2024 BIOLOGICAL OPINION

APPENDIX 2: PROPOSED ACTION

REINITIATION OF CONSULTATION ON THE COORDINATED LONG-TERM OPERATION OF THE CENTRAL VALLEY PROJECT AND STATE WATER

San Francisco Bay-Delta Fish and Wildlife Office
US Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, CA, 95814

BUREAU OF RECLAMATION

Long-Term Operation – Biological Assessment

Chapter 3 – Proposed Action

October 2024

This page intentionally left blank.

Contents

Tables

Figures

Chapter 3 Proposed Action

The United States Department of the Interior, Bureau of Reclamation (Reclamation) operates the Central Valley Project (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. The California Department of Water Resources (DWR) operates the State Water Project (SWP) for the primary purpose of water supply deliveries and flood control, and the SWP provides additional benefits including power generation and environmental stewardship. Public Law 99-546 authorized the 1986 Coordinated Operation Agreement (COA), which sets procedures for Reclamation and DWR to share joint responsibilities for meeting Delta standards and other legal uses. Operation of the CVP and SWP also provides recreation and water quality benefits.

The Proposed Action covers 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 and Bay. Figure 3-1 shows a simplified hydrologic topology and the facilities operated in the Proposed Action.

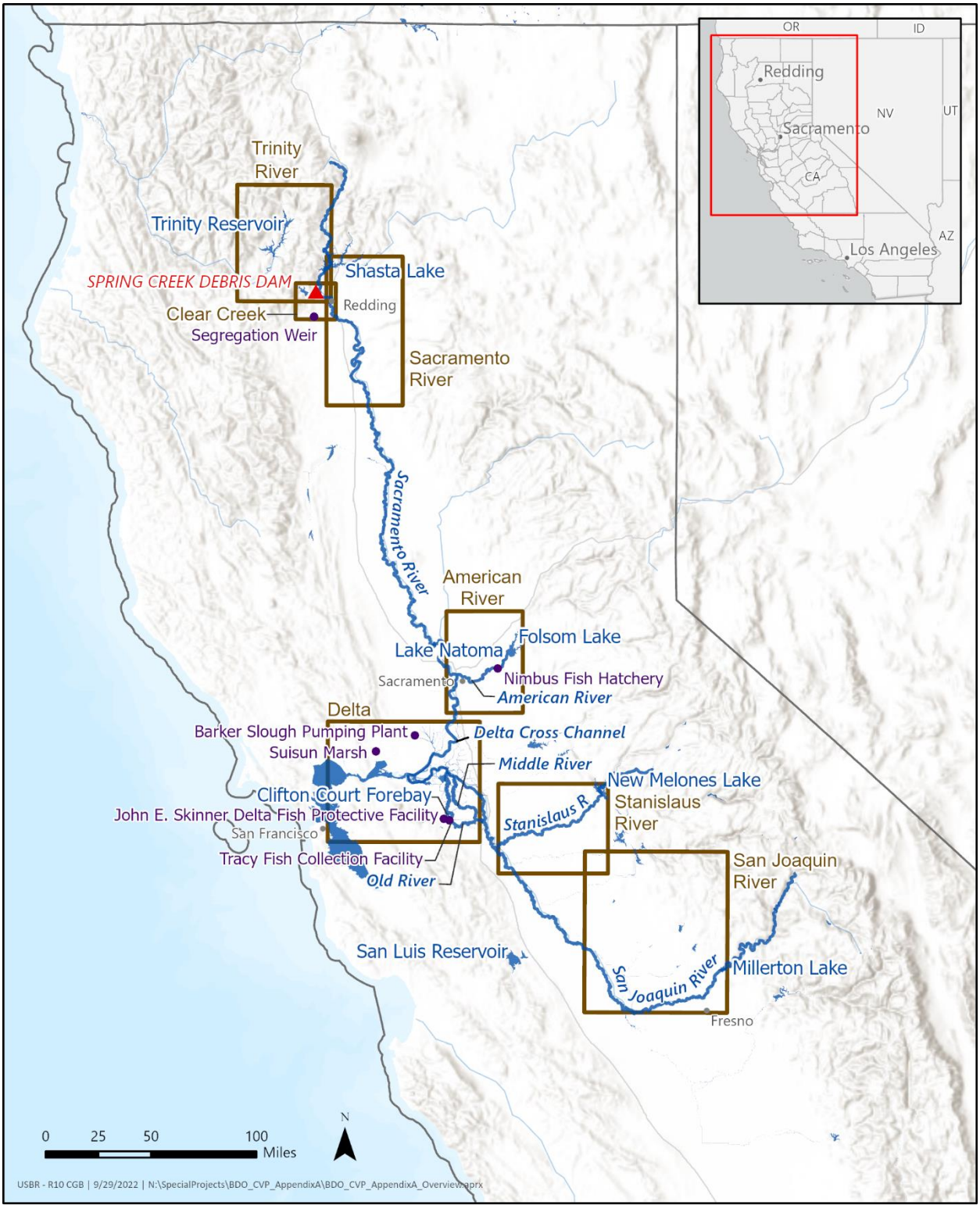


Figure 3-1. Overview of the Facilities Operated in the Proposed Action

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 State Water Resources Control Board (State Water Board) Water Right Decision 1641 [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 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. 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, Reclamation provides a reduced allocation and notifies the water service contractors that less water will be available for delivery. 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. Reclamation may execute temporary contracts, not to exceed one year, for delivery of an unusually large water supply not otherwise storable or infrequent and otherwise unmanaged flood flows[1]. Reclamation may make water available under the water service or repayment contracts in addition to the allocation and consistent with legal obligations[2]. Under the Accelerated Water Transfer Program, Reclamation may transfer water within counties, watersheds, or other areas of origin without showing it as having been consumptively used or irretrievably lost. Actions to make water available are described in the Seasonal Operations sections for each CVP and SWP facility and modelled to identify changes in river flows.

[1] Section 215 of the Reclamation Act

[2] Paragraph 3(f) of Water Service and Repayment Contracts

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). 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.

The Proposed Action is 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 Proposed Action 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 U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), interested parties, and the public 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.

Each subsequent watershed section highlights authorizing legislation and requirements under the regulations, contracts, and agreements. Watershed sections identify ongoing efforts in the baseline that mitigate the effects of the operation of the CVP and SWP and for which Reclamation and DWR are not consulting nor reinitiating consultation on as part of this Proposed Action. These programs have existing environmental compliance, agreements, and/or contracts with severable utility. These activities are in the baseline and may mitigate the effects of the operation of the CVP and SWP, some of which have been described in previous consultations and implemented.

3.1 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. Flood control operations are based on regulating criteria developed by the U.S. Army Corps of Engineers (USACE) pursuant to the provisions of the Flood Control Act of 1944. Flood control requirements reserve up to 1.3 million acre-feet (MAF) of space (flood control pool) behind Shasta Dam, leaving 3.2 MAF of space (conservation pool) for storage management during the winter flood season. Reclamation generally maintains flows of at least 5,000 cubic feet per second (cfs) at Wilkins Slough year-round and these flows may be reduced in low-storage and/or drought years.

Major facilities in the Sacramento Division of the CVP include the Red Bluff Pumping Plant, Tehama-Colusa Canal, and Corning Canal (Figure 3-2). 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 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: released from Whiskeytown Reservoir to Clear Creek and joins the Sacramento River at the mouth of Clear Creek south of Redding or 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.

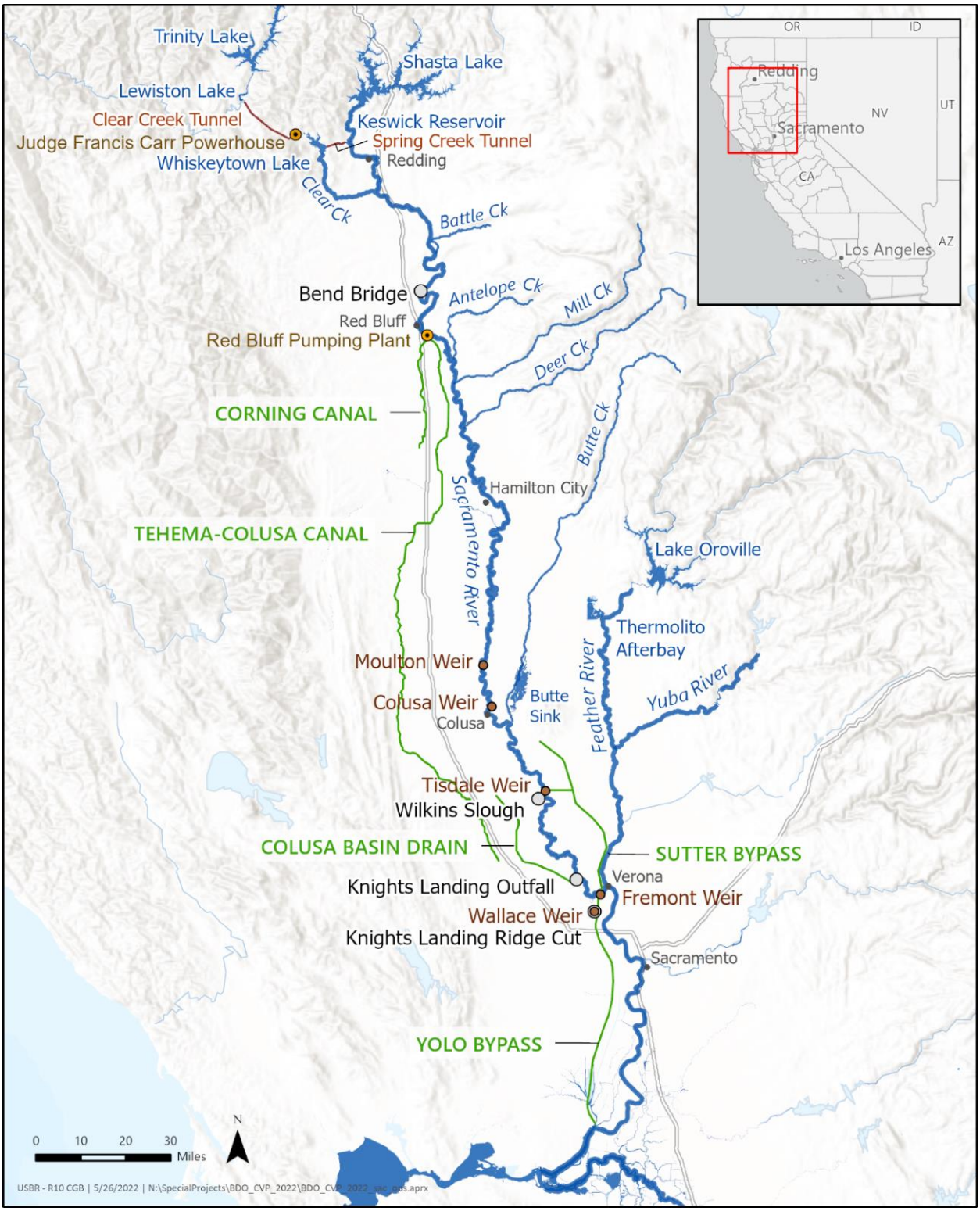


Figure 3-2. Sacramento River Facilities in the Shasta and Sacramento Divisions of the Central Valley Project and Flood Control Weirs and Bypasses

For more information on statutory, regulatory, and contractual requirements, see Appendix A, *Facilities Description*:

- Section 7 of the Flood Control Act of 1944
- Public Law 74-392 CVP Re-Authorization Act
- Public Law 81-839 Sacramento Valley Canals
- Central Valley Project Improvement Act (CVPIA)
- State Water Board Decision 990
- State Water Board Water Rights Order 90-5
- State Water Board Water Rights Order 91-1
- State Water Board D-1641
- Settlement Contracts
- Exchange Contracts
- Water Service Contracts

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitation Restoration

3.1.1 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 MAF. For the flood season, 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 the minimum flows necessary to meet downstream requirements. State Water Board Water Rights Order 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 State Water Board D-1641 provides flow standards in the Delta. 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 minimize releases and store 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 temperature requirements and increases the ability to make releases later in the year for water supply. Accretions (flows from

non-project creeks into the Sacramento River below Shasta Dam) reduce the need for additional releases from Shasta Reservoir and help to meet both instream demands and Delta outflow requirements. Wetter years with high accretions may allow Reclamation to store 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 at Keswick Reservoir Reclamation operates to flow objectives at Wilkins Slough to support diversion by Sacramento River Settlement Contractors with a prior entitlement to water in the Sacramento River, for deliveries to CVPIA wildlife refuges, and 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. The 2018 COA describes 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 5 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, to support essential features of designated critical habitat, 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 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 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 wetter 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 water 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:

temperature control (dependent on winter-run Chinook salmon emergence timing), maintenance of winter-run 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), minimizing fall-run Chinook salmon redd dewatering (dependent on late-summer flows and fall spawning timing), and stabilizing releases 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 consider that some winter-run Chinook salmon eggs and alevin are still incubating, significant instream diversion demands (e.g., rice decomposition) remain on the mainstem of the Sacramento River between Keswick Dam and Wilkins Slough and, depending on conditions, Delta requirements may require upstream reservoir releases for Delta outflow under requirements from the State Water Board or for Delta smelt habitat. 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.

Seasonal Operations will be managed by Reclamation in coordination with the Shasta Operations Team (SHOT), following the monthly SHOT Planning and Actions.

3.1.2 Sacramento River and Shasta Reservoir Coordination Forums

Governance is described in detail in Section 3.13, *Ramping Rates*, 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, Sacramento River Group (SRG) and the SHOT. The Winter-run JPE SubTeam is a technical group tasked with development of the winter-run juvenile production estimate (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, Sacramento River Settlement Contractors (SRSCs), WAPA, the State Water Board, and Native Tribes. The SHOT is a policy level group that discusses the actions described in this Proposed Action 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 SRSCs. 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.

3.1.3 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 Order 90-5, the release rate (ramping) from Keswick Dam 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 Order 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

Reclamation after coordination through the SHOT, may make deviations from this ramping rate to provide incremental benefits to fish species. Such deviations would be initially discussed through the SRG prior to coordination through the SHOT.

3.1.4 Fall and Winter Baseflows for Shasta Refill and Redd Maintenance

Fall and winter base flows support fall- and spring-run Chinook salmon, address winter-run Chinook salmon redd dewatering stressors, and support cold water pool management. 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 end-of-September storage and the current hydrology. Base flows will range from 3,250 cfs to 5,000 cfs (Table 3-1). 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 cold water pool for the following year.

Table 3-1. Keswick Dam December through February Default Release Schedule determined by End-of-September Storage

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

cfs = cubic feet per second; MAF = million acre-feet

Reclamation, after coordination through the SRG and SHOT, will determine the schedule for release reductions as well as any deviations from this default table by developing a risk analysis that relies on real-time fish monitoring data, winter-run redds remaining in the river, fall-run 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 temperature management and minimizing fall-run stranding and redd dewatering later in the fall. When higher storage exists at the end of September, 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 cold water 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.

3.1.5 Minimum Instream Flows

Under certain hydrologic circumstances during fall and winter months, 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, may temporarily reduce Keswick Dam releases below 3,250 cfs to preserve storage, as long as flows at the SAC CDEC gage maintain a minimum 3,250 cfs throughout that Keswick Dam flow reduction.

3.1.6 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 Sacramento River Settlement Contractors coordinated rice decomposition smoothing diversion schedule. Sacramento River Settlement Contractors and CVP Water Service Contractors will synchronize their diversions to lower peak rice decomposition demand. Starting in August, Reclamation and the Sacramento River Settlement Contractors, through the SRG, will develop a delivery schedule based on dewatering risk for winter-run redd locations. The delivery schedule will be updated as conditions warrant.

3.1.7 Sacramento River Pulse Flows

To increase outmigration survival of Chinook salmon, Reclamation would release up to 150 thousand acre-feet (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 SRSC 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 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.

3.1.8 Adult Migration and Holding Temperature Objectives

Spring temperatures can impact winter-run adults in multiple ways (gamete viability, spawning initiation, temperature shock, adult migration, disease risk, interaction with thiamine deficiency) as well as Late fall-run (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 warm-water 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 1st to target water temperatures of 58.0° F daily average at the Sacramento River above 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. Section 3.14, *Adaptive Management*, includes a proposal to look more closely at these pre-spawning temperature objectives and may eventually refine the standard.

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

3.1.9 Water Temperature and Storage Management

Shasta Reservoir is the largest reservoir in the CVP and the State of California. It is relied upon for meeting multiple and often competing objectives throughout the State but with limited ability to meet these objectives in drought years. In general, the approach to managing Shasta, as with all CVP reservoirs, is to best meet all the authorized purposes of the reservoir while limiting high flow, or flood control, releases where possible to maximize the beneficial use of inflow and provide flood protection for the Sacramento River and surrounding area. As climate change has been affecting the hydrology and meteorology, the drought periods have become more severe with significantly less inflow as in previous droughts, higher evaporation and evapotranspiration due to increased temperature and more extreme hydrological and meteorological events. In addition, the viability of critically endangered species and other salmon populations that rely on the Sacramento River are not improving due to multiple stressors and are being significantly impacted by these extreme events, particularly the lack of available water (including cold water) in droughts and high air temperatures.

In order to recognize and adapt to these significant changes to the system as a whole, Reclamation is proposing a new approach to managing Shasta which 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, FWS, CDFW, DWR and SRSCs to pursue a science and monitoring plan, winter-run habitat and infrastructure actions, and water operations. For this Proposed Action, Reclamation is consulting on the water operations of CVP facilities in the Shasta and Sacramento Division of the CVP.

The following sections describe the management framework for the *Plan for Shasta Reservoir Management* (Shasta Management Plan) and drought protection; an annual winter-run broodyear assessment that influences Livingston Stone National Fish Hatchery (LSNFH) 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.

3.1.10 Water Temperature and Storage Framework

The goals of the Shasta Management Plan are to provide increased drought protection and maximize suitable temperature regimes for the critically endangered Sacramento River Winter-run Chinook salmon. The Shasta 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 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 Management Plan proposes to integrate Sacramento Basin flow and non-flow measures that are part of the Voluntary Agreements (VAs) to update and implement the Bay-Delta Water Quality Control Plan. These measures are further described in Section 3.7.5, *Spring Delta Outflow*. The VAs 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 this Proposed Action are not intended to conflict with the State Water Board's Narrative Salmon Objective of the Narrative Viability Objective once adopted.

3.2 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 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 End-of April (EOA) storage and forecasted End-of September (EOS) storage indicators.

Based on the outcome of the broodyear assessment prepared by the Winter-run JPE sub-team, Reclamation, NMFS, FWS 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 LSNFH. FWS, through coordination with the SHOT, will implement measures as appropriate. The outcome of the broodyear assessment may also be considered in implementing actions within the Drought Toolkit as described in Section 3.12.

During any of the Bins described below, Reclamation may request that the Sacramento River Settlement contractors employ some of their voluntary actions identified in their resolution in

Section 3.4, *Sacramento River Settlement Contractor Resolution*, 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 SRSC to divert per their contract and would be discussed through SHOT with final decision making by the SRSC. 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 SRSCs are expected to have an action under the VA 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 Governance in Section 3.13, *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 become 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 the Proposed Action and not risking a Bin 3 year. Whether or not this allocation maintains the goals of the Proposed Action 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 the Proposed Action and/or risks the potential of a Bin 3 year, then the 0% allocation will remain.

