0 cfs
		5,000 cfs	9,000 cfs	Flows remaining after low-level pumping
		9,000 cfs	15,000 cfs	9,000 cfs plus 30% of the amount over 9,000 cfs
		15,000 cfs	20,000 cfs	10,800 cfs plus 20% of the amount over 15,000 cfs
		20,000 cfs	no limit	11,800 cfs plus 0% of the amount over 20,000 cfs

Period	Level [a]	If Sacramento River flow		The bypass is…
		Is over…	But not over…	
July through September	N/A	0 cfs	5,000 cfs	100% of the amount over 0 cfs
	N/A	5,000 cfs	No limit	A minimum of 5,000 cfs
October and November	N/A	0 cfs	7,000 cfs	100% of the amount over 0 cfs
	N/A	7,000 cfs	No limit	A minimum of 7,000 cfs

cfs = cubic feet per second.
[a] Level 1, Level 2 and Level 3 Bypass Flow Criteria do not apply July through November. Minimum Bypass Flow Criteria are applicable July through November as described in the table.
[b] Allowable diversion would be the greater of the low-level pumping or the diversion allowed by the following bypass flow rules.

E.5.19.6 Guiding Principles

To ensure that future authorizations of Sites and DCP are consistent with DWR and Reclamation's polices, guidelines, and procedures for its authorization, funding, and operation of water projects, Reclamation and DWR propose the following guiding principles to avoid, minimize and offset adverse effects of the proposed operations to listed species and critical habitat.

Guiding principles inform the upfront development of operational criteria and measures to avoid or minimize effects on listed species and critical habitat, including possible adjustment through adaptive management, that would be analyzed in the subsequent consultations. Current proposed operational criteria will be included and considered through quantitative assessments, as applicable. Potential operational refinements will be informed by the programmatic analysis (e.g., potential need for changes to the DCP Bypass Flow criteria), which will guide subsequent project-level consultations. Adaptive Management is intended to further address outstanding uncertainties up to, and throughout, the operations phase. Implementation goals are included to provide the necessary level of information to inform the programmatic section 7 analysis.

The following guiding principles are relevant to both projects, with some specific application to each project noted. Note that DCP would not create changes to baseline SWP or CVP upstream reservoir operational criteria. The DCP would be operated in a manner that does not impact either DWR or Reclamation's ability to operate upstream reservoirs to meet existing and future criteria and regulations. The guiding principles for regions upstream from the Delta are therefore specific only to Sites.

Upper Sacramento River (Sites Only)

Utilize the additional water supply provided by the Sites Project to address adverse effects of the CVP on salmonid and sturgeon habitat in the Sacramento River above the Red Bluff Pumping Plant by:

1. Optimizing the use of Reclamation's storage to facilitate the following:

- Enhancing conservation of the cold water pool in Shasta Lake for use in managing temperatures in salmonid spawning habitat downstream of Keswick Dam particularly in dry water year types
- Enhancing pulse flows envisioned in the Biological Assessment at appropriate times, particularly in years when natural pulse events are minimal, to stimulate migration of juvenile salmon downstream toward the Delta
- Stabilizing flow to minimize or preclude losses of salmon redds due to flow fluctuations associated with management of Shasta Lake for fall storage

2. Implementing additional mitigation actions as necessary and appropriate to improve spawning and rearing habitat for anadromous fish in the Upper Sacramento River

Sacramento River from Red Bluff Pumping Plant to Knights Landing (Sites Only)

1. Implement actions necessary to minimize potential impacts to listed species exposed to diversion facilities
2. Implement pulse flow criteria to provide migrating anadromous fish an opportunity to migrate past the diversion locations with minimum exposure to diversions
3. Utilize best available science to establish flow levels necessary to provide migratory and rearing habitat to minimize effects on juvenile anadromous fish survival and facilitate their movement out of the river toward the delta and bays
4. Find opportunities to develop and/or restore additional side channel habitat to offset adverse effects on salmonid migratory and rearing habitat associated with diversions of flow to Sites Reservoir

Below Knights Landing and in the Delta

1. Operate projects consistent with existing and/or future regulatory requirements in the Delta.
2. Implement pulse flow criteria to provide migrating anadromous fish an opportunity to migrate past the diversion locations with minimum exposure to diversions and further minimize effects on through-Delta survival.
3. Utilize best available science to establish flow levels necessary to provide migratory and rearing habitat to minimize effects on juvenile anadromous fish survival and facilitate their movement out of the river toward the delta and bays.
4. Monitor and mitigate effects of diversions on habitat for Delta pelagic fish species through identification and implementation of opportunities to develop additional habitat (i.e., tidal habitat restoration) to improve productivity of those fish populations.
5. Monitor and mitigate effects of diversions on migrating anadromous species and their habitat through identification of opportunities to develop additional habitat (i.e., tidal and channel margin restoration) to improve productivity of those fish populations.
6. Protect habitat conditions supporting listed pelagic and anadromous species, mitigate potential flow related effects of Sites and DCP with habitat restoration developed in

coordination with NMFS, USFWS, and CDFW to improve productivity of those fish populations.

Sites:

1. Cooperate in the monitoring of the Fremont Weir Big Notch Project to assess what effect, if any, diversions of flow to Sites Reservoir have on the effectiveness of the Big Notch Project in the entrainment of juvenile anadromous fish through the notch on the floodplain habitat in the Yolo Bypass and the passage of anadromous fish from the Yolo Bypass into the Sacramento River. If necessary, implement operational measures to avoid diminishing the performance of the Big Notch Project.

DCP:

1. Implement project operations and maintenance consistent with the proposed project description, as an integrated component of the SWP.
    a. Future consultation on Delta Conveyance Project Operations and Maintenance is envisioned to update and align elements of project description with conditions (e.g., regulatory, climate, status of species) in advance of operations of the north Delta diversions.

Suisun Bay, San Pablo, and San Francisco Bay

Cooperate with the fisheries resource agencies to monitor effects of diversions to the Sites Reservoir and DCP on the location of X2 and Delta outflow and, as appropriate, identify opportunities to offset adverse effects on critical habitat through appropriate mitigation measures or adaptive management actions.

E.5.19.7 Adaptive Management

Both Sites and DCP would have adaptive management programs that integrate with the Long-Term Operations adaptive management program and include these general principles:

1. Cooperate with and, as appropriate, participate in ongoing and planned habitat and population monitoring programs conducted by the resource agencies to ensure attainment of information pertinent to assessing the effects on endangered and threatened fish in the action area.
2. Design studies, in cooperation with resource agencies, to test modifications to operations that may be implemented to remedy or lessen unanticipated effects identified by the monitoring program.
3. Cooperate with the resource agencies to evaluate results of studies and determine whether changes in project operations are necessary and appropriate to address unanticipated adverse effects.
4. To the maximum extent possible/appropriate, integrate Sites and DCP adaptive management and monitoring with existing and proposed special studies, monitoring programs, technical teams, adaptive management and structured decision making processes associated with Long-Term-Operations.

5. Ongoing commitment to collaborative decision making processes consistent with the LTO adaptive management effort, including reliance on the LTO adaptive management wheel and structured decision making framework.

Project specific compliance efforts and monitoring would be the responsibility of the individual projects, but there would be a commitment to ongoing coordination and information sharing to support the broader monitoring and adaptive management processes.

The adaptive management program would document all activities associated with the planning phase of adaptive management and describe the process to be followed during the implementation and evaluation and response phases. Project objectives were taken into consideration in identifying where adaptive management would be most effective and applicable for the project. If the proposed project is approved, as appropriate, mitigation measures identified, such as implementation of the habitat creation and restoration actions, would integrate the concept of adaptive management in mitigation plan design, stand-alone site and/or resources specific adaptive management plans.

E.5.20 Other Activities

Other Activities include action components that are not specifically proposed by Reclamation but would not occur but for the action and that are reasonably certain to occur. These kinds of activities were previously referred to as "interrelated or interdependent" activities. Under the 2019 ESA regulations governing interagency coordination, a proposed action may cause other associated or connected actions, that are now called "other activities" to distinguish them from the proposed Federal action. These activities and their consequences must pass a two-part test of causation and foreseeability, meaning that they would not happen "but for" a Federally proposed action and that they are "reasonably certain to occur".