3.2.1 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 temperature control device (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 cold water 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 carryover storage for future year drought protection.

During Bin 1 years, Shasta 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 Sacramento River Settlement 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 end of April storage at or above 3.7 MAF and a projected end of September 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 end of April storage at or above 3.7 MAF and a projected end of September storage of at least 3.0 MAF. As discussed above, this EOA storage ensures 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 end of April storage at or above 3.7 MAF and a projected end of September 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 Sacramento River Settlement 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

3.2.2 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 cold water 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 the end of September and in the subsequent year. Shasta 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 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 Sacramento River Settlement 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 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 redd dewatering and fall run 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 end of April storage at or above 3.0 MAF and a projected end of September 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 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 general 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 end of April storage at or above 3.0 MAF and a projected end of September 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 Sacramento River Settlement 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

3.2.3 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 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 Sacramento River Settlement Contracts 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 Sacramento River Settlement 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 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 snowmelt based inflow with lower demands expected. Bin 3A is defined as having an end of April storage below 3.0 MAF and a projected end of September 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 spawning and egg incubation period to avoid critical loss of winter-run population. Reclamation will reduce Shasta 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 end of April storage below 3.0 MAF and a projected end of September 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 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 broodyear.

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 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 D1641, 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 end of April storage below 3.0 MAF and a projected end of September storage less than 2.0 MAF, which are also designated as critical years under the SRSC's contracts and have an October through April inflow of less than 2.5 MAF, available water supply for diversion under the SRSCs 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 end of September storage of 2.0 MAF using a conservative forecast (90% exceedance or equivalent). This reduced volume of available water will be applied to all SRSCs collectively and individual contractor reductions may vary based on agreements and transfers between different SRSCs. In these years, previously described SRSC 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 FWS 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 FWS 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.

SRSCs 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 Sacramento River Settlement 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 SRSCs, SRSCs propose alternative methods to meet obligations to senior water right holders under the Sacramento River Settlement 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 Sacramento River Settlement 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 broodyear
    - 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 end of April storage based on 90% exceedance or other conservative approach
    - February or March forecasts project >2.0 MAF end of September 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 end of April storage based on 90% exceedance or other conservative approach.
    - February forecasts projects <2.0 MAF end of September 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.

3.3 Egg Incubation and Emergence Temperature Objectives

Water temperature management generally occurs from May 15 through October 30th; 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.

3.3.1 Temperature Management Plan

Reclamation will coordinate through the SRG to prepare a draft Temperature Management Plan (TMP) in April. The draft TMP will include: projected reservoir releases, assumed meteorological conditions, anticipated water temperatures and target locations, and temperature-dependent mortality (TDM) 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 Shasta Dam Temperature Control Device to manage water temperatures below Keswick Dam according to the Temperature Management Plan 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.

3.3.2 Temperature Profile Tracking

Reclamation will collect temperature profile measurements for Shasta (Table 3-2), Whiskeytown, and Trinity reservoirs every month at 25 ft intervals and distributed through the SRG following QA/QC.

Table 3-2. Temperature Profile Measurements for Shasta Reservoir

Dates	Profiles
Dec. – Feb.	Monthly at 25 ft. Intervals
Mar. – April	Every Two Weeks at 5 ft. Intervals
May – Nov. 15	Every Week at 5 ft. Intervals
Nov. 15 – Nov. 30	Every Two Weeks at 5 ft. Intervals

3.3.3 Annual Winter-run Chinook Salmon Broodyear 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% of historic JPE
- TMP compliance point was above CCR
- Adverse Population Viability Trends (per previous year's 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.

3.4 Sacramento River Settlement Contractor Resolution

The Sacramento River Settlement 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 Sacramento River Settlement (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.

3.4.1 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.
    - Kick-off JPE SubTeam – establish 5-agency team, confirm meetings, schedule, work products.
    - Expected work products: JPE, Winter-run Broodyear assessment.
    - Begin tracking system conditions and hydrologic outlook. The goal is to take stock of system conditions and tracking water year hydrology.
    - SHOT discussing October releases for purpose of tracking Winter run redd 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 discusses 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 TDM 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 LSNFH production adjustments or other actions to protect winter-run 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.
- FWS, through coordination with SHOT, determines if it's appropriate to increase production at LSNFH 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
  - FWS, through coordination with SHOT, determines if it's appropriate to increase production at LSNFH or to take other actions to protect winter-run production
  - Broodstock collection begin
- Regardless of Bin type:
  - JPE SubTeam issues annual winter-run broodyear 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 end of September 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 either from the Proposed Action or from the VAs. 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 temp 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 D1641 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 broodyear 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 SRSC 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 Water Operations Management Team (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 SRSC 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.
- LSNFH 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 temp 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 D1641 or the VA system-wide objectives depending on the source of the pulse flow water.
- SHOT considers pulse flow action in consideration of broodyear 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 SRSC 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
        - LSNFH actions continuing
        - Reclamation shares the April Operational Outlook with the SHOT and any concerns or trade-offs are discussed as appropriate
        - Draft Temperature Management Plan (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 15th to allow for SRG coordination
            - If bin 1, then date of April 30th 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 SRSC 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.
        - LSNFH actions continue.
        - Possible May pulse flow.
        - Final TMP shared with both NMFS and the State Water Board with a copy to all SHOT and SRG members. Final will be issued by May 31st 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 fall transition planning to minimize redd dewatering based on available cold water and overall storage conditions.

3.4.2 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 SRSCs.
- After exploring all applicable 3B actions, develop a Temperature Management Plan 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.

3.5 Clear Creek

As a component of the Trinity Division of the CVP, Reclamation operates and maintains Whiskeytown Dam on Clear Creek (Figure 3-3), 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.

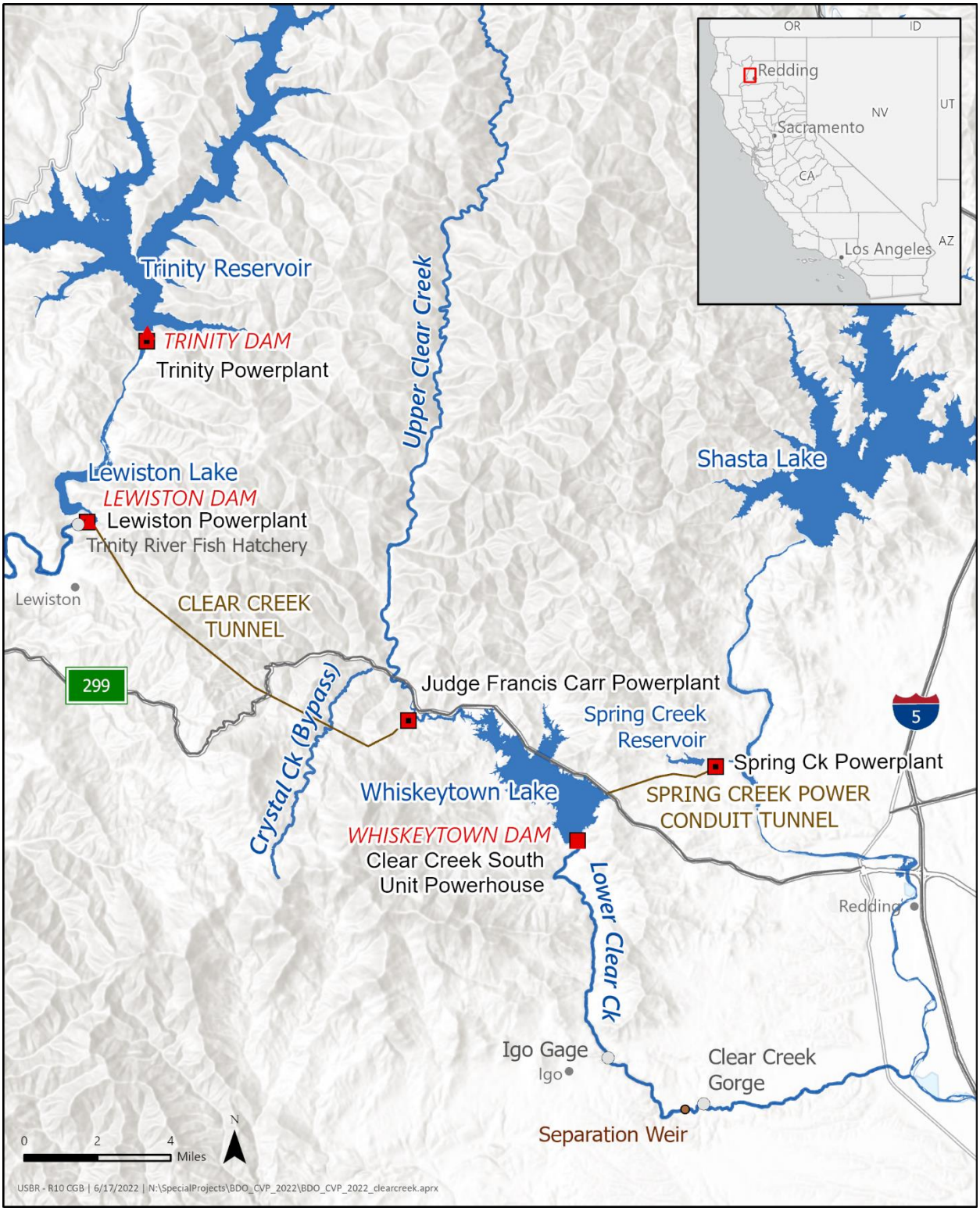


Figure 3-3. Clear Creek Facilities in the Trinity Division of the Central Valley Project

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- 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, State Water Board permit, minimum flows
- 1980 Memorandum of Understanding (MOU) with CDFW and the State Water Board (Spring Creek Debris Dam)

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitation Restoration

3.5.1 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 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 cool water for releases to Clear Creek for temperature control objectives, decrease residence time in Lewiston Lake for Trinity River temperature control, and help maintain temperature objectives in the Sacramento River by supplying water to Keswick Reservoir.

3.5.2 Ramping Rates

Ramping rates address the stranding risk stressor. Reclamation will use down ramping rates of up to 25 cfs per hour and schedule these reductions in consideration of listed species behavior (e.g., diel movement patterns).

Reclamation may vary from these ramping requirements during flood control. Reclamation, through Clear Creek Technical Team (CCTT), may develop a faster or slower down ramping rate on a case-by-case basis.

3.5.3 Minimum Instream Flows (Seasonally Variable Hydrograph)

Minimum instream flows address habitat stressors. Reclamation will release water through Whiskeytown Dam to provide intra-annual variation to emulate natural processes. As provided in Figure 3-4 and Table 3-3, 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.

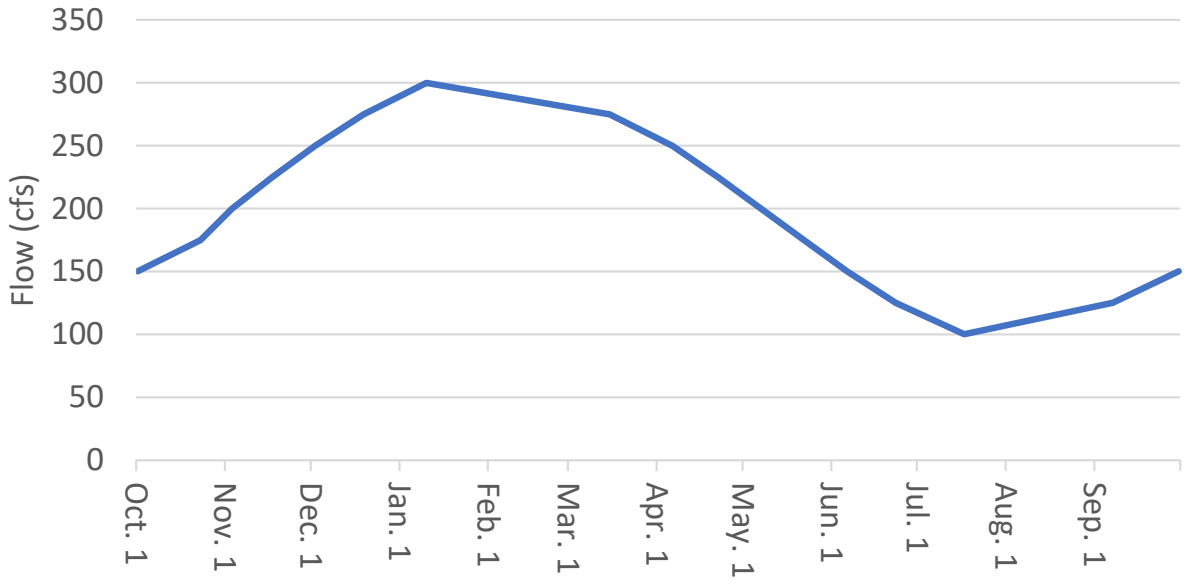


Figure 3-4. Clear Creek Seasonally Variable Hydrograph Minimum Flows, Except Critical Years

Table 3-3. 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

Date	From (cfs)	To (cfs)
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 3-4 and Table 3-3 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.

3.5.4 Pulse Flows

Pulse flows address the stressors on migration cues. 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(s) flows to 5,000 acre-feet.

3.5.5 Water Temperature Management

Water temperature management addresses adult water temperature and egg incubation stressors. 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 temperatures and will operate Whiskeytown Dam as close to these 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.

3.5.6 Segregation Weir

The segregation weir addresses competition, introgression, and broodstock removal stressors. 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 remain in place through early November. Reclamation, through the 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 (RM) 8.2 or 7.5. An additional location is being prepared at RM 7.25. 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. Removal of the weir would occur after the peak of fall run Chinook Salmon spawning when the risk of redd superimposition is very low. The weir location and timing protect most of the spring-run Chinook Salmon utilizing Clear Creek, while minimizing effects on other salmonids.

3.6 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 (Figure 3-5). 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 more than 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.

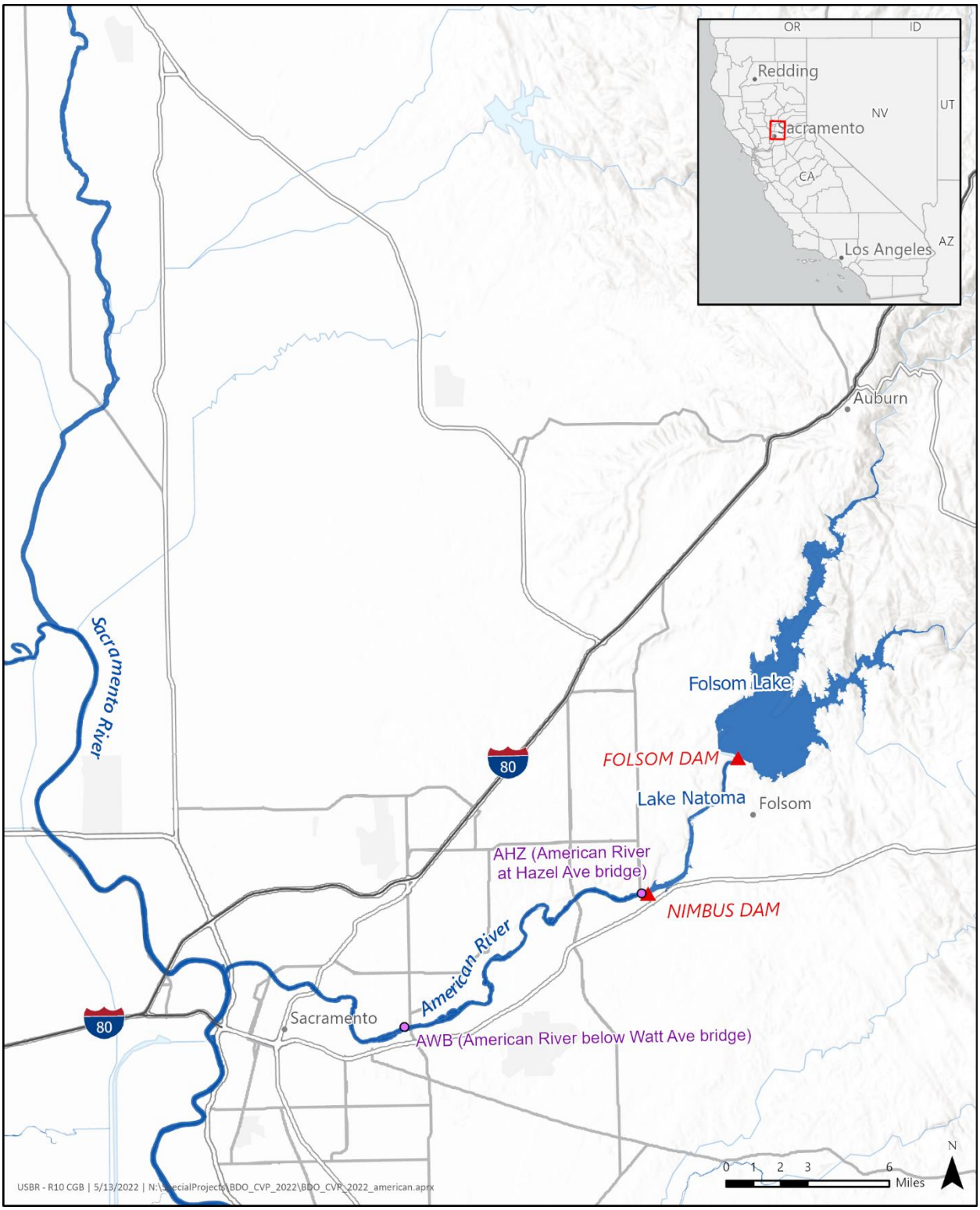


Figure 3-5. Facilities in the American River Division of the Central Valley Project

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- 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
- State Water Board D-893
- State Water Board 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

Programs in the environmental baseline to highlight:

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

3.6.1 Seasonal Operations

Reclamation operates Folsom Reservoir in the winter primarily for flood control and minimum flows in the 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. The American River Minimum Flow Schedule (ARMFS), Appendix ARMFS, 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 are frequently called on to address Delta water quality requirements under State Water Board D-1641. When releases from upstream CVP and SWP reservoirs meet Delta outflow requirements, Folsom releases can be reduced, and system-wide reservoirs balanced.

When developing the operational forecast, Reclamation would evaluate an end-of-December Folsom storage of at least 300 TAF. In some years, operational constraints may result in an end-of-December storage of less than 300 TAF. If, based on the May forecast, Reclamation does not anticipate meeting 300 TAF at the end of December, it will be reported at the May American River Group 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 the end of December. Reclamation is implementing a pilot program that considers an end-of-December planning minimum of 300 TAF (Water Forum MOU, March 2021).

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 temperature control management. Limited coldwater pool and limited storage require balancing releases and shutter operations to maximize the ability to maintain suitable 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.

3.6.2 Ramping Rates

Ramping rates address the stranding stressor. Reclamation will ramp down releases in the American River below Nimbus Dam as shown in Table 3-4 and at night, if possible.

Table 3-4. American River Ramping Rates

Lower American River 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

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 Hours (cfs)	Maximum Change per Step (cfs)
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 the American River Group (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.

3.6.3 Minimum Instream Flows (Minimum Release Requirements)

Minimum release requirements address egg dewatering, adult stranding and juvenile habitat stressors. For lower American River flows (below Nimbus Dam), Reclamation proposes to adopt the ARMFS. The ARMFS is based on the Modified Flow Management Standard developed by the Water Forum in 2017 (2017 MFMS), with additional modifications as described below. The ARMFS includes minimum release requirements (MRRs) ranging from 500 to 2,000 cfs based on time of year and annual hydrology. The flow schedule is intended to provide suitable habitat conditions for steelhead and fall-run Chinook salmon. As detailed in Appendix S, the Sacramento River Index (90% exceedance forecast) will be used to develop the MRR in January. The American River Index (90% exceedance forecast, with certain spills subtracted) will be used to calculate the MRR in February through December. All MRR calculations will be based on the hydrologic indices reported in the first Bulletin 120 of each month. Reclamation will continue to work with the American River Group to coordinate the shaping of upcoming releases within operational constraints.

Key differences in the ARMFS compared to the 2017 MFMS include the following:

- While the 2017 MFMS calculates the MRR for each month using a hydrologic index based on a 50% or 75% exceedance forecast, Reclamation proposes to calculate the MRR based on the 90% exceedance forecast for the relevant hydrologic index.
- The 2017 MFMS didn't specify how to transition from one month's MRR to the next month's MRR. In the ARMFS, Reclamation established a more defined timeframe for when the MRR would go into effect, targeting five business days after the initial monthly release of Bulletin 120. If the MRR is not implemented within five business days, Reclamation will notify the American River Group.

- Within one year of the Record of Decision (ROD), Reclamation, through the American River Group, 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, (b) develop recommendations, (c) and explanations on any recommendations not accepted.
- The offramp and volume offset in the spring pulse flow were removed so that in years when a spring pulse flow is triggered (based on the March MRR), the full volume is available to shape without a reduction in the MRR later in the spring. The current Proposed Action also specifies that the fish agencies, within operational constraints, may determine the timing of the flow.

3.6.4 Spring Pulse Flows

Spring pulse flow addresses stressors on outmigration cues to increase emigration rates and move juveniles downstream. 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, as described in the ARMFS. The peak flow of the pulse flow would be 3 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 releases would be decreased at no more than 500 cfs per day and no more than 100 cfs per hour. Changes in Nimbus releases would occur at night, if possible. The American River Group will provide technical input on shaping Spring Pulse Flow volumes, with the final timing determined by CDFW, FWS, and NMFS.

Reclamation, through the ARG, will develop a pulse flow schedule. Reclamation, through the ARG, may 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.

3.6.5 Redd Dewatering Protective Adjustments

The redd dewatering protective adjustment (RDPA), as described in ARMFS, adjusts the MRR to account for hydrology and potential dewatering impacts to fall-run Chinook salmon redds in January and February and steelhead redds in February through May based on the MRR. Dewatering Protective Adjustments based on the MRR are not protective when actual flows in-river are above the MRR. Releases can be above the MRR in the fall and winter due to contractual obligations, Delta water quality requirements, and precipitation events. There are not Redd Dewatering Protective Adjustments based on actual flows. The American River Group will provide technical input on shaping Redd Dewatering Projective 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 3-5 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 3-5. Steelhead Redd Dewatering Protective Adjustment-Based MRR for February through May[3]

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.

The maximum MRR in January through May is 1,750 cfs, but 1,800 cfs is included in the table as a maximum value. In February, the ARI-based and fall-run Chinook salmon RDPA-based MRRs for February are compared to the steelhead RDPA-based MRR in Table 3-5, using the controlling MRR in January as a basis. The highest of the three MRRs controls operations.

For March through May, the ARI-based MRR for the month is compared to the steelhead RDPA-based MRR in Table 3-5, using the highest of the controlling MRRs in January or February as a basis. The highest of the two MRRs controls operations.

3.6.6 Water Temperature Management

Temperature management supports fall-run and addresses the water temperature stressor on steelhead. The most suitable water temperature for juvenile steelhead rearing habitat in the lower American River is 65°F or lower. Ideally, the Temperature Management Plan would provide for daily average water temperatures no higher than 65°F from Nimbus Dam (just upstream of the Hazel Avenue bridge) down to the Watt Avenue bridge. The active temperature management season is approximately May 15 to October 31. Of additional importance, water temperatures below 56°F are suitable for fall-run Chinook salmon spawning. Carcass surveys in the lower

[3] The maximum MRR in January through May is 1,750 cfs, but 1,800 cfs is included in the table as a maximum value

American River indicate spawning from approximately mid-October through December and into January.

Reclamation will implement the Automated Temperature Selection Procedure (ATSP), which was developed in consultation with representatives of state and federal agencies and prioritizes water temperatures during the summer to support steelhead rearing over water temperatures in the fall to support Chinook salmon spawning. 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°F. Reclamation would consider modification to the ATSP or utilize another method in the event ARG members and fish agencies request consideration based on year-type conditions.

In years in the lower American River will have temperatures unsuitable for rearing or spawning, Reclamation, will meet with fisheries agencies to evaluate actions that can be taken to minimize temperature impacts to fisheries, may modify the ATSP 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 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 include an evaluation of whether modified Folsom operations could support an improved temperature schedule (e.g., an alternate release schedule over the summer) and 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 in the fall, with the evaluation likely to occur in August and September

By May 15, Reclamation will provide a draft TMP and solicit technical input from the ARG. By June 15, Reclamation, through ARG, will annually prepare a Temperature Management Plan for the summer through fall. The Temperature Management Plan 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, will achieve the water temperature requirement for steelhead, and may also be used to provide cold water for fall-fun spawning. During plan implementation, if the temperature is exceeded for 3 consecutive days, or is exceeded by more than 3°F for a single day, Reclamation, will notify NMFS and the ARG, and outline steps to realign water temperature with the Temperature Management Plan.

3.7 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 and C. W. "Bill" Jones Pumping Plant (Jones Pumping Plant), and Delta-Mendota Canal (Figure 3-6). The Jones Pumping Plant, located about 5 miles north of Tracy, has six fixed-speed pumps with an operating 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, Suisun Marsh facilities (including the Suisun Marsh Salinity Control Gate, Roaring River Distribution System, Morrow Island Distribution System, Goodyear Slough Outfall Gates), Clifton Court Forebay, and John E. Skinner Delta Fish Protective Facility (Skinner Fish Facility), Harvey O. Banks Pumping Plant (Banks Pumping Plant) and a portion of the California Aqueduct. The Barker Slough Pumping Plant diverts water from Barker Slough into the North Bay Aqueduct for delivery to the Solano County Water Agency and the Napa County Flood Control and Water Conservation District. The Suisun Marsh Salinity Control Gates (SMSCG) are located on Montezuma Slough about 2 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 and 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 San Luis Reservoir.

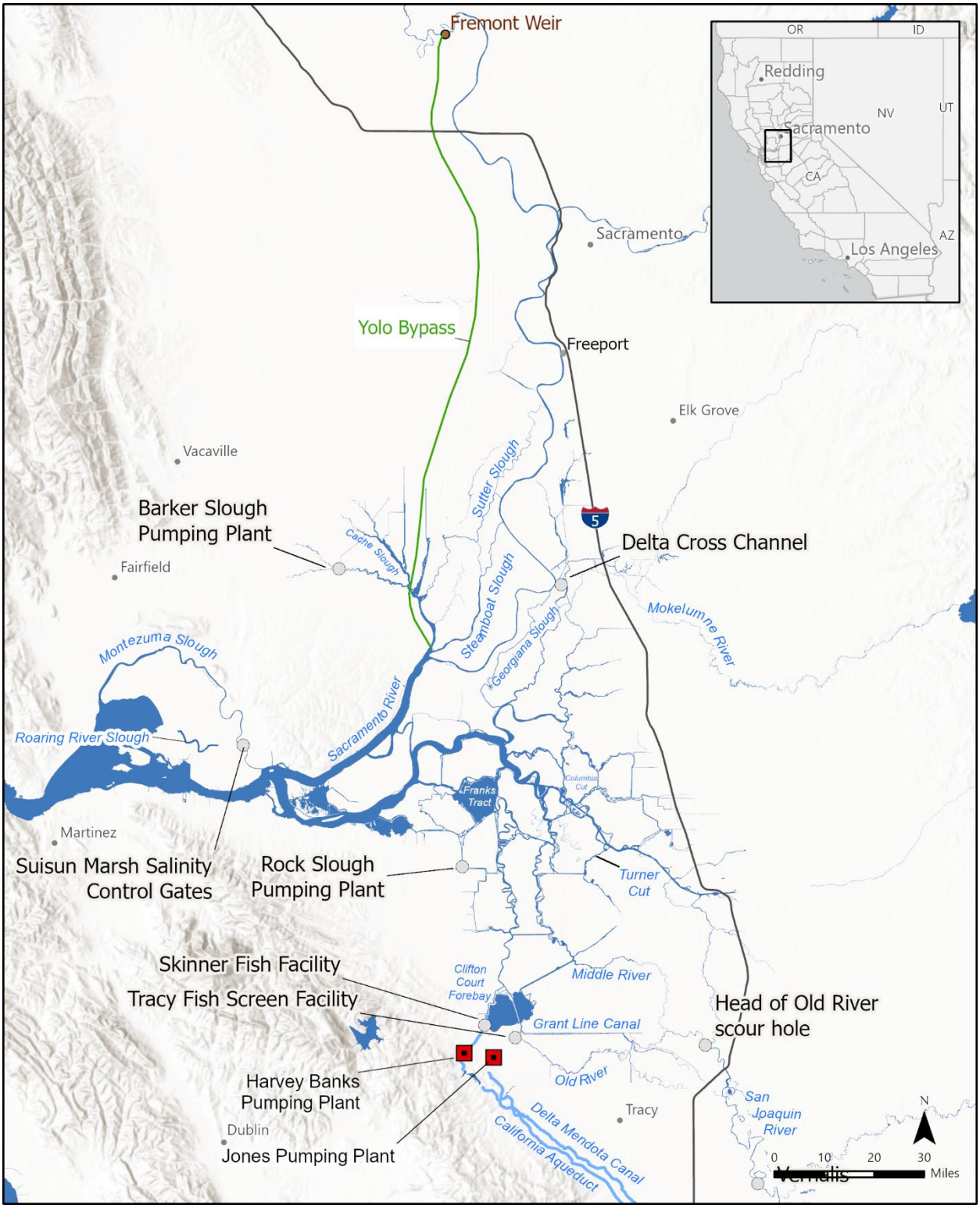


Figure 3-6. Map of the Delta Division Facilities

Statutory, Regulatory, and Contractual Requirements, see Appendix A:

- Public Law 74-392 CVP Re-Authorization Act
- State Water Board D-1641
- 1986 COA and 2018 COA amendment
- Public Law 99-546, Suisun Marsh Preservation Act
- 1986 Settlement Agreement with South Delta Water Agency (Clifton Court Forebay gate operations)
- October 13, 1981, USACE Public Notice #5820A (Clifton Court inflow criteria)
- DWR's Division of Safety of Dams criteria (Clifton Court Forebay storage)
- USACE permit number 199900715 (Clifton Court Forebay additional 500 cfs)
- DWR/CDFW Agreement (Skinner Fish Facility)
- USACE permit numbers SPK-200100121, SPK-20000696 (Temporary Barriers)

Programs in the environmental baseline to highlight:

- Agricultural Barrier Construction (USACE)
- Barker Slough Pumping Plant 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
- B.F. Sisk Dam Raise and Reservoir Expansion Project Construction
- Suisun Marsh Habitat Management, Preservation, and Restoration Plan
- Tracy Fish Collection Facility Improvement Program
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

3.7.1 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 requirements, 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 to conserve flood storage or redds may occur and result in additional flows into the Delta.

The Banks Pumping Plant pumps water from Clifton Court Forebay. The Clifton Court Forebay 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 Clifton Court Forebay is increased from 6,990 cfs to 7,490 cfs, and the maximum averaged diversion limit over any 3 days is increased from 6,680 cfs to 7,180 cfs. From mid-December through mid-March, diversions into Clifton Court Forebay may be increased by one-third of the San Joaquin River flow at Vernalis when those flows exceed 1,000 cfs. Further, Banks Pumping Plant will pump up to 195,000 acre-feet for the CVP in accordance with the 2018 COA Addendum.

3.7.2 Delta Cross Channel Gate Closures

The Delta Cross Channel (DCC) closures address the outmigration cues and entrainment risk stressor for salmon and steelhead. Reclamation operates the Delta Cross Channel to: improve the movement of water from the Sacramento River to the export facilities at the Jones and Banks Pumping Plants; improve water quality in the central and south Delta; reduce salinity intrusion rates in the west Delta; and allow passage for boaters. Reclamation closes the Delta Cross Channel during the late fall, winter, and spring to reduce straying of Mokelumne River fall-run Chinook salmon, protect out-migrating salmonids from entering the interior Delta, facilitate the State Water Board D-1641 Rio Vista flow objectives for fish passage, and reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates when Sacramento River flows exceed 20,000 cfs on a sustained basis. Delta Cross Channel closure will continue to occur as follows:

3.7.2.1 October 1 – November 30, Catch Index Closure

From October 1 through November 30, Reclamation proposes to close the DCC gates in addition to the requirements in D-1641 to further reduce juvenile salmonid entrainment risk based on the Knights Landing Catch Index and Sacramento Catch Index as described in Table 3-6. Observations of daily increases in catch indices are typically associated with increased flows at Wilkins Slough and tributaries to the upper Sacramento River, cooler water temperatures at these locations, and entry of migrating juvenile winter-run and spring-run Chinook salmon (Del Rosario et al. 2013; White and Low 2006).

Table 3-6. Delta Cross Channel Action Triggers and Responses from October 1–November 30

Action Trigger	Action Response
• Water quality criteria per D-1641 are met; and • Knights Landing Catch Index or Sacramento Catch Index (daily index) ≥ 3.0	Within 48 hours of index being reported to Reclamation, close the DCC gates for at least 3 days and keep closed until the catch index is less than three fish per day at both the Knights Landing and Sacramento monitoring sites for two consecutive days
• Water quality criteria per D-1641 are met; and • Knights Landing Catch Index or Sacramento Catch Index (daily index) ≥ 3.0; and • Real time hydrodynamic and salinity modeling shows water quality levels of concern criteria (as presented in Table 3-7) are exceeded during 14- day period following DCC closure	Reclamation and DWR, through Delta Monitoring Teams, review monitoring data and complete risk assessment to inform real-time operations of DCC gate closure.
• Water quality criteria are not met per D-1641 criteria	No DCC gate closure

Indices: Juvenile Chinook salmon at or above the minimum winter-run size based on the length-at-date Delta model used at a particular sampling location, and below the maximum size (for any run of salmon) considered by the length-at-date Delta model, on a given sampling date, are considered "older juveniles".

- *The Knights Landing Catch Index:* based on reported catch of older juveniles at the Knights Landing rotary screw trapping location and is calculated as the total catch of older juveniles (adjusted, as necessary, for partial cone operations) divided by the number of "trap days" (adjusted, as necessary, for downtime resulting from, for example, debris removal) since the last sampling event. This calculation for older juveniles/trap-day is implemented as [(total number of older juveniles/% cone sampling effort)/total hours fished)] * (24 hours fished/trap day).
- *The Sacramento Catch Index:* Both the Sacramento trawl (at Sherwood Harbor) and the Sacramento seine data are used to derive the Sacramento Catch Index. The reported catch of older juvenile Chinook salmon is used to generate a Sacramento Catch Index; a separate index for the seine data and a separate index for the trawl data.
    - The seine version of the catch index is standardized to eight hauls; therefore, the index is calculated as: (total number of older juveniles captured/# hauls) * 8. The Sacramento Seine route is based on eight sites: Verona, Elkhorn, Sand Cove, Discovery Park, American River, Miller Park, Sherwood Harbor, and Garcia Bend.
    - The trawl version of the catch index is standardized to 10 tows; therefore, the index is calculated as: (total number of older juveniles captured/# tows) * 10.

Table 3-7. Water Quality Levels of Concern Criteria (Simulated 14-day average Electrical Conductivity)

Station	Water Quality Concern Level (µmhos/cm)
Jersey Point	1800
Bethel Island	1000
Holland Cut	800
Bacon Island	700

µmhos/cm = micromhos per centimeter.

3.7.2.2 October 1 – November 30, Lower Mokelumne River Fall Closure

From October 1 through November 30, Reclamation proposes to close the DCC gates in addition to the requirements in D-1641 to enhance adult fall-run Chinook salmon passage into the Mokelumne River as described in Table 3-8. If the East Bay Municipal Utility District releases Lower Mokelumne River (LMR) attraction flows, water quality modeling shows concern level criteria (Table 3-7) are not likely to be exceeded for at least 14 days following the action, and there is no observed deterioration of interior Delta water quality, then Reclamation would close the DCC gates as soon as practicable (generally within 48 hours) for up to 5 days. Closure of the DCC gates when adult fall-run Chinook salmon attraction flows pass through the LMR can reduce straying of Chinook salmon between the Mokelumne and American rivers and increase the abundance of fall-run Chinook salmon returning to the Mokelumne River and its hatchery.

Table 3-8. Delta Cross Channel Action Triggers and Responses during Lower Mokelumne River (LMR) flow releases.

Action Triggers	Action Responses
• Water quality criteria per D-1641 are met and Real-time hydrodynamic; and • Salinity modeling shows water quality concern level targets are not exceeded during 14-day period following DCC closure; and • There is no observed deterioration of interior Delta water quality	Within 48 hours of start of LMR attraction flow release, close the DCC gates for up to 5 days
• Water quality criteria per D-1641 are met; and • Real time hydrodynamic and salinity modeling shows water quality concern level targets are exceeded during 14-day period following DCC closure	Reclamation and DWR, through Delta Monitoring Teams, review monitoring data and complete risk assessment to inform real-time operations of DCC gate closure.
• Water quality criteria are not met per D-1641	No DCC gate closure

3.7.2.3 December 1 – January 31

From December 1 to January 31, Reclamation proposes to close the DCC gates, except to avoid exceeding a D-1641 water quality criterion within the next 14 days based on water quality modeling (rather than increase releases and reduce reservoir storage further). Reclamation and DWR will prepare an assessment to evaluate opening the DCC gates for up to 5 days for up to two events within this period to avoid D-1641 water quality criteria exceedance. Reclamation and DWR will coordinate with USFWS, NMFS, CDFW and the State Water Board on how to balance D-1641 water quality and Endangered Species Act- (ESA) listed fish requirements and inform the Salmon Monitoring Team and Smelt Monitoring Team. The assessment will consider relevant monitoring information (e.g., upstream rotary screw traps, Delta juvenile fish monitoring surveys, Rio Vista flow standards, acoustic telemetered fish monitoring information) as well as potentially DSM2 modeling informed with recent hydrology, salinity, and tidal data. During these potential DCC gates openings, the CVP and SWP will limit combined exports as not to exceed 1,500 cfs, Health and Safety pumping level.