Portions of the Winter-run Action Plan (WRAP) meet the two-part test of "but for" and "reasonably certain to occur" for the following reasons: First, the Winter-run Action Plan is a result of agency discussions with the Sacramento River Settlement Contractors for the operations of Shasta Reservoir. Without the new Shasta Operations framework, elements of the WRAP would not have been proposed, thus it meets the "but for" standard. Next, the elements of the WRAP are reasonably certain to occur because the parties to the WRAP have a long history, either individually or together, of advancing science, implementing habitat restoration, reintroducing fish to historic habitats, improving system infrastructure and adaptively managing hatcheries for long-term species needs.

E.5.20.1 Winter Run Action Plan

Introduction

Sacramento River winter-run Chinook Salmon (winter-run) are an iconic species on the Sacramento River, beloved by a wide variety of communities with deep connections to the Sacramento Valley, including local landowners and residents, fishing groups, Native American tribes, and environmental non-governmental organizations (NGOs). Historically, winter-run migrated into the upper Sacramento River and spawned in high elevation tributaries with consistently cold water temperatures throughout the spring, summer, and fall. Prior to the construction of Shasta and Keswick dams, upper tributary dams and diversions above Shasta

Dam and Battle Creek were constructed for power generation that limited access to parts of these high-elevation habitats. Construction of Shasta and Keswick dams and changes on Battle Creek further limited access through impaired passage, and only a single population of winter-run remains to spawn at much lower elevations on the Sacramento River below Keswick Dam. Currently, one remaining population of winter-run persists on the Sacramento River downstream of Shasta Dam and is exposed to a wide variety of stressors, including limitations of the availability of cold-water release from Shasta Reservoir during the summer and fall spawning and rearing seasons. Winter-run have been selected as a "species in the spotlight" by the National Marine Fisheries Service (NMFS) to highlight their status among protected species with the greatest risk of extinction in the near future.

The challenges and threats faced by winter-run are diverse and complex. Some of the threats to the species include: changes in flow regime, climate variability, lost and degraded spawning habitat, removal/lack of access to rearing habitat (along the Sacramento River and in the Sacramento-San Joaquin Delta), recurring droughts and related impacts on reservoir storage and temperature management, thiamine deficiency, entrainment into water diversions, pathogens, predation by non-native species, and commercial and recreational fisheries. The extent of threats to winter-run is such that even under periods with good storage and favorable water temperatures, juvenile survival in the Sacramento River can be poor.

This Winter-run Action Plan has been developed collaboratively among representatives from the U.S. Bureau of Reclamation (Reclamation), NMFS, U.S. Fish and Wildlife Service (USFWS), California Department of Water Resources (DWR), California Department of Fish and Wildlife (CDFW), and the Sacramento River Settlement Contractors as an integrated plan to improve the survival and viability of winter-run that functions alongside planned operation of Shasta Reservoir. The intention is to implement the Winter-run Action Plan with other partners including Native American Tribes and NGOs.

Plan Priorities

Inspired by the list of threats above, this plan prioritizes implementation of six actions to reduce stressors to the species through a combination of science, fishery actions, infrastructure improvements, and improved habitat quality and access:

1. Thiamine Deficiency Complex Management
2. Reintroduction into Battle Creek and McCloud River,
3. Early Life Stage Survival Science,
4. Temperature Control Device Infrastructure Improvement at Shasta Dam,
5. Modernization of the Livingston Stone National Fish Hatchery, and
6. Habitat restoration and facility improvements.

These high priority actions are described in additional detail in Appendices 1-6. Each appendix provides a brief description of the action, a statement of purpose, an overview of past and current work potential challenges for implementation, milestones, deliverables, permitting requirements, resource needs and commitments. To avoid duplicating effort and maximize efficiency, each of

the appendices draws upon existing plans and implementation processes and identifies relevant areas of expertise. These priorities represent the current thinking on actions to reduce winter-run stressors. However, the Winter-run Action Plan is intended to adapt and address other stressors and threats that are identified in the future. The expectation is that collectively these actions will improve the status of winter-run over the next ten years.

Goals

The Winter-run Action Plan has been developed as an interdisciplinary and collaborative approach to addressing some of the priority threats to the species. The overarching goals of this plan are:

- Develop a structured and collaborative partnership that includes State and Federal agencies (Reclamation, NMFS, USFWS, DWR, and CDFW), the Sacramento River Settlement Contractors, non-governmental conservation and fishery groups, tribes, and universities;
- Elevate the prominence of priority actions, in addition to operations of Shasta Dam, that are expected to enhance our understanding of winter-run ecology, address key threats to the species, and move forward key infrastructure improvements to support the species;
- Increase abundance, improve population growth rates, maximize diversity, improve resiliency, and prevent extinction of winter-run through implementation of identified actions;
- Work together at a technical and project management level develop plans and implement each priority action, meet the established milestones, and provide timely deliverables.
- Identify resource needs to actively engage and make progress on each identified action according to milestones;
- Communicate early about permitting needs anticipated for each priority action and coordinate throughout permitting processes; and
- Consider links and potential co-benefits to other Chinook salmon runs, as well as other native fishes, during the process to plan and implement priority actions.

Partnerships and Governance

As described in the governance section, the agencies and partners will dedicate managers from each organization to participate on a Winter-run Action Plan policy team that will coordinate on plan implementation. The purpose of the policy team is to establish policy level coordination and processes for tracking plan goals, priorities, milestones and deliverables. The Winter-run Action Plan recognizes that some of the action plan components may be part of separate planning processes and the policy team will evaluate opportunities to utilize existing efforts.

E.5.20.2 Winter-run Action Plan Policy Team

A Winter-run Action Plan Policy Team (WRAP Policy Team) consisting of Agency subdirectors and Partner managers will serve as the policy group for implementing the Winter-run Action Plan. The purpose of the WRAP Policy Team is to establish policy level coordination, leadership

and direction for tracking plan goals, priorities related to the WRAP, coordination on resource needs, milestones and deliverables. The WRAP Policy Team will do the following:

1. Coordinate efforts for consultation and/or coordination agreements with Tribes, NGOs and Universities on WRAP action components.
2. Identify opportunities to leverage the ongoing work of existing scientific, habitat and fishery management teams and programs.
3. Track and meet established milestones and deliverables.
4. Track and adjust, as necessary, plan goals and priorities.
5. Identify where sub-teams require additional guidance so that managers may that provide that direction to their participating staff where appropriate.
6. Participants are responsible SHOT members are aware of activities under the WRAP.
7. Coordinate on alternative actions to evaluate.
8. Provide quarterly updates to agency Directors and partner Principals and elevate matters as described under Collaborative Decision Making (separate section of governance TBD).

E.5.20.3 Science Facilitation and Program Support

The WRAP Policy Team will work together to hire a program manager and an independent scientific facilitator to promote scientific collaboration and to address scientific debate and divergent scientific perspectives related to implementation of the WRAP. The WRAP program manager and scientific facilitator will have strong program management skills and a scientific background and/or understanding of the scientific matters related to water resource and protected species management.

The WRAP program manager with direction from the WRAP Policy Team will:

- Implement the WRAP
- Track milestones and deliverables
- Manage meeting schedules and logistics
- Coordinate WRAP-specific working groups
- Identify and track the implementation through existing working groups

The scientific facilitator will work with the WRAP Policy Team to:

- Develop processes to help streamline the development of research proposals and study plans,
- Foster an environment of scientific coordination and knowledge exchange between researchers, agencies, and partners

- Organize and facilitate regular meetings, workshops, and seminars to promote scientific discussions and idea exchange.
- Coordinate the development of briefing materials by researchers
- Identify and bridge gaps between scientific research and effective collaboration
- Summarize the status of discussions by researchers for the WRAP Policy Team
- Help the WRAP Policy Team coordinate with other science programs to leverage opportunities and avoid duplication.
- Coordinate independent review of work products

E.5.21 Alternative 2b – Multi Agency Consensus

E.5.21.1 Clifton Court Forebay Operations

DWR proposes to extend the CCF operation period to December 1 through March 31 (instead of mid-December through mid-March).