3.7.2.4 February 1 – May 20

Reclamation will keep the Delta Cross Channel Gates closed. State Water Board D-1641 requires the Delta Cross Channel Gates be closed.

3.7.2.5 May 21 – June 15

Reclamation will close the Delta Cross Channel Gates for a total of 14 days. Reclamation and DWR, through the Salmonid monitoring Team (SaMT), will prepare a plan that considers relevant information including: the upstream rotary screw traps, Delta juvenile fish surveys, Rio Vista flow standards, acoustic telemetered fish information, and DSM2 modeling. Reclamation typically schedules the Delta Cross Channel closures to occur on weekdays and keeps it open on weekends to accommodate recreational interests. State Water Board D-1641 requires the Delta Cross Channel to be closed for a total of 14 days after consultation with the USFWS, CDFW, and NMFS.

3.7.2.6 June 16 – September 30

From June 16 to September 30, Reclamation proposes to open the DCC gate.

3.7.3 Maintenance and Repair

The Reclamation Designers Operating Criteria, dated September 24, 1971, requires Reclamation to undertake routine maintenance and repair of the Delta Cross Channel Gates to continue reliable operation.[4] Certain routine maintenance and repair require cycling of the Delta Cross Channel Gates (i.e., open and close the gates several times in a row). Routine maintenance and repair will require cycling of one or both gates approximately twice per year for one day each. To avoid and minimize effects, Reclamation to the extent practicable will:

[4] Bureau of Reclamation. September 24, 1971. Reclamation Designers Operating Criteria.

- Perform cycling when federally listed fish are not likely present (mid-June through September)
- Perform cycling during daylight hours
- Minimize the duration of the time Delta Cross Channel is open during cycling when salmonids are present

Reclamation is required to maintain the Delta Cross Channel and may not have discretion over when the maintenance must occur. Reclamation will notify USFWS and NMFS of maintenance prior to its implementation, if it occurs during a closure period.

In addition:

1. As part of worker awareness training programs for federally listed species provided at the Delta Cross Channel facility, Tracy Fish Facility, Clifton Court Forebay facility and Barker Slough facility, Reclamation will include information about Northwestern Pond Turtle.

2. If Northwestern Pond Turtle is observed to be in harm's way in and/ or adjacent to the Delta Cross Channel Facility, Tracy Fish Facility, Clifton Court Forebay Facility and Barker Slough, Reclamation and DWR will ensure turtles are moved to the nearest habitat and notify the USFWS within 72 hours of event.

3.7.4 Old and Middle River Flow Management

Old and Middle River flow management addresses the entrainment stressor on adult delta smelt, larval and juvenile Delta smelt, adult longfin smelt, larval and juvenile longfin smelt, winter-run juveniles, spring-run juveniles, steelhead juveniles, and green sturgeon. Old and Middle River (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.

3.7.4.1 Winter-Run Early Season Migration

Winter-Run Early Season Migration: To minimize entrainment and salvage of early-migrating natural older winter-run Chinook salmon, DWR and Reclamation will adjust exports to achieve a 7-day of the average OMR value no more negative than -5,000 cfs for seven consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, when the genetically verified 7-day rolling sum of winter-run Chinook salmon loss, calculated daily, exceeds the following annually calculated thresholds (see calculation details in Appendix I):

- From November 1 – November 30: 0.0044% (e.g., water year 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in October, whereby the November Multiplier is:

  November Multiplier = 0.0011 x 0.25 x Survival*Fry-to-Smolt* x Survival*Smolt*

- From December 1 – December 31: 0.0084% (e.g., water year 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in November, whereby the December Multiplies is:
    - December Multiplier = 0.0021 x 0.25 x Survival*Fry-to-Smolt* x Survival*Smolt*

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 adjust exports to achieve a 7-day average of the OMR value no more negative than -5,000 cfs until 7 days after the most recent exceedance. Loss shall be calculated for the export facilities using the 2018 CDFW loss equation (Attachment R).

Reclamation and DWR will adjust 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 adjustments pursuant to the OMR limit may not be 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. If a fish is not genetically identifiable or if genetic identification is pending, then the Delta model length-at-date criteria shall be used to classify the race of the juvenile Chinook Salmon in salvage.

Spring-Run Chinook Salmon

Reclamation and DWR, through SaMT, will use real-time monitoring data, coupled with 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.

3.7.4.2 Start of OMR Management

The OMR management season starts any time after December 1 if an Adult Longfin Smelt Entrainment Protection Action, if appropriate (see Section 3.7.4.4.1, *Adult Longfin Smelt Entrainment Protection Action*), or 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 Adult Longfin Smelt Entrainment Protection Action or First Flush Action occurs or the Adult Delta Smelt Entrainment Protection Action is reached, the OMR management season starts automatically on January 1. From the onset of OMR Management, Reclamation and DWR shall adjust 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 adjust CVP and SWP exports for 14 consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, anytime between December 1 and the last day of February, to maintain a 14-day average of the 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 California Data Exchange Center Sacramento River at Freeport. 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 Smelt Monitoring Team (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.

A reduction in exports to achieve a new OMR index will occur within three days of an action that requires a change in OMR.

Once an OMR action is triggered, combined project exports will not be increased, except as scheduled prior to the trigger with notice to WOMT, in a manner that would make projected OMR more negative. Export reductions to meet the conditions of the trigger will be done using the normal scheduling procedure. Combined projected exports, export scheduling, and OMR will be discussed at WOMT each week. The intent is that combined project exports will not increase the risk to protected fish species after an OMR trigger is met.

3.7.4.3 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:

3.7.4.4 Adult Delta Smelt 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 adjust exports to achieve a five-day average of the OMR flow that is no more negative than -3,500 cfs, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, 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, Old River at Bacon Island, and Old River at Frank's Tract near Terminous.

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 offramped. While offramped, 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.

3.7.4.4.1 Adult Longfin Smelt Entrainment Protection Action

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

$$Salvage\ threshold = \left(\frac{Age\ 1 + Longfin\ smelt\ index}{20}\right) + 1$$

Where:

- The Age 1 + LFS index is calculated using age 1+ fish captured in the mid water trawl from the full San Francisco Bay Study sampling area (California Department of Fish and Game 1999). The Age 1 + LFS 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 and the complete Age 1 + LFS Index is calculated.

Then:

- From December 1 to the start of the OMR management season, Reclamation and DWR shall adjust exports to achieve an OMR flow no more negative than -5,000 cfs on a seven-day average for seven consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, and then, if appropriate, initiate the start of OMR management season. During the 7-day period, WOMT may convene and determine if initiation of OMR management season is warranted. If WOMT determines initiating OMR management is not warranted, the OMR management season does not begin at the conclusion of the 7-day period. If salvage of Longfin smelt ≥ 60 mm continues following the 7-day period where OMR is no more negative than -5,000 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. WOMT may determine if OMR management should be initiated. If WOMT does not meet then protections will 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, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. 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.

3.7.4.5 Larval and Juvenile Delta Smelt 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 of the 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 a 7-day average of the 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.

3.7.4.5.1 Larval and Juvenile Longfin Smelt Protection Action

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

- The 7-day average QWest is < +1,500 cfs (as calculated using the Dayflow QWest equation), and;

- Larval and juvenile Longfin smelt catch in the most recent Smelt Larva Survey (SLS) and 20mm survey at stations 809 and 812 exceeds the catch threshold set by the Age 1 + LFS Index as described in Table 3-9, for catch thresholds.

Reclamation and DWR will adjust the 7-day average the OMR flow to no more negative than -3,500 cfs for seven days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. Upon initiation of the action DWR and Reclamation, through WOMT, may prepare an assessment to determine if the 7-day action can be adjusted or offramped based on larval and juvenile LFS entrainment risk, as informed by available quantitative tools and real-time data. If offramped, the Larval and Juvenile Longfin Smelt Protection Action shall later be retriggered if conditions warrant..

If the WY 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 adjust to a seven-day average of the OMR of -3,500 cfs for 14 days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. If the WY 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 adjust to a 7-day average of the OMR of -2,500 cfs for 14 days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. 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 Reclamation and DWR, through the SMT, a risk assessment on appropriate OMR flows through the remainder of the OMR Management.

Table 3-9. San Francisco Bay Study Longfin Smelt Index Catch Threshold

San Francisco Bay Study Longfin smelt index[1]	Catch Threshold at 809 & 812
0 – 149	10
150 – 299	20
300 – 499	30
500 – 999	40
≥ 1000	50

3.7.4.5.2 High-Flow offramps for Larval and Juvenile Delta smelt and Longfin smelt

When the daily average Sacramento River flows at Rio Vista are greater than 55,000 cfs, or 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 offramped. While offramped, 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 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.

3.7.4.5.3 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 and for each of the hatchery winter-run Chinook Salmon populations from LSNFH and Battle Creek. The JPE for natural and hatchery winter-run Chinook salmon will be calculated at least annually by the JPE SubTeam, as described in Appendix- Winter-Run Juvenile Production Estimate, and transmitted to WOMT and SHOT. Hatchery releases of winter-run Chinook salmon will be tracked individually, and cumulative loss will be summed across release groups with the same JPE and annual loss threshold. Loss shall be calculated for the export facilities using the 2018 CDFW loss equation (Attachment R).

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 natural or hatchery winter-run Chinook salmon in a brood year exceeds 50% of the annual loss thresholds, then DWR and Reclamation will adjust south Delta exports to maintain a 7-day average of the OMR value no more negative than -3,500 cfs for 7 consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. Once exceeded, each winter-run observed in salvage would trigger another operation to an OMR limit of -3,500 cfs for 7 days.

If the cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 75% of the annual loss thresholds, then DWR and Reclamation will adjust south Delta exports to maintain a 7-day average of the OMR value no more negative than the -2,500 cfs for seven consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, 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 7 most recent prediction days. These prediction values are calculated based on length-at-date and will be updated once genetic analysis is fully adopted.

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.

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 adjustments pursuant to the OMR limit may not be 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. If a fish is not genetically identifiable or if genetic identification is pending, then the Delta model length-at-date criteria shall be used to classify the race of the juvenile Chinook Salmon in salvage.

3.7.4.5.4 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 3-10, 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 loss, then DWR and Reclamation will adjust exports to achieve a 7-day average of the OMR no more negative than -3,500 cfs for seven consecutive days. Loss shall be calculated for the export facilities using the 2018 CDFW loss equation (Attachment R).

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 RBDD 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 3-10, 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.

DWR and Reclamation, initially, will restrict exports in response to meeting the above thresholds based on the initial length-at-date identification of natural-origin older juvenile Chinook Salmon and the thresholds described above. If genetic analysis of natural-origin older juvenile Chinook Salmon observed in salvage at the SWP or CVP subsequently indicates that any given Chinook Salmon is not genetically identified as a winter-run Chinook Salmon, these fish will not count towards the loss threshold exceedance, and continued export adjustments pursuant to the OMR index limit may not be required. While the new method, SHERLOCK, undergoes field testing, both it and the current GT-seq method 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. If a fish is not genetically identifiable or if genetic identification is pending, then the Delta model length-at-date criteria shall be used to classify the race of the juvenile Chinook Salmon in salvage.

Table 3-10. 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.
* The week of 2/26–3/4 includes 8 days during leap years

3.7.4.5.5 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 CCV steelhead at the CVP and SWP salvage facilities will be counted cumulatively for each Brood Year, starting July 1st 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 3.11.1 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 3.11.1).

3.7.4.5.6 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.

3.7.4.5.7 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 for surrogate release group, Reclamation and DWR will adjust south Delta exports to achieve a 7-day average of the 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 February 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 February 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.

Loss shall be calculated for the export facilities using the 2018 CDFW loss equation (Attachment R). The surrogate methods are intended to be an interim measure that will be replaced with a measure as described in Section 3.11.2, *Spring-Run Juvenile Production Estimate and Life Cycle Model*.

3.7.4.6 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 Coordinated Operations Agreement, as amended in 2018; and
2. QWEST is greater than +1,500 cfs; and
3. X2 is <81km; and

4. The daily average turbidity at the Holland Cut, Old River at Bacon Island, and Old River at Frank's Tract 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 National Fish Hatchery late-fall run chinook salmon (yearling spring run chinook salmon surrogate) is less than 0.5% within any of the release groups.

If the criteria above are met, WOMT will decide whether to request that DWR and Reclamation use estimates of the real-time distribution of listed-species from SMT and SaMT, 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 no additional real-time OMR protections for the upcoming week are likely to be triggered, Reclamation and DWR will bring a request back to WOMT for approval to operate to OMR no more negative than -6,250 cfs and will update the assessment no less than weekly.

If conditions indicate an additional real-time OMR protection is likely to trigger, Reclamation and DWR will adjust south Delta exports to achieve a 14-day average of the 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.

3.7.4.7 End of OMR Management Season

OMR Management season for Delta smelt and Longfin smelt will conclude when the three consecutive days of daily mean water temperature at Clifton Court Forebay 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 71.96°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 71.96°F (22.2°C) for 7 non-consecutive days (does not have to be consecutive) in June.

3.7.4.8 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 fulfill commitments under the ROD that will be signed by Reclamation on the Consultation on the Coordinated Long-Term Operation of the CVP and SWP to produce a seasonal report each year. Additionally, this seasonal report will be used to support the development of Reclamation's Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project. Finally, this seasonal report will inform any Four-Year Review Panels adopted under the ROD. 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 fulfill commitments under the ROD that will be signed by Reclamation on the Consultation on the Coordinated Long-Term Operation of the CVP and SWP to produce a seasonal report each year. Additionally, this seasonal report will be used to support the development of Reclamation's Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project Finally, this seasonal report will inform any Four-Year Review Panels adopted under the ROD. The purpose of the independent review will be to evaluate the efficacy of actions undertaken to reduce the adverse effects on listed species.

3.7.5 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 the following: Reclamation and DWR south of Delta export modifications; Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds; and passing Delta inflow from water made available by VA Parties. Actions to result in increased Delta outflow are shown in Table 3-11. These volumes (and associated footnotes) are reflected in the Memorandum of Understanding signed by VA parties in March 2022.

Table 3-11. Water Made Available by the CVP and SWP[5]

	Critical (TAF)	Dry (TAF)	Below Normal (TAF)	Above Normal (TAF)	Wet (TAF)
SWP and CVP Forgone Exports[6]	0	125	125	175	0

[5] These numbers are set forth in the Term Sheet, Appendix 1. Flow Tables

[6] Subject to Public Health and Safety exports of 1,500 cfs.

	Critical (TAF)	Dry (TAF)	Below Normal (TAF)	Above Normal (TAF)	Wet (TAF)
SWP Flow Purchases Implemented through Forgone SWP exports	0	30	30	30	0
SRSC Fallowing[7]	2	102	100	100	0
Sac. Valley Purchase[8]	0	10	10	10	0
American River Groundwater and Reoperation of Upstream Reservoirs[9]	30	40	10	10	0
CVP SOD Purchase[10]	0	12.5	24.5	35	0
Westlands Contract Assignment Purchase[11]	3	6	15	19.5	27
Additional CVP SOD[12]	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)[13]	0	45	45	45	0
Total CVP and SWP Outflow Potentially through CVP and SWP Operations[14]	33	423.5	414.5	478.5	27
Additional Feather River Actions accounted for under Total VA Outflow (below)		60	60	60	
Total VA Outflow by All VA Parties	155	825.5	750.5	824.5	150

[7] SRSC 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.

[8] The new flow contributions from the Sacramento River Basin identified in this Table 3-12, 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 Table 3-12, are not intended to result in idling more than 35,000 acres of rice land in the Sacramento River Basin.

[9] 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.

[10] Subject to CVP SOD Agricultural Allocation.

[11] 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.

[12] If flows are not obtained through this source, the equivalent volume would be obtained at market price or otherwise obtained through other mechanisms.

[13] The VA's governance program will be used to determine the use of available funding to provide additional outflow in AN, BN, or W 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 AN, BN and D years.

[14] The volumes identified in this row represent the CVP and SWP contributions. Additional flows from other VA parties and Permanent State Water Purchases will 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 approves the VAs, as substantially proposed by the VA parties, and (b) the VA parties execute or are in the process of executing 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.

3.7.6 Delta Smelt Summer and Fall Habitat

3.7.6.1 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 ≤ 80km for September through October.

3.7.6.2 Suisun Marsh Salinity Control Gate

To address effects on 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, and dry years following wet or above normal years, DWR will operate SMSCG for 60 days, to maximize the number of days that 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 the SMSCG is required. In dry years following below normal years, DWR will operate SMSCG for 30 days to maximize the number of days Belden's Landing three-day 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 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. Subsequently, DWR and Reclamation may propose alternative operations of the SMSCG for WOMT to consider prior to May 15 of each year a SMSCG action will be required. DWR and Reclamation, through the DCG, will develop a monitoring plan that responds to uncertainties in the performance metrics to evaluate action performance based on a schedule determined by the Adaptive Management Steering Committee (AMSC). DWR and Reclamation will also produce a report that summarizes monitoring findings and assess action performance based on a schedule determined by the AMSC. The Summer-Fall Habitat Action (SFHA) shall be included in independent reviews under the adaptive management program.

3.7.7 Tracy Fish Collection Facility

The Tracy Fish Collection Facility addresses the entrainment stressor. Reclamation will operate the Tracy Fish Collection 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 Collection Facility, the secondary channel is operated to achieve water approach velocities for striped bass of approximately 1 to 2.5 feet per second from June 1 through October 31 and for salmon of approximately 3 feet per second from November 1 through May 31.

Salvage of fish at the Tracy Fish Collection 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 Tracy Fish Collection Facility or Skinner Fish Facility or when a temperature trigger of 53.6°F (12°C) at nearby California Data Exchange Center stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m. The standard operating procedures for the Tracy Fish Collection Facility are included in Attachment T.

To seek additional improvements to the operating procedures and reporting of the Tracy Fish Collection 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 (SDM) results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

3.7.7.1 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 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 Collection Facility and may not have discretion over when the maintenance must occur.

3.7.8 John E. Skinner Delta Fish Protective Facility

Skinner Fish Facility addresses the entrainment stressor. 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 Tracy Fish Collection Facility or Skinner Fish Facility or when a temperature trigger of 53.6°F (12°C) at nearby California Data Exchange Center stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m. The standard operation procedures for the Skinner Fish Facility are included as Appendix U.

To seek additional improvements to the Skinner Fish Facility; DWR proposes to develop the ALPS-IP. The ALPS-IP would include a structured decision-making (SDM) process to develop and implement a pilot study that would include consideration of additional studies and salvage facility loss parameterization and, potentially, procedural modifications. DWR will proceed with the following items, Debris Management Effectiveness Study, and facility improvements evaluations as described below and on the timelines provided.

3.7.8.1 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 Clifton Court Forebay radial gates.

3.7.8.2 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 WY 2023 as specified in the manual. Skinner Fish

Facility will have access to a staff biologist for consultation to support salvage staff, research studies, and special handling of tagged fish.