E.5.21.2 Spring-Run Chinook Salmon Assessment

Reclamation and DWR, through SaMT, will use real-time monitoring data, relevant tools, and new science gained through ongoing efforts to develop a spring-run juvenile production estimate and life cycle model to inform weekly risk assessments (October through June) for natural-origin juvenile spring-run Chinook salmon. If the risk assessment identifies a more positive OMR flow requirement is needed to minimize take of natural-origin juvenile spring-run Chinook salmon, the WOMT may consider a more positive OMR flow requirement.

E.5.21.3 Longfin Smelt Larval and Juvenile Protection Action

Under Alternative 2b the 7-day average QWEST (the average daily flow traveling past Jersey Point, which represents the net flow in the lower San Joaquin River) is <+1,500 cfs

- Winter-Run Chinook Salmon Annual Loss Threshold

In addition to the description of Alternative 2, once annual loss threshold is exceeded, each winter-run Chinook Salmon observed in salvage would trigger another operation to an OMR index limit of -2,500 cfs for seven consecutive days when the Winter-Run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that the change to -2,500 cfs will shift the model output to a classification of absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the seven most recent prediction days.If the cumulative loss of either natural or hatchery-origin winter-run Chinook Salmon in a brood year exceeds 100 percent of the annual loss thresholds, then DWR and Reclamation will immediately convene the Salmon Monitoring Team (SaMT) to review recent fish distribution information and operations and provide advice regarding future planned SWP and CVP operations to minimize subsequent loss during that year. The SaMT will report the results of this review and advice to the WOMT. Operational decisions will be made following the process described in Section 3.3.18, Governance. If either annual loss threshold is exceeded, DWR and Reclamation will also convene an independent peer review panel to review SWP and CVP

operations and the annual loss thresholds prior to November 1. The purpose of the independent peer review is to review the actions and decisions contributing to the loss trajectory that led to an exceedance of an annual loss threshold, and make recommendations on modifications to SWP and CVP operations, or additional actions to be conducted to stay within the annual loss thresholds in subsequent years.

E.5.21.4 Spring-Run Chinook Salmon and Surrogate Thresholds

Same as the description of Spring-Run Chinook Salmon and Surrogate Thresholds in Alternative 2 above, except the three in-river releases of late-fall Chinook salmon from Coleman National Fish Hatchery is extended through February.

E.5.21.5 Storm-Flex

Similar to previous description of Storm Flex in Alternative 2, Reclamation and DWR, through WOMT, may prepare an assessment to evaluate operating to a daily average OMR index no more negative than -6,250 cfs. to capture peak flows during storm-related events described in Alternative 2. Under this alternative QWEST flows are increased for +1,000 cfs to +1,500 cfs.

E.5.21.6 Suisun Marsh Salinity Control Gates

DWR will operate the Suisun Marsh Salinity Control Gates (SMSCG) for 60 days to maximize the number of days when Belden's Landing three-day average salinity is equal to, or less than, 4 practical salinity units (psu) to maximize the spatial and temporal extent of Delta Smelt low salinity zone habitat in Suisun Marsh and Grizzly Bay. Operation of the SMSCG will occur between June 1 and October 31 in years which operation of SMSCG is required. In dry years following below normal years, DWR will operate SMSCG for 30 days to maximize the number of days when Belden's Landing three-day average salinity is equal to, or less than, 6 psu to maximize the spatial and temporal extent of Delta Smelt low salinity zone habitat in Suisun Marsh and Grizzly Bay. DWR and Reclamation, through the DCG, may prepare an assessment to propose an alternative gate operation if modeling of hydrological and/or existing D-1641 conditions indicate the action can achieve the same habitat benefits in an equal or better manner within the range of effects analyzed. DWR and Reclamation may propose alternative operations of the SMSCG as a recommendation to WOMT prior to May 15 of each year a SMSCG action will be required. Reclamation and DWR, through the DCG, will develop a monitoring plan that responds to uncertainties in the performance metrics to evaluate action performance based on the schedule determined by the AMSC. DWR and Reclamation will also produce a report that summarizes monitoring findings and assess action performance based on a schedule determined by AMSC. The Summer-Fall Habitat Action shall be included in Independent Reviews under the Adaptive Management Program.

E.5.21.7 Spring-Run Juvenile Production Estimate and Life Cycle Model

Spring-Run Chinook Salmon Juvenile Production Estimate (SR-JPE)

Reclamation and DWR will support continued development of a SR-JPE framework for CVP and SWP tributaries and the Delta, and from the framework, propose a SR-JPE Plan for implementation, including an approach for modeling a SR-JPE and the monitoring program to support that approach. The SR-JPE Plan will incorporate independent peer review and will be the basis for consideration of updated entrainment minimization measures described in Section

3.3.2.3, *Spring-run Chinook Salmon and Surrogate Thresholds*, including updating hatchery surrogate measures. The process to develop the framework and SR-JPE Plan will continue the ongoing effort to develop a SR-JPE initiated in 2020 and outlined in the SR-JPE Science Plan (DWR et al. 2020), the SR-JPE Interim Monitoring Plan (Allison et al. 2021), the SR-JPE Run Identification Research and Initial Monitoring Plan (Bedwell et al. 2021), the SR-JPE Data Management Strategy (Harvey et al. 2022), and the SR-JPE Decision Charter (Horndeski 2022). These plans describe the decision processes, research, monitoring, and data management infrastructure that will be needed to meet the goal of developing a SR-JPE ready for implementation in 2026, including guidance by an interagency SR-JPE Core Team using structured decision-making (SDM) principles, rapid and coordinated reporting of new data onto a publicly accessible repository, routine and rapid genetic testing, and additions to existing and/or new monitoring programs at Delta entry and in representative spring-run streams: Clear Creek, Battle Creek, Mill Creek, Deer Creek, Butte Creek, Yuba River, and Feather River.

Spring-run Chinook Salmon Lifecycle Model (SR-LCM)

DWR and USBR will support the development of a SR-LCM for the purpose of informing management actions to improve Central Valley spring-run population status. DWR and Reclamation will assemble an interagency management team (SR-LCM Management Team) including representatives from Reclamation, DWR, CDFW, NMFS, and USFWS, to define the specific management issues and objectives to be addressed by the SR-LCM. Because of the close link between SR-LCM and SR-JPE development through a shared use of historical and newly generated data, the SR-JPE Core Team will be responsible for guiding the development of the SR-LCM to address the management objectives, and for determining whether the required modeling can be accomplished through an update of one or more existing Central Valley Chinook salmon modeling efforts, such as the SR-JPE, the NMFS spring-run lifecycle model, and the CVPIA Science Integration Team salmon lifecycle models. The SR-JPE Core Team will use SDM principles when appropriate. The SR-JPE Core Team will develop and submit a SR-LCM Modeling Plan and timeline to the SR-LCM Management Team for approval, and guide implementation of the plan. To facilitate open communication between the lead life-cycle modeler and agency staff, a SR-LCM Modeling Subteam will be established. Throughout the process to develop the SR-LCM and implement the SR-LCM Modeling Plan, the lead lifecycle modeler will collaborate with the SR-LCM Modeling Subteam through regular meetings to solicit feedback and integrate that feedback into model development iteratively, in a manner similar to the SR-JPE Modeling Subteam described above.

Required actions in 2025 under Alternative 2b:

1. Under the guidance of the SR-JPE Core Team, the SR-JPE Modeling Subteam will develop an a suite of initial SR-JPE models based on available spring-run Chinook Salmon data and provide the models to the SR-JPE Core Team for review. The SR-JPE Core Team will recommend an SR-JPE framework, composed of the initial selected SR-JPE models and the monitoring program required to provide data to calculate an annual SR-JPE.

In coordination with the SR-JPE Core Team, the Adaptive Management Steering Committee will charter and convene an independent peer review panel to provide feedback on the SR-JPE Core Team's recommended SR-JPE framework.

DWR and Reclamation will assemble the SR-LCM Management Team and begin coordination with the SR-JPE Core Team on the development of the SR-LCM.

Required actions in 2026 under Alternative 2b:

1. Following the independent peer review, and in consideration of independent peer review feedback, DWR and Reclamation will prepare a draft SR-JPE Plan in collaboration with CDFW, NMFS and USFWS, that describes the approach to calculating a SR-JPE and the monitoring and special studies needed to collect the data to calculate a SR- JPE annually. The draft SR-JPE Plan will be guided by the SR-JPE Core Team SDM process and SR-JPE framework recommendation, and by the independent peer review panel;s feedback on the SR-JPE framework recommendation. DWR and Reclamation will submit the draft SR-JPE Plan to the SR-JPE Core Team for review and work collaboratively to incorporate SR-JPE Core Team comments into the final SR-JPE Plan.

For implementation in 2026, DWR and Reclamation will submit the final SR-JPE Plan to CDFW and NMFS for approval no later than six months after the independent peer review.

The SR-JPE Core Team will evaluate the minimization provided by the spring-run Chinook Salmon hatchery surrogate OMR minimization measure described in Section 3.3.2.3, Spring-run Chinook Salmon and Surrogate Thresholds.

DWR, CDFW, Reclamation, and NMFS will meet to contemplate development of a new or modified spring-run Chinook Salmon hatchery surrogate OMR minimization measure described in Section 3.3.2.3, Spring-run Chinook Salmon and Surrogate Thresholds, informed by the final SR-JPE Plan, independent peer review panel feedback on the SR-JPE framework, historical spring-run Chinook Salmon monitoring data, new data obtained from the monitoring and special studies needed to collect the data to calculate the SR-JPE, SR-JPE Core Team review of the spring-run Chinook Salmon hatchery surrogate OMR minimization measure, and other relevant information (for example Georgiana Slough monitoring data). Any new minimization measure approach for spring-run Chinook Salmon will:

1. Take into account the limitations of the initial SR-JPE approach to calculate the SR-JPE
2. Be an interim approach to be refined as the SR-JPE approach evolves and the SR-LCM is completed
3. Anticipate future iterations and refinements of SR-JPE approach
4. Rely primarily on monitoring data rather than salvage data

After the final SR-JPE Plan is approved by CDFW and NMFS, DWR and Reclamation will convene the SR-JPE Core Team and subteams to provide an annual SR-JPE estimate, implement the final SR-JPE pPlan (including monitoring), and ensure all data obtained through long-term monitoring programs is are stored in a publicly accessible repository.

The SR-JPE Core Team will develop and submit a draft SR-LCM Modeling Plan and timeline to the SR-LCM Management Team for approval and guide implementation of the final SR-LCM Modeling Plan upon approval.

DWR and Reclamation will assemble the Lifecycle ModelingSR-LCM Modeling Subteam for coordination between the lead life cycle modeler and the SR-JPE Core Team.

Required actions in 2027 under Alternative 2b:

1. If approved by NMFS and CDFW, DWR and Reclamation will implement the new or modified spring-run Chinook salmon OMR minimization measure based on the initial SR- JPE approach to calculate the SR-JPE.
2. DWR and Reclamation will implement changes to monitoring if recommended through the SR-JPE Core Team SDM process and approved by CDFW and NMFS through appropriate take authorization for monitoring activities and contingent on stakeholder participation from non-CVP or SWP tributaries.
3. The SR-JPE Modeling Subteam will continue to develop and refine the SR-JPE model by integrating new data as it becomes available and adjusting the modeling approach in collaboration with the SR-JPE Core Team and in response to SDM processes conducted by the SR-JPE Core Team.
4. The SR-LCM Modeling Subteam will convene regular meetings to implement the final SR-LCM Modeling Plan and to solicit and incorporate feedback on model development.

Required actions in 2028 under Alternative 2b:

1. Under the guidance of SR-LCM Management Team and SR-JPE Core Team, the SR-LCM Modeling Subteam will recommend an initial SR-LCM.
2. In coordination with the SR-JPE Core Team and the SR-LCM Management Team, the Adaptive Management Steering Committee will consider chartering and convening an independent peer review panel to provide feedback on the SR-JPE model and the initial SR-LCM.

Required actions in 2029 and 2030 under Alternative 2b:

1. If the independent peer review is convened, the SR-JPE Core Team and the Lifecycle Modeling SR-LCM Modeling Subteam will review independent peer review panel feedback and the SR-JPE Core Team will use SDM to evaluate and implement changes to the SR-JPE model and the initial SR-LCM.

E.6 Alternative 3 – Modified Natural Hydrograph

Alternative 3 (Modified Natural Hydrograph) represents actions heavily informed by discussions and input from some of the environmental NGOs involved in state-wide water projects. Implementation of this alternative may require additional authorities and actions by parties beyond Reclamation and DWR. It combines additional Delta outflow with measures to improve drought protection and temperature management through increased reservoir carryover storage.

Alternative 3 includes authorizing legislation, water rights, contracts, and agreements as described by common components. These include Water Quality Control Plans, the COA, CWP and SWP Water Contracts, Settlement and Exchange Contracts (with modifications), and Record of Decisions on independent related activities not proposed for modification and reinitiation of consultation under this effort. Alternative 3 applies the following priority order for meeting downstream demands:

1. Meet D-1641;
2. Meet minimum reservoir release and instream flow requirements;
3. Divert water for human health and safety as defined by California Code of Regulations, Title 24, Section 878;
4. Meet storage requirements further described below for Shasta, Folsom, Oroville, and New Melones;
5. Meet Delta outflow requirements as proposed in this alternative – limit water diversions by CVP and SWP water service contractors, settlement contractors, and exchange contractors under SWP and CVP water rights to human health and safety if outflow requirements are not achieved, and limit releases of stored water beyond releases necessary to meet D-1641 in most months to prioritize achieving reservoir storage requirements;
6. Meet Delta operational requirements as described below (e.g., OMR, 2:1 San Joaquin import/export flow ratio);
7. Divert and deliver water for wildlife refuges;
8. Divert and make water available for diversions for settlement, and exchange contractor demands (diversions/deliveries can be reduced by more than contract terms currently allow);
9. Divert water for CVP and SWP water service contractors.

E.6.1 Sacramento River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.6.1.1 Ramping Rates

This component is the same as Alternative 2.

E.6.1.2 Winter and Spring Pulses and Delta Outflow

This component replaces the Spring Pulse flow component seen in the other alternatives.

Subject to modeling demonstrating that operations are reasonably likely to meet the Shasta Reservoir storage requirements for water temperature management described below, Alternative 3 bypasses 55% of unimpaired inflow to Shasta Reservoir from December through May to achieve the monthly Delta Outflow criteria in Table E-23, as described below in Section E.6.1.2,

Winter and Spring Pulses Delta Outflow. If the monthly Delta Outflow criteria in Table E-23 are met, then releases from Shasta Reservoir that month may be reduced to 45% of unimpaired inflows from December to May.

E.6.1.3 Water Temperature Management

Reclamation would reduce deliveries from stored water releases from Shasta Reservoir to meet the storage requirements below. In addition, Reclamation would release unstored water to meet Delta outflow requirements described in Section E.7.1.1, *Water Temperature Management*, from December through May to the extent modeling indicates doing so was consistent with meeting these storage requirements. Reclamation would release stored water to meet Delta outflow requirements from May through November. These storage requirements are designed to achieve water temperatures that protect winter-run Chinook salmon, and protect the salmon fishery, including fall-run Chinook salmon, pursuant to WRO 90-5:

- EOA Storage
    - Critical Year: 3.6 MAF
    - All other Years: 3.9 MAF
- EOS Storage
    - Critical Year: 1.9 MAF
    - All other Years: 2.2 MAF

Reclamation would not make water available for delivery until operational plans show the targets in 7.1.1 and 7.1.2 are likely to be met or exceeded. When those targets can be met, Reclamation would then make releases for deliveries in the priority identified above (first to CVPIA wildlife refuges, then to the SRS Contractors, then water service contractors).

Reclamation would develop an annual temperature management plan, consistent with WRO 90-5 and these criteria. The TMP will be reviewed and approved by NMFS on or before April 15, and will be approved before Reclamation releases water from Shasta Dam for delivery to or diversion by any contractor.