3.7.8.3 Fish Protection Facility Improvements

DWR proposes to continue to screen fish from Banks Pumping Plant with the Skinner Fish Facility, located west of the CCF, 2 miles upstream of the Banks Pumping Plant. DWR proposes to continue refinement and improvement of the Skinner Fish Facility fish sampling procedures and infrastructure to improve the accuracy and reliability of data and fish survival by:

1. Implementation of the ALPS-IP as part of the Alternative Loss Equation Pilot Study, which would include an SDM process to prioritize potential additional data needs, additional facility improvements to support salvaged listed fish species survival, and more accurate estimates of loss and loss parameters at the SWP and CVP export facilities.

2. Minimization of impacts from debris and excessive numbers of fish, which would include:

a. Continued implementation of the recently adopted fall herbicide application to CCF;

b. An Effectiveness Study to analyze the effectiveness of CCF herbicide application on debris management procedures;

c. If the results of the Effectiveness Study identify feasible additional improvements that require further development and/or prioritization, an SDM process may be utilized to develop improvement requirements including design criteria and/or procedures to implement the study recommendations (e.g. alternative methods of managing fish counts during periods of heavy debris and/or large numbers of fish); and

3. Implementation of updated training curricula as identified in Section 2.3.7.2, “Fish Protection Facility Operations Manual.”

Within one year from the ROD or ITP, whichever is later, DWR will submit a draft Effectiveness Study Plan to agency sub-directors for approval. The Effectiveness Study plan will include a timeline for study completion, and an SDM process for alternatives development and design criteria development with participation from DWR, CDFW, NMFS, and USFWS. At the conclusion of the SDM process, the SDM recommendations will be submitted to the sub-directors for implementation, as needed. In the interim, the historical count length reduction procedures for managing heavy debris and/or large numbers of fish will be used.

3.7.9 Tidal Habitat Restoration

DWR and Reclamation have or will carry out tidal habitat restoration acre targets identified from the 2008 and 2019 FWS 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 [ITP]). Currently, twelve restoration projects have been identified to satisfy the total acreage requirement of 8,396.3 acres (Table 3-12). 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 ITP). DWR and Reclamation will complete its 8,396.3 acre restoration requirements by 2026.

Table 3-12. Tidal Habitat Restoration

Project	Estimated Acres	Phase
Arnold Slough	138	Constructed
Decker Island	113	Constructed
Lower Yolo Ranch	1713	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	3000	Under construction
Prospect Island	1,500	Planning, construction planned in 2024
Chipps Island	687	Planning; construction planned in 2023

The process and documentation for design, protection and long-term management of these sites is described in Appendix V Tidal Habitat Restoration Administrative Process and Documentation Requirements.

3.7.10 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 U.C. Davis Fish Conservation and Culture Laboratory (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 125,000 fish by water year 2024, a minimum 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. 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.

3.7.11 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 are transfers of water, up to contract totals, between CVP contractors within counties, watersheds, or other areas of origin (e.g., Accelerated Water Transfers). These transfers do not require demonstration of that water being consumptively used or irretrievably lost to beneficial use.

Transfers not meeting these requirements, including Out of Basin transfers (e.g., Long Term Water Transfer Program (North to South-of-Delta Transfers, Long Term San Joaquin River Exchange Contractor 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 transfers (i.e., reducing consumptive use by crop idling, contractor reservoir releases or groundwater substitution) have separate ESA section 7 consultation (see Programs in the Environmental Baseline for additional information), and are not part of this consultation. However, the specific timing and operations associated with the movement of the water to be transferred is a component of this Proposed Action and, thus, covered by this consultation. Updated in 2019, the paper provides detailed information on establishing transfers and how to complete a particular transfer and document it in a way to prevent harm to other legal users of water. The following is a brief summary from the Water Transfers White Paper on making water available for transfer. Making water available for transfer is not a part of this Proposed Action:

- **Cropland Idling/Crop Shifting Transfers:** Water from idling cropland or growing lower-water-use crops. The seller reduces surface water diversion from their normal operations.
- **Groundwater Substitution Transfers:** Water from reducing surface water diversions and replacing that like amount water with groundwater pumping.

- **Reservoir Storage Release:** Water from seller releasing stored water from their reservoir in excess of what would be released annually under their normal operations (e.g., reservoir storage targets, historical operation patterns, instream flow requirement, conveyance losses, refill, and other downstream obligations).

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 water, Reclamation and DWR may restrict transfers. Maximum transfers are shown in Table 3-13.

Table 3-13. 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.

In general, a north to south water transfer involves an agreement between a willing seller and a willing buyer to use available infrastructure capacity to convey water between the parties. To make water available for transfer, the willing seller must take action to reduce the consumptive use of water or release additional water from reservoir storage (i.e., Water Transfers White Paper). This water is then conveyed to the buyers' service area for beneficial use.

Programs to make transfer water available not included in this consultation include:

- Long Term Water Transfer Program (North to South-of-Delta Transfers)
- Long Term San Joaquin River 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.

3.7.12 Agricultural Barriers

Agricultural barriers maintain water levels for south Delta agricultural diverters. DWR has renewed permits from the USACE for the installation of three agricultural barriers in the south Delta for 2023-2027. DWR may install barriers as early as May 1 in Old River near Tracy 0.5 mile upstream of the Tracy Fish Collection 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).

3.7.13 Barker Slough Pumping Plant

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

3.7.13.1 Maximum Spring Diversions

DWR operates the Barker Slough Pumping Plant (BSPP) to divert water from the North Delta into the North Bay Aqueduct. 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.

3.7.13.1.1 Barker Slough Pumping Plant Protections for Larval Delta Smelt

Barker Slough Pumping Plant maximum spring diversions addresses the entrainment risk and transport direction stressor for Delta smelt. Cumulative Barker Slough Pumping Plant diversions for the March to June period, at design capacity, is 42 TAF.

The incidental take of larval Delta smelt at the Barker Slough Pumping Plant 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) Barker Slough Pumping Plant 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 Barker Slough Pumping Plant operations.

3.7.13.1.2 Barker Slough Pumping Plant Conservation Measures

3.7.13.1.2.1Larval 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.

3.7.13.1.2.2Larval 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.

3.7.13.2 Maintenance

Fish screen cleaning, sediment removal, and aquatic weed removal at the Barker Slough Pumping Plant is needed year-round to maintain operation of the Barker Slough Pumping Plant. 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. Attachment W provides the operating manual and details for Barker Slough Pumping Plant maintenance, including best management practices to minimize adverse effects on listed species.

3.7.14 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 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 Clifton Court Forebay. Algal blooms degrade drinking water quality through production of taste and odor compounds or algal toxins. DWR will apply herbicides and algaecides or will use mechanical harvesters on an as-needed basis to control aquatic weeds and

algal blooms in the Clifton Court Forebay. The March 2023 Clifton Court Forebay Aquatic Weed Management Standard Operating Procedures provides the operations manual and details for Clifton Court Forebay Weed Management, including best management practices to minimize adverse effects on listed species.

3.7.15 B.F. Sisk Dam Raise and Reservoir Expansion

Upon completion of construction, Reclamation and DWR will operate Delta facilities with an expanded San Luis Reservoir. The raising of Bernice Frederick Sisk Dam will increase reservoir storage capacity by 130 TAF. Reclamation and DWR completed a final EIS/Environmental Impact Report in September 2019 for the addition of shear keys and downstream stability berms to provide seismic stability for the embankment during a large earthquake and to raise the dam crest by 12 feet. Reclamation consulted with the USFWS on construction and signed a record of Decision in October 2023. This Proposed Action consults on the operational effects from increased exports with an expanded San Luis Reservoir.

3.7.16 Suisun Marsh – Roaring River Distribution System Fall Flood-Up

This Proposed Action includes DWR's operation of the Suisun Marsh Facilities (SMSCG, RRDS, MIDS and GYSO) in accordance with the Suisun Marsh Preservation Agreement (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 Montezuma Slough. The duration of gate operation may range from no use to full use for the entire September through May period. Assuming no significant long-term changes in the operational data, gate operations (outside of additional actions described under Delta Smelt Summer-Fall Habitat Action) will continue as necessary to meet D-1641 and SMPA standards.

The Roaring River Distribution System (RRDS) was constructed to provide lower salinity water to approximately 8,000 acres of managed wetlands. RRDS diversion rates have been controlled to maintain a maximum approach velocity of 0.2 feet/second at the intake fish screen except for a 5-week contiguous period (5-week flood-up window) when RRDS diversion rate will be controlled to maintain a maximum approach velocity of 0.7 feet/s for fall flood-up operations. The dates of the 5-week 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. The Proposed Action includes operation of the RRDS for a 5-week flood up period each year.

If Reclamation and DWR reinitiate the consultation on the SMP (i.e., *Biological Opinions on the Proposed Suisun Marsh Habitat Management, Preservation, and Restoration Plan and the Project-Level Actions in Solano County, California*), operations of the Suisun Marsh Facilities would be included in their entirety under those consultations and no longer under the long-term operation of the CVP and SWP ROD.

3.8 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 (Figure 3-7).

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.

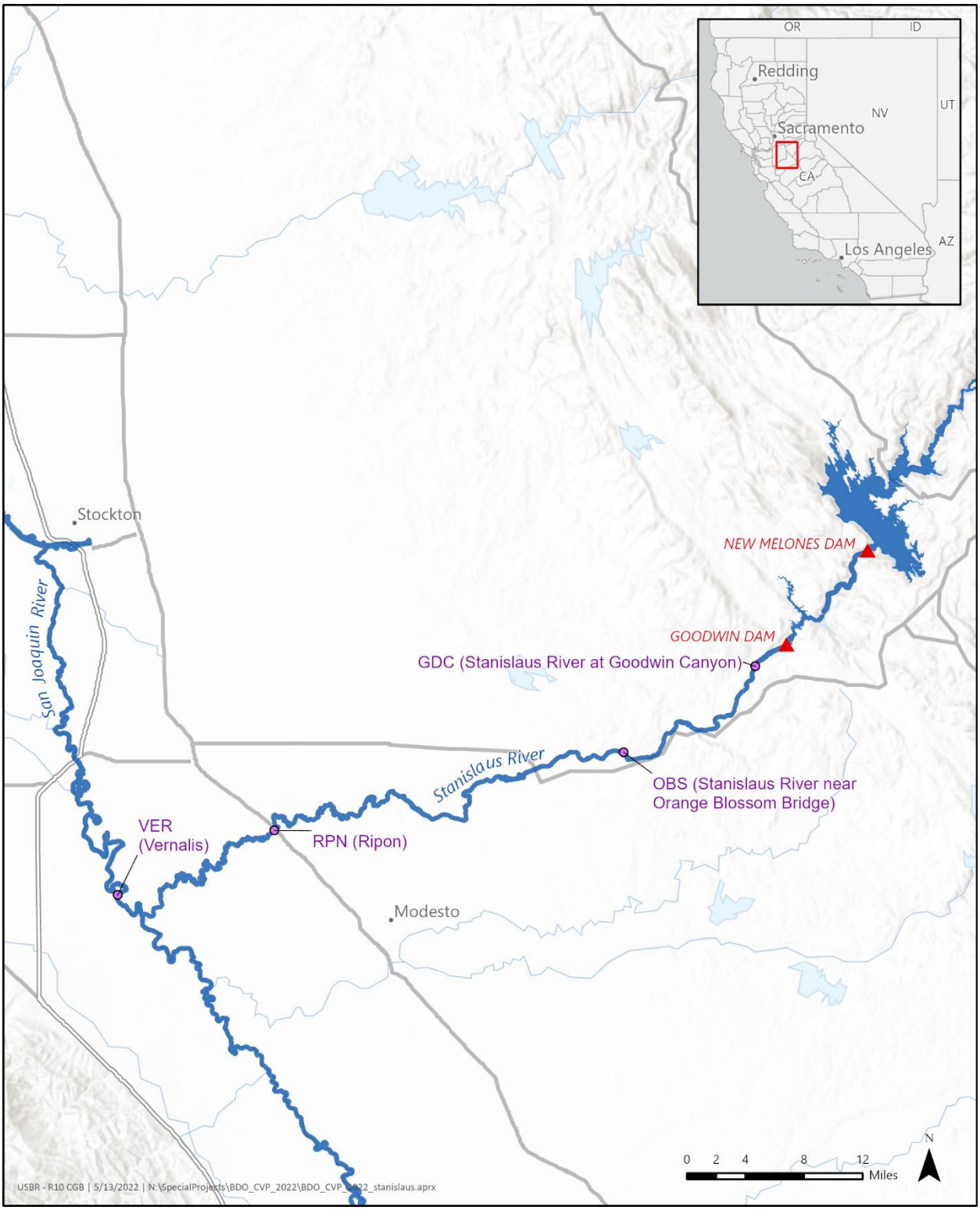


Figure 3-7. Map of the Stanislaus River and Eastside Division

Statutory and Regulatory Requirements, see Appendix A:

- 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
- USACE Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California (April 1959)
- 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 CDFG)
- Minimum Dissolved Oxygen standards: State Water Board D-1422
- State Water Board D-1641, D-1422, 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

Programs in the environmental baseline to highlight:

- Spawning and Rearing Habitat Restoration
- Temperature Modeling Platform

3.8.1 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 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.

Reclamation is required to maintain applicable dissolved oxygen standards on the lower Stanislaus River for species protection. The 7.0 milligrams per liter (mg/L) dissolved oxygen 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 at Vernalis in October for fish attraction. Otherwise, Reclamation operates to base flow requirements in order to rebuild storage. If necessary, releases might be made for dissolved oxygen at Ripon or EC concerns at Vernalis, but these are rare.

3.8.2 Ramping Rates

Ramping rates address the stranding risk stressor. Reclamation will coordinate releases on the Stanislaus River as shown in Table 3-14. For determining the water year type, Reclamation will use the San Joaquin Valley "60-20-20" Water Year Hydrologic Classification (60-20-20) developed for D-1641 implementation and based on a 90% exceedance forecast.

Table 3-14. 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 Water Year Type Rate of Increase (cfs per 2 hours)	C and D Water Year Type Rate of Decrease (cfs per 2 hours)
At or above 4,500	250	250	250	250
2,000 to 4,499	500	250	500	250
500 to 1,999	250	100	500	200
300 to 499	100	50	200	100

cfs = cubic feet per second; C = critical (60-20-20 San Joaquin Index); D = dry (60-20-20 Index).

Reclamation, through the Stanislaus Watershed Team, 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 Stanislaus Watershed Team, 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.

3.8.3 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 3-8; Appendix N Attachment N (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 3,000 cfs in the default schedule.

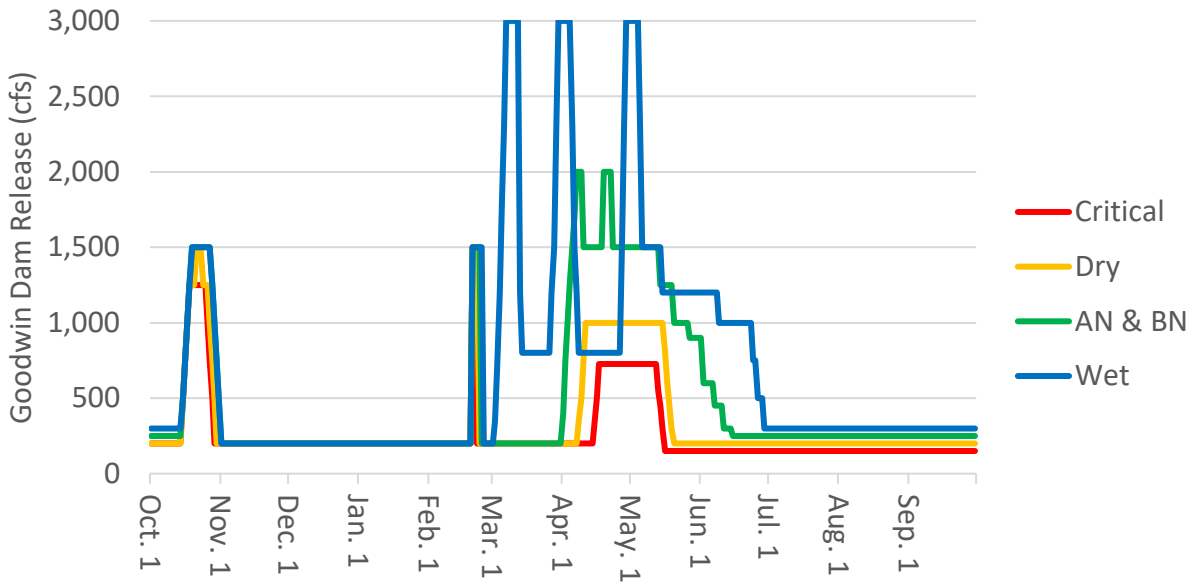


Figure 3-8. 2023 New Melones Stepped Release Plan with Modified Winter Instability Flows

For determining the water year type, Reclamation will use the San Joaquin Valley "60-20-20" Water Year Hydrologic Classification (60-20-20) 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:

3.8.3.1 Winter Instability Flows

Winter instability flows address the outmigration and juvenile habitat stressors. 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 Stanislaus Watershed Team, 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 necessary. Reclamation, through the Stanislaus Watershed Team, will prepare an assessment when rain events meet the need for winter instability flows and not require additional releases.

3.8.3.2 Spring Pulse Flows

Spring pulse flows address the outmigration and juvenile habitat stressors. Reclamation will release additional flows starting as early as March through as late as June. Reclamation, through the Stanislaus Watershed Team, will schedule spring pulse flow volumes consistent with volumes in the Stepped Release Plan.

3.8.3.3 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 Stanislaus Watershed Team, will schedule fall pulse flow volumes consistent with the volumes in the Stepped Release Plan and considering other system objectives.

3.9 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 (Figure 3-9). 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.