In water years classified as wet, above normal, below normal, or dry, the TMP would achieve daily average water temperatures of 53.5°F at the Clear Creek gage from the earlier of the onset of spawning of winter-run Chinook salmon or May 15 until October 31. In water years classified as critical, the TMP would seek to achieve daily average water temperatures of 54.5°F or cooler at the Clear Creek gage from the earlier of the onset of spawning of winter-run Chinook salmon or May 15 until October 31, to the maximum extent possible. In addition, Reclamation's operations would not result in seven-day average of daily maximum water temperatures at the Jelly's Ferry gage that exceed 61°F from March 1 to May 15. Shasta Dam operations described in the TMP would include modeling of water temperature dependent mortality using the Martin et al. model, and modeled estimates of water temperature dependent mortality of winter-run Chinook salmon should not exceed 30% in a critically dry year, 8% in a dry year, or 3% in other water year types. Reclamation should consider and implement warmwater and/or coldwater power bypasses at Shasta Dam when necessary to achieve these water temperature criteria.

If Reclamation, NMFS, and the Water Board jointly determine that reservoir storage is inadequate to achieve these water temperature criteria and comply with WRO 90-5, Reclamation, NMFS and the Water Board should jointly develop or revise the TMP such that it maximizes water temperature benefits for salmon spawning below Shasta Dam, provides a reasonable likelihood to achieve storage targets in the following year if that year is dry, documents water deliveries to contractors, and is disclosed to the public. This plan will be approved by NMFS before Reclamation releases water from Shasta Reservoir for its contractors.

E.6.2 Clear Creek

All components for this watershed are the same as Alternative 2, except that Reclamation will manage Whiskeytown Dam releases to not exceed mean daily water temperatures of 60°F at the Igo gauge from June 1 through September 15 and 56°F from September 15 through November 15.

E.6.3 American River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.6.3.1 Minimum Instream Flows (Minimum Release Requirements)

This component is the same as Alternative 2, except that Reclamation would incorporate the following Folsom Reservoir storage requirements:

- EOS: 300 TAF (230 TAF in a second consecutive dry or critical water year type)
- EOD: 300 TAF

Reclamation would prioritize minimum flows under the MRR, then storage, then additional Delta outflow in the winter and spring, then water deliveries.

E.6.3.2 Winter and Spring Pulses and Delta Outflow

This component replaces the Spring Pulse flow component seen in the other alternatives.

Subject to annual modeling demonstrating that operations are reasonably likely to meet the storage requirements described above, Alternative 3 bypasses 55% of unimpaired inflows to Folsom Reservoir from December through May to achieve the monthly Delta Outflow criteria in Table E-23, as described in Winter and Spring Delta Outflow. In addition, and again subject to achieving the storage requirements described above, Reclamation may release stored water from May to November to meet the Delta Outflow criteria described in Table E-23. If the monthly Delta Outflow criteria in Table E-23 is met, then releases from Folsom Reservoir that month may be reduced to 45% of unimpaired inflows from December through May.

E.6.4 Delta

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

Alternative 3 assumes a single unit operation is feasible for exports to meet public health and safety and would be shared between the CVP and SWP.

E.6.4.1 Old and Middle River Reverse Flows

Reclamation and DWR would coordinate operations of the CVP and SWP to meet the following requirements that are different from the No Action Alternative.

From the earlier of January 1 or the onset of OMR management, until the earlier of June 30 or the offramp of OMR Management, OMR flows shall not exceed -5,000 cfs on a 14-day running average. These requirements do not apply when San Joaquin River flows at Vernalis are greater than 20,000 cfs. In addition, when the SVI has been classified as a critically dry year for a second (or more) consecutive year, OMR flows shall not exceed -2,500 cfs on a 14-day running average.

From April 1 to May 31, Reclamation and DWR shall operate to achieve a 2:1 ratio of San Joaquin River inflow at Vernalis to combined CVP/SWP exports in all water year types.

E.6.4.2 Winter and Spring Delta Outflow

This component replaces the Spring Pulse flow component seen in the No Action Alternative, and Alternatives 1, 2, and 4.

Winter-spring Delta outflow criteria are intended to reduce the adverse impacts of CVP/SWP operations on listed species, by increasing abundance and productivity of longfin smelt, increasing survival of winter-run Chinook salmon, spring-run Chinook salmon, and Central Valley steelhead (as a result of increased flows that increased survival in the Sacramento River and increase survival through the Delta), increasing recruitment of Delta smelt, and increasing survival and abundance of green sturgeon. In addition to the requirements under D-1641, and consistent with modeling demonstrating that operations are reasonably likely to meet storage requirements described above, on a monthly basis, Reclamation and DWR shall operate to meet the Delta Outflow criteria in Table E-23 for the months of July to November (https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/PCFFA&IGFR/part2/pcffa_168.pdf). For the months of December through June, on a monthly basis, Reclamation and DWR shall operate to meet Delta Outflow that is the lesser of 65 percent of unimpaired Delta inflow or the Delta Outflow criteria in Table E-23.

Table E-23. Maximum Required Delta Outflow Criteria by Month and Water Year Type.

Month	Water Year Type							
	Wet	Above Normal	Below Normal	Dry	Second Consecutive Dry	Critical	Second Consecutive Critical	Third or more Consecutive Critical
January	90,000 cfs	42,800 cfs	29,000 cfs	20,000 cfs	11,400 cfs	11,400 cfs	7,100 cfs + OMR -2,500 cfs	NC
February	90,000 cfs	42,800 cfs	29,000 cfs	20,000 cfs	11,400 cfs	11,400 cfs	7,100 cfs + OMR -2,500 cfs	NC
March	90,000 cfs	42,800 cfs	29,000 cfs	20,000 cfs	11,400 cfs	11,400 cfs	7,100 cfs + OMR -2,500 cfs	NC
April	90,000 cfs	42,800 cfs	29,000 cfs	20,000 cfs	11,400 cfs	11,400 cfs	7,100 cfs + OMR -2,500 cfs	NC
May	90,000 cfs	42,800 cfs	29,000 cfs	20,000 cfs	11,400 cfs	11,400 cfs	7,100 cfs + OMR -2,500 cfs	NC
June	D-1641	D-1641	D-1641	8,000 cfs	8,000 cfs	8,000 cfs	7,100 cfs to June 15 then July criteria	4,000 cfs
July	8,000 cfs	8,000 cfs	7,100 cfs	6,500 cfs	NC	5,000 cfs	NC	4,000 cfs
August	7,100 cfs	7,100 cfs	6,900 cfs	6,900 cfs	NC	5,000 cfs	4,000 cfs	4,000 cfs
September	8,100 cfs	7,100 cfs	5,000 cfs	4,000 cfs	NC	3,000 cfs	NC	NC
October	8,100 cfs	7,100 cfs	5,000 cfs	4,000 cfs	NC	3,000 cfs	NC	NC
November	≤7,100 cfs a	≤7,100 cfs a	5,000 cfs	4,500 cfs	NC	3,500 cfs	NC	NC
December	65% UIF	65% UIF	65% UIF	65% UIF	NC	65% UIF	NC	NC

Note: Lesser of 65% of unimpaired flow or maximum required Delta outflow for months of December through June.
cfs = cubic feet per second; OMR = old and middle river; UIF = unimpaired flow; NC = no change.
[a] Reservoir inflow

To meet the Delta outflow in Table E-23, consistent with annual modeling demonstrating that storage requirements are reasonably likely to be achieved, for the months of December through May, Reclamation and DWR shall bypass 55% of unimpaired inflow to Shasta, Folsom, and Oroville reservoirs and 40% of unimpaired inflow to New Melones Reservoir. If the storage requirements and monthly Delta Outflow criteria in Table E-23 are met, then releases from Shasta, Folsom, and Oroville reservoirs that month may be reduced to 45% of unimpaired inflows from December through May. Reclamation and DWR may release stored water to meet Delta outflow criteria in May through November.

Reclamation and DWR would prioritize meeting the storage requirements described herein before making additional reservoir releases beyond what is required to meet D-1641 and human health and safety.

E.6.4.3 Delta Smelt Summer and Fall Habitat

Alternative 3 is the same as Alternative 2, except releases from upstream reservoirs are constrained to a Delta outflow of 7,100 cfs in November of wet and above normal years as described in Table E-23. Fall salinity may vary based on the ability of export reductions to achieve Fall X2 subject to public health and safety.

E.6.4.4 Bernice Frederic Sisk Dam Raise and Reservoir Expansion

Same as Alternative 1.

E.6.5 Stanislaus River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.6.5.1 Minimum Instream Flows

Consistent with the 2018 Bay-Delta Water Quality Control Plan, this component is consistent with the No Action Alternative in the summer and fall. Alternative 3 requires reservoir releases to meet 40% of unimpaired inflow on a 7-day running average to the confluence with the San Joaquin in February through June.

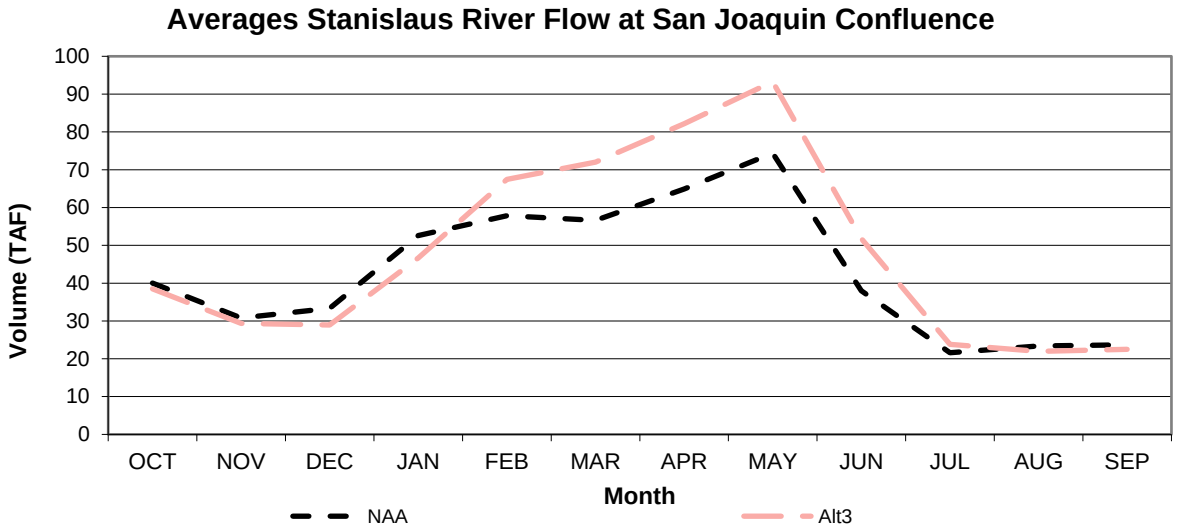


Figure E-212223. Stanislaus River Flow at Confluence with San Joaquin River.

In the months of February through June, Reclamation also would make releases from New Melones as necessary to contribute its share (29%) of meeting the 1,000 cfs minimum flow at Vernalis required in the Bay-Delta Water Quality Control Plan.

Reclamation would reduce deliveries to all CVP contractors to achieve a minimum EOS storage in New Melones Reservoir of 700 TAF.

E.6.5.2 Winter Instability Flows

This component is replaced by unimpaired inflow as minimum instream flows.

E.6.5.3 Spring Pulse Flows

This component is replaced by unimpaired inflow as minimum instream flows.

E.6.5.4 Fall Pulse Flows

This component is the same as Alternative 2.

E.6.6 San Joaquin River

This is the same as the No Action Alternative. Reclamation would continue implementation of the San Joaquin River Restoration Program as an independent related activity.

E.6.7 Monitoring

This component is the same as Alternative 1.

E.6.8 Special Studies

This component is the same as Alternative 1.

E.6.9 Drought

Similar to Alternative 2 however Alternative 3 does not include and prohibits the use of a temporary urgency change petition. Alternative 3 does not include construction nor operation of the Drought Barrier in West False River.

Key drought measures analyzed from the drought toolkit include:

- Delta Cross Channel Gate Openings
- Winter-Run Hatchery Increased Adult Intake
- Curtailment Conditions
- SRS Contractor Meet and Confer Provisions
    - Delayed Rice Floodup
    - Delayed Water Transfers
- Spring Warmwater Power Bypass at Shasta Reservoir
- Summer/fall coldwater power bypass at Shasta Reservoir
- Fall Coldwater Power Bypass at Folsom Dam

Other actions may be considered and analyzed as necessary. Reclamation and DWR, through Governance, may update the toolkit.

E.6.10 Governance

This component is generally the same as Alternative 2, except that: (1) the management teams (e.g., Shasta Water Interagency Management Team, WOMT, Sacramento River Temperature and Flow Technical Group) will be comprised solely of staff from federal and state agencies and Native American tribes; (2) fishery agencies (NMFS, USFWS, CDFW) will make final decisions regarding water project operations if the issue is not resolved in the management team process.

E.7 Alternative 4 – Risk Informed Operation

Alternative 4 provides alternative criteria for Shasta Reservoir and incorporates improved real-time analytics for using real-time information to support water deliveries in the Delta while limiting effects on listed species.

Alternative 4 includes authorizing legislation, contracts, and agreements as described by Common Components. These include Water Quality Control Plans, COA, CWP and SWP Water Contracts, Settlement and Exchange Contracts, and Record of Decisions on independent related programs not proposed for modification and reinitiation of consultation under this effort.

Alternative 4b is derived from Alternative 4, but includes modifications developed by American River interested parties. These components are described below in Section 3.6.4.

Sensitivity studies show that changes resulting from Alternative 4b are within the range of effects modeled for Alternative 4. Moreover, Alternative 4B includes limitations such that the modifications to Folsom Reservoir operations do not result in impacts outside of those described for Alternative 4. *Appendix E – Draft Alternatives* include additional description of each of the components of Alternative 4B.

E.7.1 Sacramento River

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

On the Sacramento River, Reclamation would make releases from Shasta Reservoir for flood control, minimum instream flows, senior water rights, Delta requirements, and deliveries to CVP water service contractors. Minimum instream flows and ramping rates would remain the same as the No Action Alternative.

E.7.1.1 Water Temperature Management

Reclamation would manage planned releases from Shasta Reservoir for water service contract deliveries to achieve an EOS storage of 2.0 MAF in Shasta Reservoir based on the 90% forecast unless a less conservative forecast requires more releases.

To address early season hydrologic uncertainty, Reclamation would limit the use of water under North of Delta Agricultural water service contractor allocations to no more than 30 TAF prior to the temperature management season and completion of a TMP.

If reductions to water service contracts would not achieve 2.0 MAF of storage in Shasta Reservoir by EOS, Reclamation would reduce releases for the Project Water component of SRS Contractors' Contracts, resulting in diversions of ~60% of contract totals.

Alternative 4 includes drought toolkit action such as Wilkins Slough Relief and relaxation of D-1641 water quality requirements that may improve the volume of coldwater pool and level of drought protection in Shasta Reservoir.

Reclamation would coordinate through governance to implement a temperature management strategy that considers:

- EOS Coldwater Pool
- Minimization of modeled Temperature Dependent Mortality.

The water temperature management strategy would start with a 53.5°F temperature target at or downstream of CCR from May 15 through October 30 while preserving a projected EOS coldwater pool of 400 TAF. If projections show EOS coldwater pool cannot be achieved, the water temperature management strategy would relax water temperatures in the following order:

- Target ≤56°F at CCR starting May 15 and delay the ≤53.5°F target to no later than June 15

- Target June 16 temperatures ≤54°F at CCR through October 30
- Relax end of October temperatures to ≤56°F daily to as early as October 1 and reduce the EOS coldwater pool target to 200 TAF
- Increase June 16 through September 30 temperatures to ≤56°F
- Reduce the EOS coldwater pool target and confer on additional drought toolkit actions.

Reclamation, through governance, would prepare a TMP consistent with requirements in WRO 90-5 and update the plan throughout the water temperature management season to improve water temperature conditions on or after June 16.

E.7.1.2 Fall and Winter Instream Flows

Fall and Winter Instream Flows under Alternative 4 are implemented as follows:

Table E-24. Keswick Dam December through February Default Release Schedule determined by EOS Storage.

Keswick Release (cfs)	Shasta EOS Storage (MAF)
3,250	<2.4
4,000	≥2.4
4,500	≥2.8
5,000	≥3.2

EOS = end-of-September; cfs = cubic feet per second; MAF = million acre-feet.