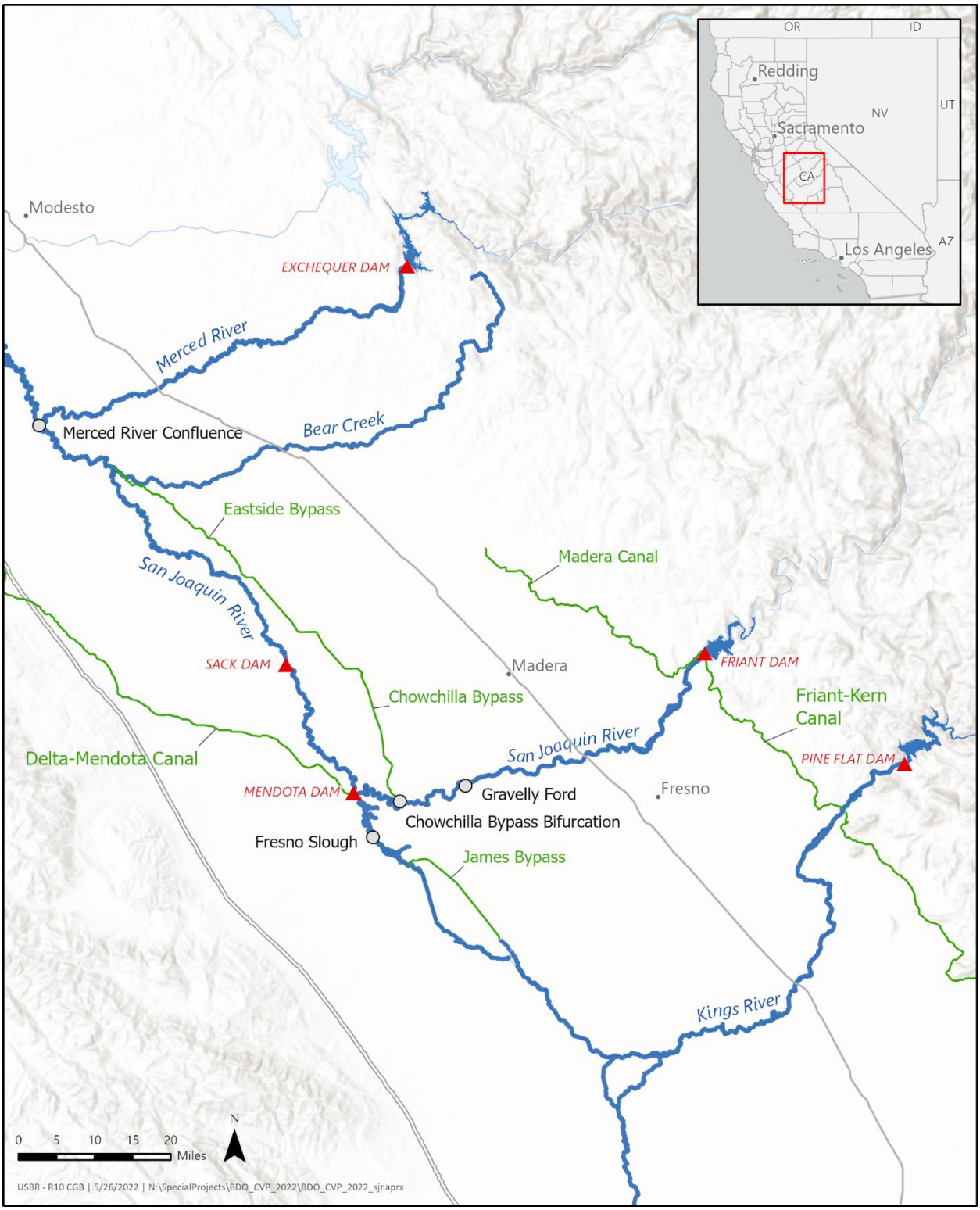


Figure 3-9. Map of the Friant Division and San Joaquin River

Statutory, Regulatory, and Contractual Requirements

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

Programs in the environmental baseline to highlight

- San Joaquin River Restoration Program

Reclamation would operate the Friant Division consistent with the San Joaquin River Restoration Program Record of Decision, which is a related action not included in this consultation.

3.10 Monitoring

Reclamation and DWR would undertake monitoring to inform long-term operations associated with this Proposed Action. Monitoring is necessary to determine and help avoid and minimize the effects of the Proposed Action, including minimizing anticipated incidental take, and informing specific real-time actions.

Because of the ongoing nature of the Proposed Action, ongoing monitoring efforts to inform operational actions and effects of those actions are currently occurring under existing and separate Section 7 consultations and section 10(a)(1)(A) permits and are described in the Baseline. Potential future changes to monitoring programs associated with the operation of the CVP and SWP will be addressed as a Framework Programmatic consultation.

Some programs in the environmental baseline currently provide incidental take coverage for monitoring associated with the Coordinated Operation of the CVP and SWP. Active ESA-listed species take permits and consultations cover real-time monitoring surveys, status and trend surveys, and current special studies. Please refer to Chapter 2, *Environmental Baseline*, for more detail on these ongoing monitoring efforts, including regulatory mechanisms that are in place to exempt take from these efforts.

Reclamation and DWR propose a Framework Programmatic consultation approach to include as part of this Proposed Action that addresses future changes to monitoring associated with the Proposed Action. 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 incidental take coverage associated with the operation of the CVP and SWP. The Framework Programmatic consultation approach specifies that material changes to monitoring efforts and/or ESA compliance would require subsequent consultation.

Reclamation and DWR provide funding to various partners for ongoing monitoring efforts associated with the long-term operation of the CVP and SWP. Section 7 compliance and incidental take coverage would continue to be provided by the existing consultations and permits outlined in the environmental baseline section until and if Reclamation and DWR complete a subsequent consultation with FWS and NMFS on changes to monitoring. Changes outside the scope and effects in the existing consultations and permits are not authorized to commence until the subsequent consultation is completed.

The Framework Programmatic consultation approach for monitoring includes the following principles which would be incorporated into any future changes to monitoring programs addressed in a subsequent consultation:

- Ensure monitoring will be beneficial to long-term operation of the CVP and SWP for:
    - minimizing effects on listed species and habitat (informing real-time operations, understanding species status, etc.)
    - understanding if various operational objectives are met (e.g., effectiveness and validation monitoring); and
    - measuring if and when the reinitiation trigger associated with amount or extent of incidental take has been met.
- Confirm that data collected should meet data quality objectives and open data practices;
- Establish multi-agency collaborative approach including management structure for decision making;
- Ensure scientific rigor of new or modified monitoring and achieving objectives of new or modified monitoring;
- Develop and test mechanisms for learning and adopting new technologies, while maintaining comparability and continuity to historical information on fish and the environment;
- Incorporate a fish, aquatic habitat, and ecosystem monitoring enterprise for the long-term operations of the CVP and SWP should effectively measure physical conditions, water quality, primary and secondary production; abundance, distribution, and production of ESA-listed species (natural and hatchery origin); Delta and tributary fish assemblages; and salvage at the CVP/SWP fish collection facilities;
- Establish mechanisms for close coordination with any existing or future adaptive management program; and
- Provide for robust synthesis of monitoring data to incorporate results and lessons learned.

Monitoring of the LTO operations is subject to change over time by implementing these principles to improve monitoring where incorporating the best available scientific information indicates such change is appropriate. If and when Reclamation and DWR decide changes to a given monitoring program is necessary, Reclamation will provide the supporting information to USFWS and NMFS to support subsequent section 7 consultation as outlined in 50 CFR 402.14.

3.11 Special Studies

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. Studies are incorporated for the following reasons:

1. The study design is complete, implementation is needed to authorize the LTO, and success is not reliant on requiring flexibility to make future changes.

2. Incidental take is likely required: This consultation seeks the necessary incidental take coverage, if not already covered.

3. The new information may reveal effects and/or warrant a modification of the Proposed Action in a manner or to an extent not previously considered: Analysis could consider a broader potential range of operations and/or different confidence in likelihood of effects from operations.

The criteria for identification of a special study in the Proposed Action balances uncertainty and flexibility. Reclamation would not rely on uncertain outcomes from a study but may require direct or incidental take to conduct the study. Requiring modifications to this Proposed Action to change special studies may impose unnecessary administrative delays or risk an unnecessary need for reinitiation of consultation.

Special studies in the Proposed Action are described below.

3.11.1 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.

3.11.1.1 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.

3.11.1.2 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.

3.11.1.3 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 FWS, 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 independent panel review 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, 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 anticipate conducting the second independent panel review 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.

3.11.2 Spring-Run Juvenile Production Estimate and Life Cycle Model

3.11.2.1 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 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 (California Department of Water Resources 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 an SR-JPE ready for implementation in 2026, 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.

3.11.2.2 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 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 (CV) 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 develop 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. 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:

1. 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.
2. Following the independent peer review, 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. 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.
3. The SR-JPE Core Team will review the spring-run Chinook Salmon hatchery surrogate OMR measure .
4. DWR, CDFW, Reclamation, and NMFS will meet to contemplate development of a new or modified spring-run Chinook Salmon hatchery surrogate OMR measure informed by the independent peer review panel input on the SR-JPE framework, historical spring-run Chinook Salmon 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 measure, and other relevant information (for example Georgiana Slough monitoring data). Any new approach for spring-run Chinook Salmon will:

    a. Take into account the limitations of the initial SR-JPE approach to calculate the SR-JPE

    b. Be an interim approach to be refined as the SR-JPE approach evolves and the SR-LCM is completed

    c. Anticipate future iterations and refinements of SR-JPE approach

    d. Rely primarily on monitoring data rather than salvage data

5. 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 and spring-run

Chinook Salmon hatchery surrogate OMR measure review are completed, whichever is later.

5. 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 Plan (including monitoring), and ensure all data obtained through long-term monitoring programs is stored in a publicly accessible repository.
6. 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.
7. DWR and Reclamation will assemble the Lifecycle Modeling Subteam for coordination between the lead life cycle modeler and the SR-JPE Core Team.

Required actions in 2027:

1. If approved by CDFW and NMFS, DWR and Reclamation will implement the new or modified spring-run Chinook Salmon OMR 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 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 they become 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 Lifecycle 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:

1. Under the guidance of SR-LCM Management Team and SR-JPE Core Team, the Lifecycle 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:

1. Following the independent peer review, the SR-JPE Core Team and the Lifecycle Modeling Subteam will review independent peer review panel input (if convened) and the SR-JPE Core Team will use SDM to evaluate and implement changes to the SR-JPE model and the initial SRLCM.

3.11.3 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, etc.). that may enhance food web production and rearing habitat for Delta smelt. The process for completing the administrative documentation to ensure these restoration sites are protected, monitored, and managed so that they function as intended long-term. This process is described in *Appendix V: Tidal Habitat Restoration Administrative Process and Documentation Requirements.*

3.11.4 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.

3.11.5 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

3.11.6 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.

3.11.7 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.

3.11.8 Delta Smelt Summer and Fall Habitat

DWR and Reclamation will consider food subsidy measures to augment the Summer-Fall Habitat Action. 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 Summer-Fall Habitat Action 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 Summer-Fall Habitat Action, or if appropriate, termination of actions deemed ineffective.

3.11.9 Longfin Smelt Science Plan

DWR, in coordination with Reclamation, will implement science activities identified in the 2020 ITP 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.

3.11.9.1 Longfin Smelt Science and Monitoring Initiatives

DWR and CDFW, in collaboration with the State Water Contractors and USFWS, developed the LFSSP to meet a requirement in the 2020 ITP, and the LFSSP was finalized on December 8, 2020. DWR, in coordination with Reclamation, will support the implementation of the Longfin Smelt Science Plan (LFSSP) through a multi-agency process. 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.

3.11.10 Management of Winter-run Spawning Location and Timing

Reclamation will study how flow and temperatures can be used to manage Sacramento River winter-run Chinook salmon spawning on the Sacramento River. Reclamation will support the applicable costs and implement the results of the studies, contingent on available appropriations, to improve future management as applicable. This action does not specify the funding level for this project, only the commitment to fund as appropriations are available. 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 winter-run Chinook salmon 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 winter-run Chinook salmon 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 winter-run Chinook salmon reproductive performance on the Upper Sacramento River (National Marine Fisheries Service 2014, Bureau of 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 winter-run Chinook salmon 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 on 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 TDM and estimate potential decreases in the Shasta Reservoir Cold Water Pool 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 and/or 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 winter-run Chinook salmon 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, and committed funding levels, contingent on available appropriations, to implement the action. When research actions are completed, Reclamation will report the result to the Sacramento River Temperature Task Group for potential implementation into temperature management.

Potential research actions may include:

- Summarize available literature on thermal tolerance for adult Sacramento River Winter-Run Chinook 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 Sacramento River winter-Run Chinook salmon 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.

3.11.11 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 (CV) steelhead. DWR, in coordination with Reclamation, proposes to further refine the parameters of this tool by developing an 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. The ALPS-IP will be completed in coordination with the Skinner Fish Facility and Salvage Release sites improvements activities and if practicable will be utilized to further enhance these activities.

DWR and Reclamation propose to collaborate on the following actions:

1. ALPS-IP Development

- Within six 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 Contractors, and Reclamation.
- Within six 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:
    - 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 CV 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 four 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 one month of receiving CVFFRT, SaMT review, and subsequent agency sub-director comments/approval DWR would finalize the ALPS-IP.

2. Pilot Study Implementation and Prioritization

- DWR and Reclamation shall conduct the ALPS-IP pilot study as defined.
- DWR and Reclamation would utilize the ALE-TT and the defined SDM procedures to complete a prioritization of the pilot study recommendations for further implementation.
    - The ALE-TT may utilize an independent science panel review to further enhance the SDM prioritization process.
- DWR and Reclamation shall complete the Pilot Study and prioritized recommendations within 1.5 years of completing the ALPS-IP and submit final recommendations to the agency sub-directors for approval.

3. Implementation Prioritization recommendations

- DWR and Reclamation shall proceed with the recommendations for further implementation

The ALPS-IP, Pilot Study, the prioritization of the recommendations for further implementation, and implementation shall be completed within 7 years after the latest effective date of the ROD or ITP.

3.11.12 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.

3.12 Drought

Starting each October, Reclamation and DWR, through the Drought Relief Year 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, Appendix Q 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.

3.13 Governance

Governance information is described in the following sections.

3.13.1 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 represents the science, policy and management based on the best of their ability and current knowledge. Representatives come 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:

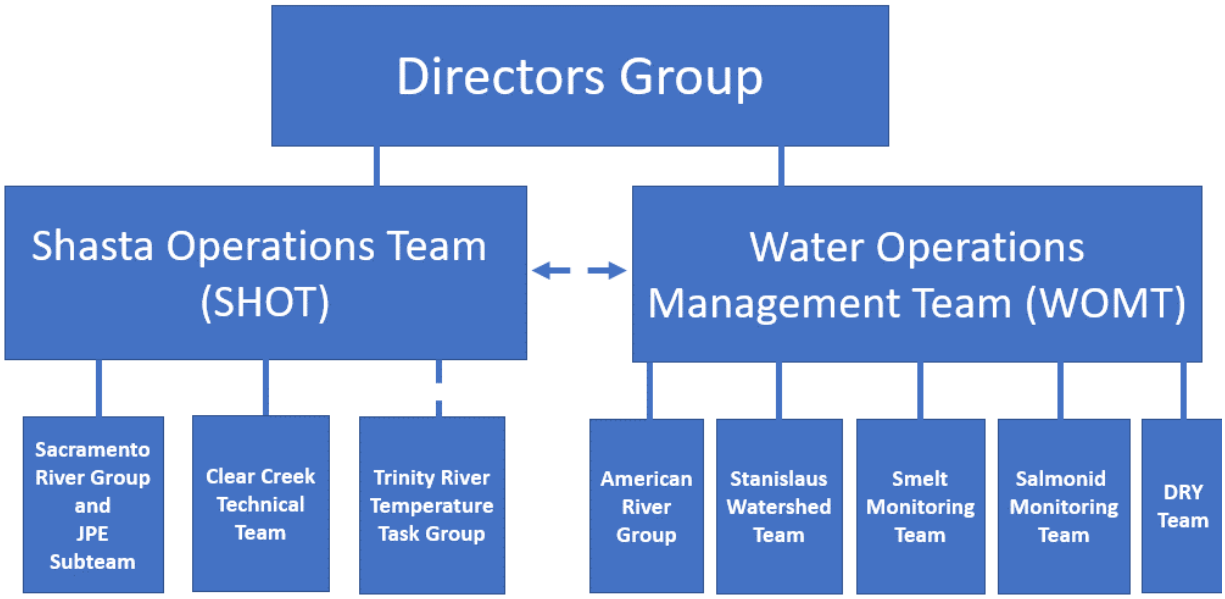
- **Collaboration—**The leading principle of CVP/SWP Governance is collaborative, science-based decision making. CVP/SWP governance is structured to seek consensus across scientific, technical and policy levels, with elevation and decision making processes in place when consensus cannot be reached.
- **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.

3.13.2 Organizational Structure and Description of Collaborative Teams by Division

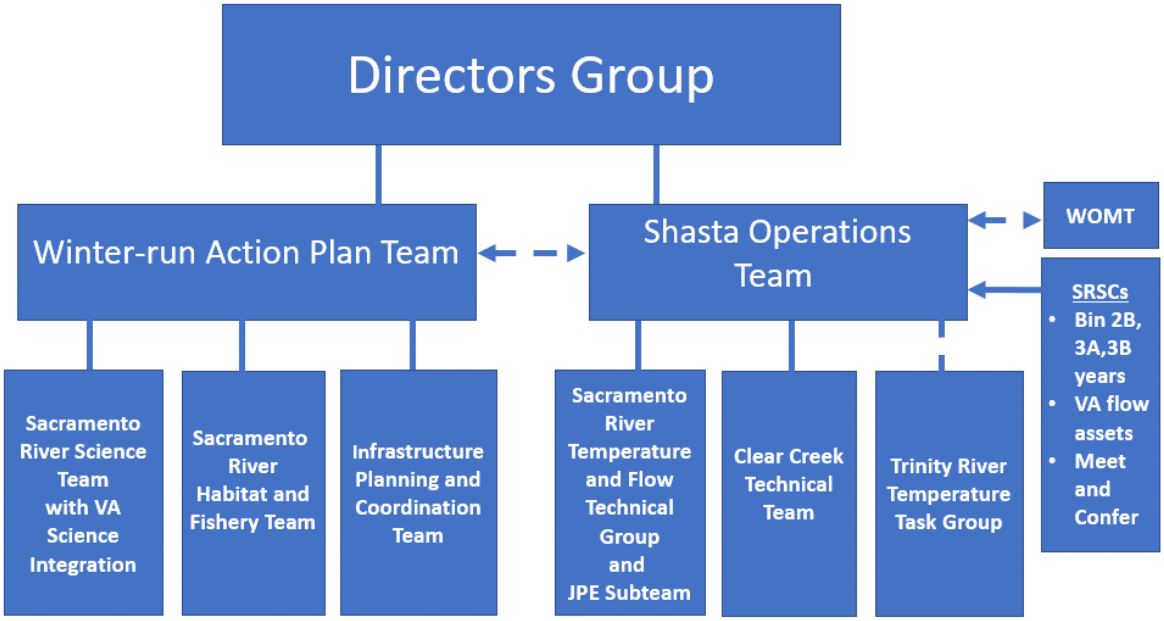
CVP/SWP Governance is structured such that a 5 Agency Directors Group oversees the ongoing authorities of each respective agency and serves as the final decision making body for operational matters. The Directors Group directly interfaces with two management and policy level groups (SHOT and WOMT), whose Federal and State agency representatives discuss the actions described in the Proposed Action 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 3-10 illustrates the CVP/SWP structure for water operations.

Figure 3-11 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 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 3-10. Governance Structure for the Central Valley Project and State Water Project Water Operations



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 SRSCs indicates SRSC integration into SHOT.

Figure 3-11. Governance Structure for Shasta and Sacramento River Activities

3.13.3 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.

3.13.3.1 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 Proposed Action 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 SRSCs. 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, SRSCs, WAPA, the State Water Board, 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.

3.13.3.1.1 Shasta Operations Team

A SHOT consisting of Agency subdirectors and managers will serve as the management and policy group for decisions related to Shasta 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 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 the Proposed Action, the SHOT will work together, with input from the Sacramento River Temperature and Flow Task Group, to manage Sacramento River Basin Voluntary Agreement (VA) assets. Relevant operational actions that VA assets are intended to support include Shasta Reservoir cold water 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.