E.7.2 Clear Creek

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.7.2.1 Minimum Instream Flows (Seasonally Variable Hydrograph)

Same as Alternative 2

E.7.2.2 Pulse Flows

Same as Alternative 2.

E.7.2.3 Water Temperature Management

Reclamation will target Whiskeytown Dam releases to not exceed the mean daily water temperatures at Igo gauge:

- 61°F from June 1 through August 15.
- 60°F from August 16 through September 15.

- 56°F from September 15 through November 15.

Water temperature management on Clear Creek is implemented through changes in guard gate configurations and flow manipulations. In dry, critical, or import curtailment years, Reclamation may not be able to meet these water temperatures, and will operate Whiskeytown Dam as close to these temperatures as practicable.

Additional flows may be required to meet water temperature objectives. Reclamation will determine if additional water is available for water temperature management and inform the agency representatives through Governance. If two consecutive days of mean daily temperature are exceeded, then Reclamation may add 25 cfs to the seasonally variable hydrograph. If additional water is not available, Reclamation may, through Governance, reshape the remaining seasonally variable hydrograph to make this water available. Reshaping will consider maintaining spring-run Chinook salmon redds.

E.7.3 American River

Reclamation will seek to develop and operate under a new ATSP, otherwise operations on the American River are the same as the No Action Alternative.

E.7.4 American River Alt 4b

Reclamation, with support from the Water Forum, would adjust how the initial American River Index (ARI) is calculated in February and March and would use the 90 percent exceedance criteria for calculation of the ARI and corresponding monthly MRR.

E.7.4.1 Minimum Instream Flows (Minimum Release Requirement)

Reclamation would adopt the minimum flow schedule outlined in the "2023 Updates and Refinements to the Lower American River 2017 Flow Management Standard Technical Memorandum" ("2023 MFMS"). The 2023 MFMS includes MRR ranges from 500 to 2000 cfs based on time of year and annual hydrology. The flow schedule is intended to improve coldwater pool and habitat conditions for steelhead and fall-run Chinook salmon.

After the construction of recent spawning habitat enhancement projects, Chinook salmon spawning habitat availability in the lower American River reaches its peak at approximately 1,600 cfs. Prior to the construction of these projects, fall-run Chinook salmon habitat reached its peak at approximately 2,000 cfs. Reducing the maximum MRR to 1,600 cfs, therefore would optimize use of available habitat as well as increasing operational flexibility for managing Folsom Reservoir end-of-year storage. In the fall months, maintaining a lower MRR would ensure that salmon and steelhead redds were placed in areas that will continue to receive water, even if the following winter and spring prove dry. Maintaining flows at the lower MRR thus reduces the risk of Chinook salmon and steelhead redds being constructed in areas that are dewatered in the following winter or spring.

Reclamation and the Water Forum would continue to review and update Folsom Reservoir's end-of-year Planning Minimum. The Planning Minimum facilitates development of the coldwater pool in Folsom Reservoir and preserves sufficient water supplies to protect water users who rely on deliveries from Folsom Reservoir from potential impacts of drought cycles of two consecutive dry years. Through realtime operations, Reclamation will prioritize that the Planning

Minimum and the revised MRR do not result in substantive impacts elsewhere in the system. Evaluation of changes and actions to implement may include using best available forecasts for fall inflows based on information from upstream operators, starting operations for the end-of-December storage level in August, and including an assumption about maintaining flows in the lower American at least to the MRR in October through December in the end-of-December operations plan to minimize potential risk of fall-run Chinook salmon dewatering in the following winter.

E.7.4.2 Water Temperature Management

By June 15, Reclamation, through Governance, will annually prepare a TMP as described under the No Action Alternative.

Reclamation will implement the ATSP described in the 2023 MFMS. Each ATSP schedule determines a monthly series of water temperature targets (for daily average water temperature) at the Watt Avenue Bridge. Schedule 1 has a water temperature upper limit of 63°F from May through September, and 56°F in October and November. Schedule 75 has a water temperature upper limit of 72°F from May through September, 65°F in October, and 58°F in November. Schedules 2 through 75 each represent a change in a single month's upper temperature limit by 1.0°F. The ATSP may be modified as follows:

- For Schedule 22 or higher (greater than 65°F at Watt Avenue Bridge, May through September), the TMP may consider a temperature location at Hazel Avenue.
- For greater than 65°F at Hazel Avenue Bridge for May through September, the TMP will include an evaluation of whether modified Folsom Reservoir operations could support an improved temperature schedule (e.g., an alternate release schedule over the summer).
- For greater than 68°F at Hazel Avenue for May through September, the TMP will evaluate a power bypass during the summer and/or fall.
- For greater than 56°F at Hazel Avenue in November, the TMP will evaluate a power bypass.

E.7.5 Delta

Reclamation would continue to operate by season with the same primary purposes as described in Common Components. This alternative differs from the No Action Alternative as described in subsequent sections.

E.7.5.1 Old and Middle River Flow Management

Reclamation and DWR will operate to the Hutton (2008) OMR index to allow for operational planning and real-time adjustments.

E.7.5.2 Start of OMR Management

Reclamation and DWR will reduce exports to achieve OMR no more negative than -5,000 cfs when one or more of the following conditions have occurred:

"First Flush"

In addition to the reduction in exports described in the No Action Alternative, Reclamation and DWR may initiate the "first flush" if, through Governance, monitoring indicates a high risk of migration and dispersal of smelt into areas at high risk of future entrainment. "First Flush" may be off ramped to OMR no more negative than -5,000 cfs if the San Joaquin River at Vernalis is flowing at 10,000 cfs or more.

Delta Smelt Salvage

After December 1, if the Enhanced Delta Smelt Monitoring Program observes Delta smelt in the lower San Joaquin River and Southern Delta region or if any salvage of Delta smelt occurs, Reclamation and DWR, through the Governance process, may cease OMR restrictions related to this trigger or adjust the trigger requirements if hatchery release and monitoring data indicate that Delta smelt catch within the south Delta represent less than 5% of the overall catch.

Adult Longfin Salvage

After December 1 if monitoring data indicates that longfin smelt catch within the south Delta represent greater or equal to 5% of the overall catch or if any salvage of longfin smelt occurs. Reclamation and DWR, through the Governance process, may cease OMR restrictions related to this trigger if monitoring data (e.g., Enhanced Delta Smelt Monitoring Program, Bay Study, Fall Midwater Trawl) indicate that longfin smelt catch within the south Delta represent <5% of the overall catch.

Juvenile Salmonid Salvage

After December 1, Reclamation and DWR, through the Governance process, may incorporate additional or different predictive models as necessary to improve the onset of OMR management season for salmonid species if any of the following occurs:

- Gaeta et al.'s (2023) machine learning model predicts one week in advance the presence of winter-run length-at-date juvenile Chinook salmon across all 30 submodels, or
- salvage of genetically confirmed juvenile winter-run or spring-run Chinook salmon, or
- annual cumulative loss total reaches 60 or above for wild Central Valley steelhead.

E.7.5.3 Real-time Adjustments

In addition to "First Flush", additional restrictions use real-time monitoring to identify an increased risk of entrainment. Reclamation and DWR will manage to a more positive OMR than -5,000 cfs under the following conditions:

Adult Delta Smelt Turbidity Protection

Reclamation and DWR would manage exports to OMR no more negative than -2,000 cfs when daily average turbidity at both HOL and OBI are at or above 12 FNU. Reclamation and DWR will maintain OMR at no more negative than -2,000 cfs for one week, and then no more negative than -3,500 cfs until measured daily average turbidity at both sensors are less than 12 FNU, or as revised through the Governance process.

Adult Delta smelt protection will off-ramp when three-day average water temperature at Jersey Point reaches 59ºF. This off ramp will be based on data from the San Joaquin River at Jersey Point averaged over three days.

Delta Smelt Larvae and Juveniles Protection

Larval and juvenile Delta smelt management period will initiate when detected within the entrainment zone based on real-time sampling, or adult Delta smelt protection has off-ramped based on water temperature, whichever comes first. The presence of Delta smelt larvae and juveniles can also be identified through a detection of spent adult females in survey or salvage.

Reclamation and DWR will restrict exports to allow OMR no more negative than -3,500 cfs when Secchi depth average measurement is equal or less than one meter.