3.13.3.1.2 Sacramento River Temperature and Flow Technical Group

The Sacramento River Temperature and Flow Technical Group 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 State Water Board, WAPA, the Yurok Tribe, the Hoopa Tribe and the Sacramento River Settlement 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 Temperature Management Plan 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 Temperature Management Plan at the request of the SHOT. At the conclusion of the 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.

3.13.3.1.3 Meet and Confer Group

The SRSCs 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 SRSCs will meet and confer with Reclamation, NMFS, and other agencies, as appropriate, to determine if there is any role for the SRSCs 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 SRSCs; (2) voluntary, compensated water transfers by the SRSCs subject to Reclamation approval; and (3) delayed SRSC 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 SRSCs at any time during the winter or spring months. According to the SRSC's resolution, this group may agree to invite the USFWS, CDFW, and/or the State Water Board 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 SRSC actions with the SPG.

3.13.3.2 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 National Fish Hatchery.

3.13.3.3 Trinity River Division – Clear Creek

The Clear Creek component of the Trinity River Division includes the Clear Creek Technical Team and SHOT. The Clear Creek Technical Team will provide technical input to Reclamation on habitat restoration and the shaping and timing of flows released from Whiskeytown Dam to optimize biological benefits downstream and provide recommendations on operations to meet temperature criteria. SHOT will coordinate with the Clear Creek Technical Team, 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.

3.13.3.3.1 Clear Creek Technical Team

The Clear Creek Technical Team 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 provide 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.

3.13.3.4 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, the SMT and the 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.

3.13.3.4.1 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 Old and Middle River 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 Proposed Action 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.

3.13.3.4.2 Smelt and Salmonid Monitoring Teams

The Smelt and Salmonid Monitoring Teams (SMT and SaMT, respectively) includes participants from Reclamation, USFWS, NMFS, DWR, CDFW, and the State Water Board. 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 the Proposed Action and risk assessments.

Agency team leads: (1) notify their agency's WOMT representative(s) if a Proposed Action/ITP identified trigger/threshold is or will be met; (2) provide input on any assessment prepared by Reclamation and DWR : 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:

3.13.3.4.3 Delta Monitoring Workgroup

DWR and Reclamation will convene the Delta Monitoring Workgroup (DMW) if a real-time assessment in triggered. Interested parties may provide information and supporting documentation for DWR and Reclamation to share with WOMT. If WOMT does not reach consensus on an operational outcome, interested party supporting documentation will be provided to the Directors for consideration of their final decision. DWR and Reclamation will revise the existing Delta Monitoring Workgroup charter within six months of the ROD.

3.13.3.4.4 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 Suisun Marsh Salinity Control Gate 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.

3.13.3.5 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 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.

3.13.3.5.1 American River Group

A group of federal, state, and local agencies, water users, and non-governmental organizations (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, FWS, and NMFS. The ARG will provide technical input on shaping Redd Dewatering Projective Adjustments. The draft Temperature Management Plan 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 3 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.

3.13.3.6 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 Stanislaus Watershed Team (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.

3.13.3.6.1 Stanislaus Watershed Team

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:

3.13.3.6.2 Stanislaus River Forum

The Stanislaus River Forum is an open forum for all interested stakeholders to receive Stanislaus River Operations updates and to provide feedback for SWT and Reclamation consideration. The Stanislaus River Forum 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.

3.13.4 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 the LTO Proposed Action.

3.13.4.1 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.

3.13.4.1.1 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.

3.13.4.1.2 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 the opportunity to dispute a decision within 2 days, providing a written explanation of the nature of the dispute. The proposing agencies 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 the proposing agency determines may create a potentially high risk to Project infrastructure or liability to the United States or State of 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.

3.13.4.2 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.

3.13.4.3 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.

Consistent with the Proposed Action for the Shasta Division, the SHOT will work together, with input from the Sacramento River Settlement Contractors, to manage Sacramento River Basin Voluntary Agreement (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 cold water 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.

3.13.4.4 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 the SHOT section above and, if necessary, the procedure in the Directors section above.

3.13.4.5 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.

3.13.4.6 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 is 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 the SHOT section above and, if necessary, the procedure in the Directors section above.

3.13.4.7 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 is individually responsible for communicating the issues and any background information to their WOMT representative. The decision making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.13.4.8 Smelt and Salmonid 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 a Proposed Action/ITP identified trigger/threshold is or will be met; (2) provide input on the Proposed Action assessment and any assessment prepared by Reclamation and DWR : 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 is individually responsible for communicating the issues and any background information to their WOMT representative. The decision making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.13.4.9 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 is individually responsible for communicating the issues and any background information to their WOMT representative. The decision making process will follow the procedure described in the WOMT section above and, if necessary, the procedure in the Directors section above.

3.14 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.

DWR, CDFW, Reclamation, USFWS, and NMFS (collectively, “the Implementing Entities”) intend to utilize adaptive management to inform the long-term operations of the SWP and the 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 to coordinate through individual Adaptive Management Teams 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 Adaptive Management Steering Committee 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 R. Attachment 1 to the Adaptive Management Program describes the steps required to implement the adaptive management process and explains how the process links to the operations of the SWP and CVP. Attachment 2 to the Adaptive Management Program 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 Adaptive Management Teams responsible for implementing them:

- Winter-run Chinook Salmon OMR Management
- Spring-run Chinook Salmon 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

3.15 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[15]. This consultation includes a mix of standard consultation and programmatic consultation (which can include an Incidental Take Statement or defer the Incidental Take Statement 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 Proposed Action 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 Proposed Action 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 the LTO Proposed Action along with broadly assessing the impacts of the operations of these projects in the context of the LTO Proposed Action. 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.

Reclamation proposes to initiate section 7 consultation for the non-operational construction and maintenance components of Sites and U.S. Army Corps of Engineers proposes to initiate section 7 consultations for the non-operational construction and maintenance components of the DCP, both separately from LTO. These construction-focused consultation efforts will proceed in-parallel with this Proposed Action.

---

[15] 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.

In the future, Reclamation also proposes to initiate section 7 consultation for the operational components of Sites and DCP. As these separate future consultations are completed for each project and as Reclamation makes a decision regarding each project, each will become part of the Environmental Baseline and will need to be incorporated into the modeled baseline condition for subsequent projects, including any future reinitiations of consultation for LTO. In order to ensure effects of Sites and DCP are sufficiently addressed, those separate section 7 consultations, including construction-focused consultation efforts noted above, will reference this framework when addressing the effects of operations of each of these projects. Reclamation will ensure that section 7(d) is adhered to by ensuring operations will not commence before completion of project-specific section 7 consultation for operations. In addition, implementation of any potential construction-related activities prior to completion of the future section 7 operations consultation would not affect the requirement for Reclamation to implement, if necessary, Reasonable or Prudent Alternatives identified during subsequent consultation.

Project descriptions for the proposed Sites and DCP, as well as the proposed approach for considering operational effects of Sites and DCP in relation to the updated LTO Proposed Action, are provided below and are proposed to be addressed programmatically.

3.15.1 Future Project Considerations and Regulatory Processes

Both the Sites and DCP projects are subject to future consultations under Section 7 of the ESA. Both projects are subject to the requirements of Section 2081 of the California Endangered Species Act (CESA) and future coordination with CDFW will likely be required to ensure consistency with compliance under both the ESA and CESA. Since it will be several years before these projects become operational, there are other factors (e.g., climate change) that will need to be addressed in future project design modifications, as feasible, and operational criteria refinements. In addition, there are other regulatory processes and approvals that could influence final operation of these projects or final design. These potential changes would need to be addressed in the future ESA consultations. These future processes include, but are not necessarily limited to:

- Completion of CEQA and a decision on whether to approve Sites, or an alternative, by the Sites Authority and the DCP, or an alternative, by DWR; additional CEQA compliance may be necessary where additional discretionary decisions require review of new information, a change in circumstances, or change in the project.
- The water rights process administered by the State Water Board for both Sites and DCP, which is expected to result in separate water rights orders that may limit how water will be diverted from the Sacramento River. DWR is not proposing to increase the existing SWP water right for DCP and will only request a change in point of diversion for the SWP water rights. Sites is petitioning the State Water Board to obtain new water rights for diversion and storage.
- Updates to the Bay-Delta Water Quality Control Plan by the State Water Board, which may result in changes in the operational parameters for both Sites and DCP.
- Consistency with the Delta Plan for DCP per the requirements of the Delta Reform Act.

- Coordinated operations agreement(s) between Reclamation and DWR (and Sites for Sites operations) which will need to incorporate DCP and Sites into the existing CVP and SWP coordinated operations system and would specify how water will be transferred, exchanged, and exported.
- Authorizations from the U.S. Army Corps of Engineers under the Clean Water Act and Rivers and Harbors Act for certain aspects of each project.

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

3.15.3 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 to help supply food for delta smelt (*Hypomesus transpacificus*). 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 the Bureau of 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 Water Storage Investment Program 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 3-15. 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 (Final Environmental Impact Report/Environmental Impact Statement - Sites Reservoir (sitesproject.org)) that analyzes the impacts of the project and is included in this Biological Assessment by reference.

Table 3-15. Operational Programmatic Components of Proposed Sites Project

Sites Project Activity	Description
Diversions to Sites Reservoir, Operating	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

Sites Project Activity	Description
Criteria, and Diversion Criteria	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.
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.

3.15.4 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 is evaluating the project consistent with the portfolio approach and is currently reviewing the proposed project under CEQA with a Final Environmental Impact Report and decision on approval expected by the end of 2023.

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 3-16 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 BA, 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 3-16 describes key operational programmatic components of the Proposed Project.

Table 3-16. 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

DCP Project Activity	Description
	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).

3.15.5 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 no action, based on the projects' objectives.

3.15.6 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.

3.15.7 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.

3.15.7.1 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 3-18);
- 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 3-17 provides a summary of the Sites project minimum diversion criteria.

Table 3-17. 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 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.

3.15.7.2 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 3-19, 3-20a, and 3-20b describe the proposed DCP operational criteria.

Table 3-18. 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 table 3-20. 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

Parameter	Delta Conveyance Project Criteria
	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 3-19a. Proposed North Delta Diversion Bypass Flow and Pulse Protection Requirements

	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 3-19b). • 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 3-19b) 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 3-20b. 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
	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

Period	Level [a]	If Sacramento River flow		The bypass is…
		Is over…	But not over…	
		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
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.

3.15.8 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.

3.15.8.1 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

3.15.8.2 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

3.15.8.3 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:

7. 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:

8. 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.

3.15.8.4 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.

3.15.9 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.

3.16 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.

3.16.1 Winter run action plan

3.16.1.1 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 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 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 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 Reclamation, NMFS, USFWS, DWR, 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.

3.16.1.2 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
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, and funding sources. 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.

3.16.1.3 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;
- Collaboratively assess funding needs to implement each of the priority actions, identify available funding sources, and pursue additional funding sources, as needed;
- 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.

3.16.1.4 Partnerships and Governance

As described in Section 3.13, 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, funding, resource needs, 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.

3.16.1.5 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. Review budget annually to identify potential gaps in funding
4. Track and meet established milestones and deliverables

5. Track and adjust, as necessary, plan goals and priorities

6. Identify where sub-teams require additional guidance so that managers may that provide that direction to their participating staff where appropriate

7. Participants are responsible SHOT members are aware of activities under the WRAP

8. Coordinate on alternative actions to evaluate

9. Provide quarterly updates to agency Directors and partner Principals and elevate matters as described under Collaborative Decision Making

3.16.1.6 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

3.17 References

Allison et al. 2021

Anderson 2022

Bedwell et al. 2021

Blankenship et al. 2020

California Department of Fish and Wildlife 2020

California Department of Fish and Game 1999

Del Rosario et al. 2013

California Department of Water Resources et al. 2020

Harvey et al. 2022

Hendrix et al. 2017

Horndeski 2022

Jennings and Hendrix 2020

Johnson et al. 2017

Lindley et. al. 2007

Martin 2017

Mount et al. 2016

National Marine Fisheries Service 2019

National Marine Fisheries Service 2014

Reclamation 2019

Smith et al. 2021

Souchon et al. 2008

State Water Resources Control Board 2000

U.S. Fish and Wildlife Service 2019

U.S. Fish and Wildlife Service 2018

U.S. Fish and Wildlife Service 2020

White and Low 2006

Windell et al. 2017

Long Term Operations of the State Water Project and the Central Valley Project – Adaptive Management Program

1. Introduction

Adaptive management is a science and decision analytic-based approach to evaluate and improve management actions, with the aim to reduce uncertainty over time and increase the likelihood of achieving and maintaining a desired management objective. Decision analysis tools can be used to determine which uncertainties are important for management decisions, and which scientific approaches should be deployed to address those uncertainties considered necessary to inform subsequent decisions. When correctly designed and executed, adaptive management provides a means to evaluate management actions or programs (collectively "actions") and allows for evidence-based adjustments to the actions defined, to improve their effectiveness in achieving management objectives, if warranted. The adaptive management approach can provide a scientific basis for continuing or modifying an action or allow for an alternative action to be evaluated and implemented, if determined.

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 as a part of this Adaptive Management Program (Program).

The Implementing Entities anticipate that it may be necessary to undertake additional monitoring and research that builds on existing efforts in order to carry out this Program. The Implementing Entities will establish an Adaptive Management Steering Committee (AMSC) that will serve as the primary decision group for implementation of this Program. Members of the AMSC will include one designated sub-Director representative[1] and one designated alternate each from DWR, CDFW, Reclamation, USFWS, and NMFS. The AMSC's role in implementing this Program is described in Section 4a.

The Implementing Entities intend to use the AMSC to provide direction and guidance for work under this AMP through Adaptive Management Technical Teams (AMTs), coordinate each agencies participation, and assign existing work groups to the extent possible (for example the Delta Coordination Group (DCG)) to serve as AMTs, only creating new work groups if needed. Appendix A describes the role of adaptive management, as envisioned by this Program, to inform the long-term operations of the SWP and CVP. The AMSC will utilize AMTs and outside experts (as needed) to develop adaptive management plans or work plans to implement Adaptive Management Actions (AMAs) identified in this Program (Appendix B) and track required monitoring, data collection, research, and publications that inform future decisions (see Section 4b).

The Program will utilize a suite of decision support tools tailored to each action with consideration of each AMA's management objective, timeline, stage of development (i.e., initiating a new AMAs or continuing an existing longer-term effort), the anticipated application and or incorporation of information gained. The AMSC and its AMTs agree to use the fundamental components of Structured Decision Making (SDM) for AMAs identified in the Program including independent, floating facilitators to assist with problem framing, objective development, and information synthesis. Floating facilitators are intended to serve as independent, neutral facilitators of the entire AMP. Their role is to facilitate each

[1] "Designated Sub-Director Representative" means the official representative designated by the director of an Implementing Entity to act on her or his behalf.

individual AMT, ensuring the AMTs follow guidance and sideboards provided by the AMSC, fostering cross communication among AMTs when helpful, and working closely with assigned leads of each AMT. In addition to working directly with AMTs they will also facilitate the AMSC, foster communication between AMTs and the AMSC as needed to inform discussions and decision making, and assist in communicating guidance and sideboards from the AMSC to individual AMTs. Given the scope of the AMP, it is likely that a team of independent facilitators will be needed to serve these roles.

Appendix B provides an initial list of AMAs and expectations for monitoring and science activities to be implemented by the AMTs. Roles and responsibilities of the AMSC and AMTs are described in Sections 4a and 4b of this document. Independent science reviews may be used to evaluate progress towards reducing uncertainty and utilizing the best available science for informing CVP and SWP management (see Section 7c). Appendix B also sorts AMAs into Bins (1-3) based on the timeframe of their evaluation and the level of SDM tools anticipated to be needed for evaluation and decision making. AMAs to be included in Bin 1 will be managed adaptively based on present conditions, such as hydrology or annual species status, and will require quick decision-making relative to full SDM. Consultation and ITP amendment inquiries will be conducted, but reinitiation of consultation or an ITP amendment is not expected to be required to refine the approach to implementation after each evaluation. Bin 2 will apply to those AMAs that are iterated or linked over time whereby actions taken early on may result in learning that improves management within the next 3-8 years. The evaluation may trigger re-initiation of consultation or an ITP amendment for the actions, or not, depending on scope and scale of recommended change. Bin 3 will include AMAs for which agencies evaluate data over longer periods of implementation, on the order of 10-15 years. These AMAs require a full SDM process whereby qualified and independent facilitators will guide a structured decision-making process. It is anticipated that Bin 3 AMAs will require substantial time to plan, evaluate, and implement to facilitate learning opportunities for future action management.

The use of decision support tools will help the AMSC make transparent, evidence-based decisions by comparing the expected outcomes of alternative actions with regard to meeting management objectives, identifying key sources of uncertainty affecting the ability to predict action outcomes, and highlighting tradeoffs between competing management objectives. There are additional studies that may be at different stages of development and do not provide for the shared consideration of alternatives but warrant the sharing of information and the use of components of SDM.

Working through the collaborative process outlined in this Program, 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). Should the AMSC not come to consensus, the Implementing Entities would follow the governance process identified in the associated Biological Opinion and ITP. The Implementing Entities seek to use the potential flexibility provided by an adaptive management approach to ensure the specific management objectives identified for each action are met, maintained, and/or improved upon. The full implementation of an independently facilitated AMP is an approach that the Implementing Entities believe best balances positive outcomes for species listed under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA) with operation of the CVP and SWP.

Nothing in this Program is intended to modify each Implementing Entity's roles, authorities, or obligations under statute or regulation. Each Implementing Entity retains discretion to make decisions as appropriate within its authority after considering the available information and considering the input of the other Implementing Entities through the AMSC.

2. Purpose and Intent

Scientific uncertainty will always exist regarding Central Valley rivers and Bay-Delta ecosystems, including the needs of the listed species, the effects of coordinated CVP and SWP operations on those species and their habitats, and the efficacy of actions intended to minimize or mitigate those effects. Further, even when scientific certainty is relatively high, the real-world need for trade-offs will increase the complexity of implementing decisions. This Program is being implemented to help reduce important scientific uncertainty where it exists, and to enhance application of decision tools to support decision making related to the long-term operations of the CVP and SWP.

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.

The broad purposes of this Program are: 1) to promote collaborative, participatory, accountable, relevant, innovative, and transparent science and documentation of the decision process, 2) guide (by identifying, prioritizing, and funding) the development and implementation of scientific investigations and monitoring for CVP and SWP management actions necessary to evaluate if management objectives are being achieved, 3) incorporate new information into decision support tools to gain insights to management decisions, actions, and constraints, and 4) maximize the effectiveness of an action toward achieving the management objectives for the operation of the CVP and SWP while considering potential tradeoffs.

This Program creates a structure whereby participants in science workgroups (i.e., AMTs) working with floating, independent facilitators to implement scientific investigations and monitoring that will best reduce important uncertainties specific to each AMA (Appendix B). The science-based decision products of the AMTs are rolled up by the floating, independent facilitators and presented to the steering committee (i.e., AMSC) for consideration by each agency. The members of the AMSC can then make informed resource management decisions such as whether to propose changes to an existing AMA determine whether particular lines of inquiry are no longer able to generate further insight, and other kinds of decisions that can be expected to typify an adaptive response to a set of recurring actions. Decisions regarding potential changes to regulatory approaches will be handled separately, as described in Section 5 of this document.