Longfin Smelt Larvae and Juveniles Protection

Recent studies indicated that regulations limiting Delta export for salmonids and Delta smelt since 2008-2009 have been protective for populations of longfin smelt.

Winter-Run Chinook Salmon Annual Cumulative Loss Thresholds

Reclamation and DWR will manage OMR to remain below the total annual loss thresholds for genetically-verified winter-run Chinook salmon at the Tracy and Skinner fish facilities:

- Natural winter-run Chinook salmon: Salvage Loss <0.5% of JPE (same as the No Action Alternative)
- Hatchery winter-run Chinook salmon: Salvage Loss <0.5% of JPE

JPE will be calculated using O'Farrell et al. (2018). Reclamation and DWR will use then-current monitoring of juvenile passage at Red Bluff Diversion Dam. Reclamation and DWR may update the JPE through the Governance process. Loss shall be calculated using the equation provided in CDFW (2018).

During the brood year, if at any time cumulative loss of natural or hatchery winter-run Chinook salmon exceed the total annual loss threshold, DWR and Reclamation shall restrict south Delta exports to maintain an OMR value of no more negative than -3,500 cfs for 14 days. Reclamation and DWR, through the Governance process, will also develop, implement, and update weekly an OMR schedule for the rest of the OMR management season to avoid further exceeding the annual loss thresholds using entrainment prediction tools and documented in an assessment.

Winter-Run Chinook Salmon High Salvage Avoidance

Reclamation and DWR will reduce exports to achieve OMR of no more negative than -3,500 cfs for at least seven days when Gaeta et al.'s (2023) machine learning model predicts one week in advance the high presence of winter-run length-at-date juvenile Chinook salmon across all 30 submodels. High presence is defined as seven-day moving average of more than 4.29 winter-run Chinook salmon expanded salvage at the salvage facilities. This action can only occur in the months of February, March, and April. OMR would continue to be managed to be no more negative than -3,500 cfs for longer than seven days until Gaeta et al.'s (2023) model no longer predicts high presence across all submodels.

Spring-Run Chinook Salmon Surrogate Thresholds

Reclamation and DWR will reduce exports to achieve OMR no more negative than -3,500 cfs for seven days the first instance cumulative salvage loss of a release group equals or exceeds 0.5% of the releases group at Delta entry.

Reclamation and DWR, through the Governance process, will develop the locations and times of in-river surrogate releases to best represent natural juvenile spring-run Chinook salmon migration into the Sacramento River and Delta. The percentage of the release group at Delta entry will be determined by survival from the release site to the Delta, similar to the development of the winter-run Chinook salmon JPE.

Steelhead Salvage Loss Thresholds

Same as Alternative 2.

E.7.5.4 Stormflex

Reclamation and DWR may operate to an OMR no more negative than -6,250 cfs to capture peak flows during storm-related events when no backstop conditions are triggered and following conditions are met:

- The Delta is in excess conditions as defined in 2018 amendment to the COA, and
- QWEST is greater than 0.

DWR and Reclamation, through the Governance process, will use estimates of the real-time distribution of winter-run Chinook salmon, PTM, and prediction tool output to assess potential winter-run Chinook salmon entrainment risk differences using OMR inputs of -5000, and –6250 cfs. If the assessment indicates that additional entrainment protections are unlikely to be triggered, Reclamation and DWR may operate to OMR no more negative than -6,250 cfs and will update the assessment no less than weekly.

If conditions indicate a backstop condition is likely to trigger, Reclamation and DWR will resume OMR no more negative than -5,000 cfs. If a backstop condition is triggered, Reclamation and DWR will cease storm-flex and implement the backstop.

E.7.5.5 End of OMR Management

Same as Alternative 2

E.7.5.6 Spring Delta Outflow

Same as Alternative 2.

E.7.5.7 Barker Slough

Same as Alternative 2.

E.7.5.8 Delta Smelt Summer and Fall Habitat

Same as Alternative 2.

E.7.5.9 Delta Smelt Supplementation

Same as Alternative 2.

E.7.5.10 Bernice Frederic Sisk Dam Raise and Reservoir Expansion

Same as Alternative 1.

E.7.6 Stanislaus River

This alternative differs from the No Action Alternative as described below.

E.7.6.1 Minimum Instream Flows

This component is the same as Alternative 2.

E.7.6.2 Fall Pulse Flows

This component is the same as Alternative 2.

E.7.6.3 Fall Pulse Flows

This component is the same as Alternative 2.

E.7.7 San Joaquin River

Alternative 4 is the same as the No Action Alternative for the San Joaquin River. Reclamation would continue implementation of the San Joaquin River Restoration Program as an independent related activity.

E.7.8 Monitoring

This component is the same as Alternative 1.

E.7.9 Special Studies

This alternative does not include species studies; however, Reclamation's science enterprise will continue through separate environmental compliance and future plans as independent programs.

E.7.10 Governance

Reclamation and DWR would coordinate with CDFW, NMFS, USFWS, tribes, and interested parties specific to the operation of the CVP and SWP through two main processes, as shown in Figure E-22.**Error! Reference source not found.**

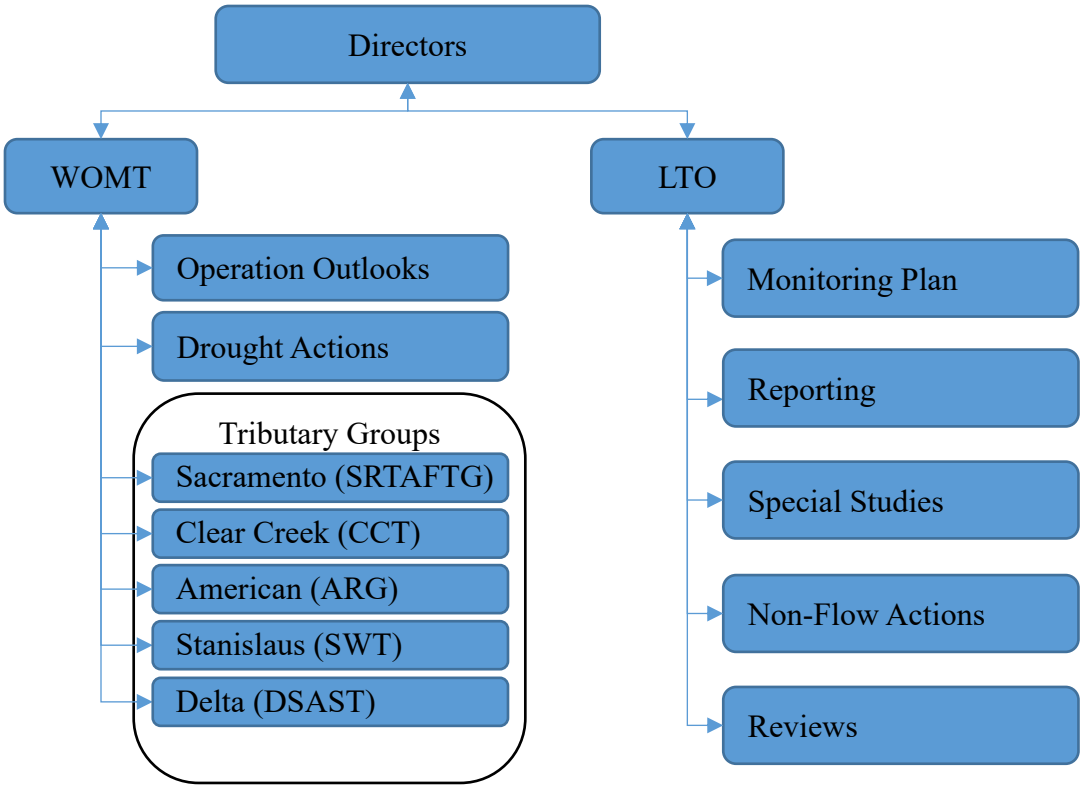


Figure E-22. Governance Structure.

In the event of a dispute within any of the teams, an individual within the team may elevate the dispute to their WOMT or LTO representative, who will decide whether to raise the dispute. Interested parties may elevate to Reclamation or another agency representative. In the event the managers in WOMT or LTO cannot resolve disputes between agency staff, tribes, and interested parties, representatives may elevate to the Directors of the agencies for resolution consistent with statutory authorities.

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