The intents of this Program are to:

a. Describe the steps required to implement the adaptive management process (see Appendix A) and explain how the process links to the operations of the CVP and SWP.

b. Describe how adaptive management for ongoing engagement on the operations of the CVP and SWP will be utilized for specific actions (see Appendix B).

c. Inform future consultation and permitting processes for the CVP and SWP through the science produced by the Program, which can be thought of as adaptive management of more involved decisions occurring over longer time scales.

d. If necessary and agreed upon by the Implementing Entities, develop and implement new AMAs.

e. Describe the decision-making and governance structure that will be used to implement the adaptive management process including how adaptive changes will be made to the AMAs with consideration of how these changes will be coordinated and reflected in corresponding state and federal authorizations.

f. Describe the structure for communication among the Implementing Entities and the broader stakeholder community regarding implementation of this Program.

g. Describe the role of the AMSC in tracking, on an annual basis, funding for this Program.

3. Scope of Adaptive Management Program

a. Actions

The CVP and SWP have been operated for decades. Scientific research and monitoring of the projects' ecological impacts has been extensive, and these impacts are thoroughly discussed and described. Operational approaches have varied over time, in part guided by the accumulation of ecological data and improved understanding of the projects' impacts on species and their habitats. However, constraints on successfully reducing impacts to listed species caused by operations of the projects under varying climatic conditions are also understood and documented, yet difficult to achieve while maintaining project objectives. The initial adaptive decision space proposed in this Program involves the application of decision analysis and scientific inquiry into topic areas where the Implementing Entities believe that further understanding might improve one or more aspects of CVP and SWP operations. Decision support tools will be used to facilitate evaluation of effects of components of the AMAs identified (Appendix B) and inform Implementing Entities about whether and how best to adapt those AMAs, if needed. The AMAs to be evaluated include, but are not limited to, the following:

- 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 and Salvage Thresholds
- 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

b. Compliance and Effectiveness Monitoring

Compliance and effectiveness monitoring programs will include the elements as described in Appendix B, unless the AMSC, through its adaptive management process, recommends a modification, DWR and Reclamation request modifications, and the regulatory agencies accept those modifications. Such modifications may be subject to independent review (see Section 7). Changes to the compliance and effectiveness monitoring (Section 3.10 of the Proposed Action) may require ESA consultation and may require amendments to the relevant CESA authorization before being implemented (see Section 5).

4. Program Structure, Roles, and Responsibilities

a. Adaptive Management Steering Committee (AMSC)

The Implementing Entities will establish the AMSC to implement the Program. The Implementing Entities through the AMSC are responsible for support, coordination, and implementation of the Program. The Program will address important uncertainties and trade-offs (policy and ecological) associated with adaptively managing actions identified in Appendix B. AMSC decisions will be informed by AMTs dedicated to each individual AMA identified in Appendix B. The agencies comprising the AMSC will hire a team of floating independent facilitators to help each AMT identify management objectives and goals, identify and synthesize information areas related to those objectives, determine critical uncertainties affecting management decisions, define additional information needs to reduce critical uncertainties, and integrate products of the various AMTs in a way that clarifies what decisions need to be made, what trade-offs may need to be considered, and how confidently the outcomes of those decisions can be predicted.

i. Purpose and Function

The purpose of the AMSC is to provide guidance and direction for the Program and ensure effective and efficient implementation of all AMAs. Specifically, the AMSC will:

- Provide recommendations to Agency Directors based on recent science, including the need to re-initiate consultation and request an ITP amendment.
- Elevate issues for resolution to Agency Directors, as needed, including disputes and results of adaptive management processes conducted through AMTs and the AMSC.
- Serve as primary management level review of AMA implementation. All considerations involving a regulatory change under CESA or ESA do not fall under the perview of the AMSC, see Section 5.
- Provide direction and guidance for action-specific AMTs including articulation of management objectives, dispute resolution, and coordinating participation by each agency.

- Request annual presentations from each AMT to track the status of AMA implementation and look ahead to next steps.
- Review AMT suggestions for identified areas of uncertainty, needed data improvements, proposals for enhanced monitoring or focused research, as appropriate, to assure they are effectively supporting the information needs of the members of the AMSC.
- Request proposals from AMTs to conduct new data collection or conduct focused research to reduce uncertainty or fill data gaps relevant to components of identified AMAs.
- Discuss recommendations from AMTs based on the decision-making process.
- Form and direct AMTs as necessary. Existing teams and workgroups will be used to the maximum extent practicable.
- Assure that all AMSC and AMT activities are conducted in a transparent manner. To allow time for coordination with interested parties meeting schedules will allow for at least 30-day review and consideration of relevant documentation prior to any decision making regarding potential changes to an action in the ITP or PA by the AMSC.
- Post meeting notes, AMT presentations, documentation of decisions, and rationale to support decisions on a publicly available website.
- Identify the need for independent review of specific adaptive management plans and results.
- Set the course for scope and facilitation of reviews, identify the appropriate group to conduct independent reviews, and develop any draft charges for independent review.
- Conduct outreach to the broader stakeholder community regarding implementation of the Program.
- Review annual AMP budget annually to assess potential gaps in funding relevant to overall implementation.

ii. Membership

The AMSC will include one designated sub-Director level representative and one designated alternate each from each of the Implementing Entities. Upon unanimous approval, the members of the AMSC may invite additional staff from any of the Implementing Entities or consultants engaged by one or more of the Implementing Entities to provide technical assistance or other support for specific topics. AMSC meetings will be organized and facilitated by a floating, independent facilitator (or team of facilitators) agreed upon by all Implementing Entities to ensure continuity across meetings and efficient use of time.

b. Adaptive Management Technical Teams (AMTs)

AMTs will be dedicated to each AMA identified in Appendix B. AMTs are charged with identifying uncertainty, building knowledge, and implementing each AMA.

i. Purpose and Function

The purpose of individual AMTs is to convene scientific technical staff from each of the Implementing Entities and interested parties in working groups to plan, implement, and assess each of the actions identified in Appendix B. AMTs formed by the AMSC will have at least one designated team leader from an Implementing Entity and will report to the members of the AMSC on progress in addressing uncertainty associated with each AMA identified in Appendix B (see Appendix A for additional details regarding required reporting). The AMTs will design and implement monitoring and science plans to gather data necessary to build knowledge and decrease uncertainties and conduct the analysis and synthesis of the information gained. The AMTs will evaluate whether actions identified in Appendix B are achieving their intended management goal, and identify potential adaptive management changes based on the science if objectives and or those goals are not being achieved, to be considered by the members of the AMSC for implementation in the future. Generally, each AMT will:

- Utilize decision support tools to define relevant uncertainty, develop action alternatives, estimate expected consequences of the alternatives, and evaluate trade-offs and preferences when making choices between alternative courses of action. Depending on the scope and timeline of each AMA, and the level of SDM tools used by the AMA, these could include:
  - Development of performance metrics for each AMSC-defined management objective to allow evaluation of ongoing and proposed actions relative ability to achieve those objectives.
  - Development of potential alternative actions and synthesis of existing information to evaluate expected action performance.
  - Identification of uncertainties in expected action performance that are most influential in decision tradeoffs.
  - Development of monitoring and science plans to reduce uncertainty around management action outcomes.
  - For AMAs in Bin 1, develop experimental actions supported by monitoring and science, and review outcomes of experimental actions and revise experimental actions as appropriate.
- As requested by the AMSC, prepare necessary documentation for independent reviews, and participate in post-review dialogue.
- Provide data to support the members of the AMSC to track Adaptive Management Program implementation.
- Track other monitoring and research relevant to the subject of the AMA.
- Assure transparency in the implementation and investigation of the AMA.
- Prepare annual presentations of AMA implementation status to the AMSC and subsequently post presentations on a publicly available website.

The scope and responsibilities of each AMT, and timelines for deliverables, are described in more detail for each AMA in Appendix B. The descriptions in Appendix B may be refined using decision support tools by each AMT and documented in a work plan describing the monitoring and or science that the AMTs plan to conduct, which will be submitted to the AMSC for review and approval.

ii. Membership

Membership in individual AMTs will be open to technical staff from each of the Implementing Entities. AMTs will also be open to tribes, consultants, stakeholders, other local, State or federal agencies, or academic researchers, as described in the individual team charter.

c. Decision-making

The Implementing Entities commit to working collaboratively through the AMSC and AMTs to reach consensus on adaptive management changes (including decisions not to make changes) to the maximum extent feasible, and to elevate any disputes over decisions to the Directors for each Implementing Entity. In the event that resolution of the dispute cannot be reached by the AMSC, review of the issue in dispute may occur through the presentation of alternative viewpoints as part of an annual review, or a separate independent science review. Decision support tools, including structured decision making, as described in Appendices A and B, will be used to provide a rational and organized framework for evaluating management objectives relative to each action's goal, as well as any alternative decisions.

Nothing in this Program is intended to modify each Implementing Entity's roles, authorities, or obligations under statute or regulation. Each Implementing Entity retains discretion to make decisions as appropriate within its authority after considering the available information and considering the input of the other Implementing Entities through the AMSC.

5. Link between AMP and Regulatory Processes

a. Federal Endangered Species Act

The Code of Federal Regulations at 50 CFR § 402.16 describe the process for reinitiating ESA section 7 consultation. Specifically, reinitiation is required and shall be requested by the Federal action agency (in this case, Reclamation) or by the USFWS or NMFS (depending on which species are involved) if any one or more of several criteria are met. Although, there is no regulatory mechanism to modify ESA section 7 biological opinions absent reinitiating the section 7 consultation, there are options to improve understanding or modify an action without reinitiating the section 7 consultation so long as doing so does not meet a reinitiation trigger. Specifically, new information or a change in the proposed action would require reinitiation of consultation if:

1. new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; or

2. the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence.

Therefore, the additional objectives of this Program, as it pertains to ESA section 7 consultation, are to:

1. identify the areas of potential action uncertainty and the range of effects to species that may occur as the AMP is implemented such that the potential range of effects of the action may be considered during consultation; reinitiation will be required if that range of anticipated effects is exceeded; and

2. provide the mechanism for regular inquiries and evaluation to determine if reinitiation is required as the AMP is implemented.

In the event that a change is required to the Incidental Take Statement (ITS), and the change is fully consistent with the analysis in the biological opinion, the Services can revise the ITS without reinitiating the consultation. Examples include where new information allows for a more specific take surrogate, reduction in the amount or extent of take (which would include surrogates), or for clarification of the terms and conditions. Under these scenarios, the Services would issue a new ITS to the Federal action agency.

b. California Endangered Species Act

Title 14 of the California Code of Regulations (CCR), section 783.6, subdivision (c) describes general criteria and information pertaining to minor and major amendments to ITPs. If permittee (in this case, DWR) submits a request for changes to an ITP that do not significantly modify the scope or nature of the project or any of the minimization, mitigation, or monitoring conditions of the ITP, as determined by the CDFW, a minor amendment may be processed. However, if a permittee is seeking changes that will significantly modify the scope or nature of the project, or if those changes trigger additional review under the California Environmental Quality Act, as determined by CDFW, the amendment would be processed as a major amendment. CDFW reviews major amendment requests according to processes set out for initial permit applications, including submittal of an application and supporting information, although the amendment application may rely on and supplement the information from the initial application. Approval of both minor and major amendments to ITPs are subject to CDFW finding that the ITP issuance criteria in CCR title 14, section 783.4 continue to be met.

6. Funding

Funding is anticipated from a variety of sources including CDFW, DWR FWS, NMFS, and Reclamation. Federal funding is subject to appropriations. CDFW cannot fund DWR permit obligations but may allocate staff time to provide technical assistance and engage in implementation of this program.

It is expected that the Adaptive Management Plan will require substantial resources to support the required evaluations and independent review. The specific level of support remains to be determined and will likely vary depending on the Adaptive Management Actions conducted each year.

7. Relationship of the Adaptive Management Program to Other Processes

a. Real-time Operations

The adaptive management and decision-making processes described here do not directly apply to real-time operations; where individual real-time operation decisions must be made on a daily, weekly, or monthly time scale. However, real-time operational criteria may be changed over time through the adaptive management process based on new information. Such a change may require an ESA reinitiation of consultation inquiry and an ITP amendment (See Section 5, Link between AMP and Regulatory Processes).

b. Voluntary Agreements

The Voluntary Agreements are a package of flow and non-flow measures proposed by a diverse range of interests for adoption by the SWRCB as an approach to implement the Bay-Delta Water Quality Control Plan (Bay-Delta Plan). The Voluntary Agreements would state commitments of water, funding, and other measures to implement Bay-Delta Plan water quality objectives related to protection of native fishes, including the Covered Species. The Voluntary Agreements offer a watershed-wide approach that includes new flows, habitat restoration in the Delta and Suisun Marsh as well as tributary systems, and a governance and science program that would use a structured decision-making approach to guide adaptive management. Voluntary Agreements include commitments to fund and undertake new science (monitoring and research) to address hypotheses related to the efficacy of flow and habitat restoration actions, including increases in Delta outflow in March – June to benefit Covered Species. As information is gained through the VA Science Program pertaining to actions contained in the AMP, it may be used to inform AMT discussions and recommendations and may be considered in decision-making processes of the AMSC.

The Voluntary Agreements are subject to ongoing discussion and have neither been finalized nor adopted by the State Water Resources Control Board.

c. Independent Peer Review

Independent peer review can play an important role in guiding the evaluation and response stages of the adaptive management cycle by providing unbiased, transparent reviews of the science and advice for the processes used to guide management decisions. The AMSC will oversee the use of independent peer review processes on an as-needed basis for individual adaptive management actions. The need for independent peer review may rise from a lack of consensus on the relevant science and its application to the management action, from a need for additional expertise on a specific subject matter, or when specific management actions have reached a milestone in terms of the volume of available information. In the latter situation, independent review is advisable for informing key management decisions.

Independent review may consist of letter reviews without associated formal meetings, or panel reviews in which reviewers have a public opportunity receive information from the members of the AMSC or relevant AMT in a meeting. The members of the AMSC may initiate an independent review for any adaptive management action if there is a consensus on the need for the review. The members of the AMSC can request the services of an impartial organization to facilitate the peer review process (e.g., the Delta Science Program, National Academy of Sciences, or similar organizations). In the interest of transparency, materials and recommendations from panel or letter reviews will be available publicly on agency websites. The AMSC members will encourage and support the development of peer-reviewed publications in scientific journals. Article publications, along with reports and datasets, may inform the evaluation of the adaptive management actions.

Attachments

Appendix A: Adaptive Management Program Framework and Implementation

Appendix B: Adaptive Management Actions and Programs

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 Attachment A and B 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
- 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

Appendix A: Adaptive Management Program Framework and Implementation

1 Overview

In the broadest sense, the set of decisions that collectively answer the question what is the 'best' way to operate the Central Valley Project (CVP) and State Water Project (SWP) (hereafter, Projects) is a complex series of recurring decisions based on an ever-changing knowledge base and set of socio-ecological circumstances. The decisions about how best to operate the Projects have increased in complexity over time due to a growing number of constraints on the decision space (Figure A.1). The accumulation of constraints is one 'certainty' in 'wicked problems', which are problems that morph over time and change in response to intervention (Rittel and Webber 1973; Luoma et al. 2015).

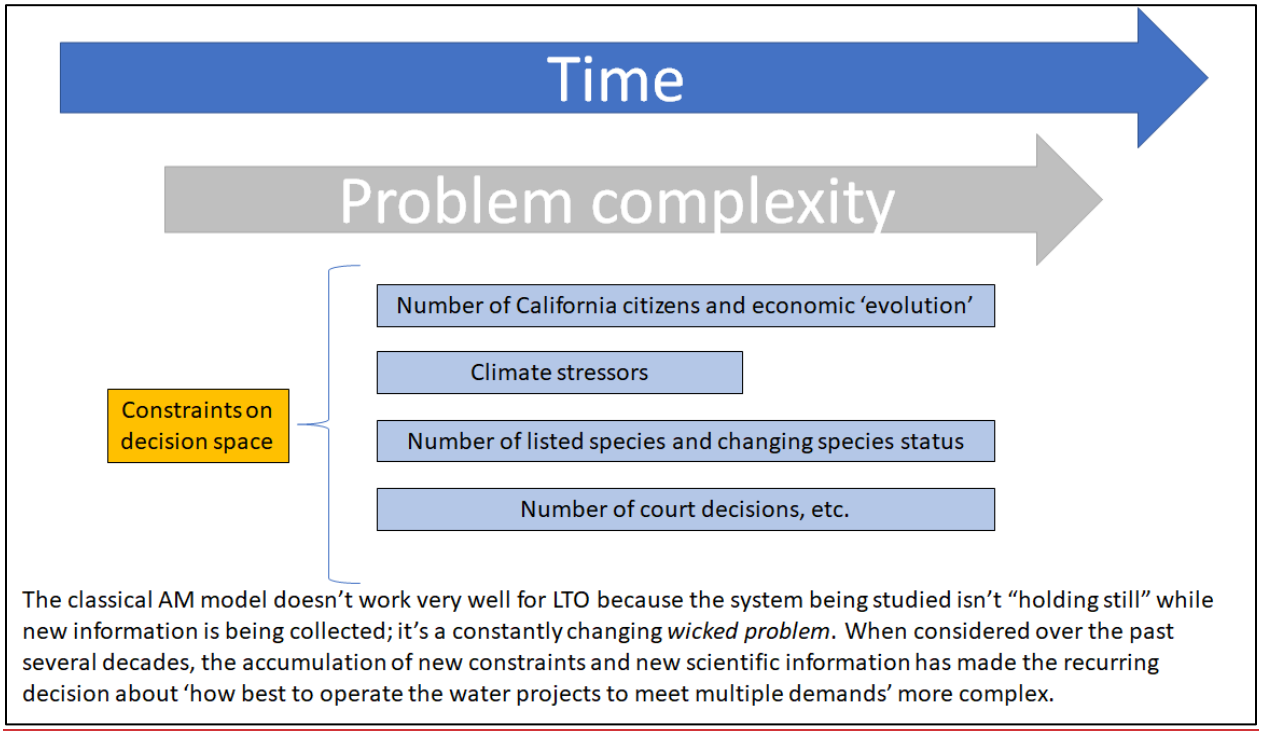


Figure A.1. Conceptual diagram of the increasing complexity of water operations consultations over time as constraints on decision space have increased.

The classical adaptive management (AM) model posed by Walters and Hilborn (1978) suggests that applying the scientific method to complex natural resource management problems is an objective way to navigate complex problems, and as such, AM has frequently been suggested as a best management practice for Project operations. However, AM as originally described does not work well in the management of systems experiencing constant change, i.e., systems that are of themselves wicked problems (DeFries and Nagendra 2017). Rather, wicked problems require a more nuanced version of 'adaptive management' that is better integrated in decision theory or structured decision-making (SDM; Figure B.2).

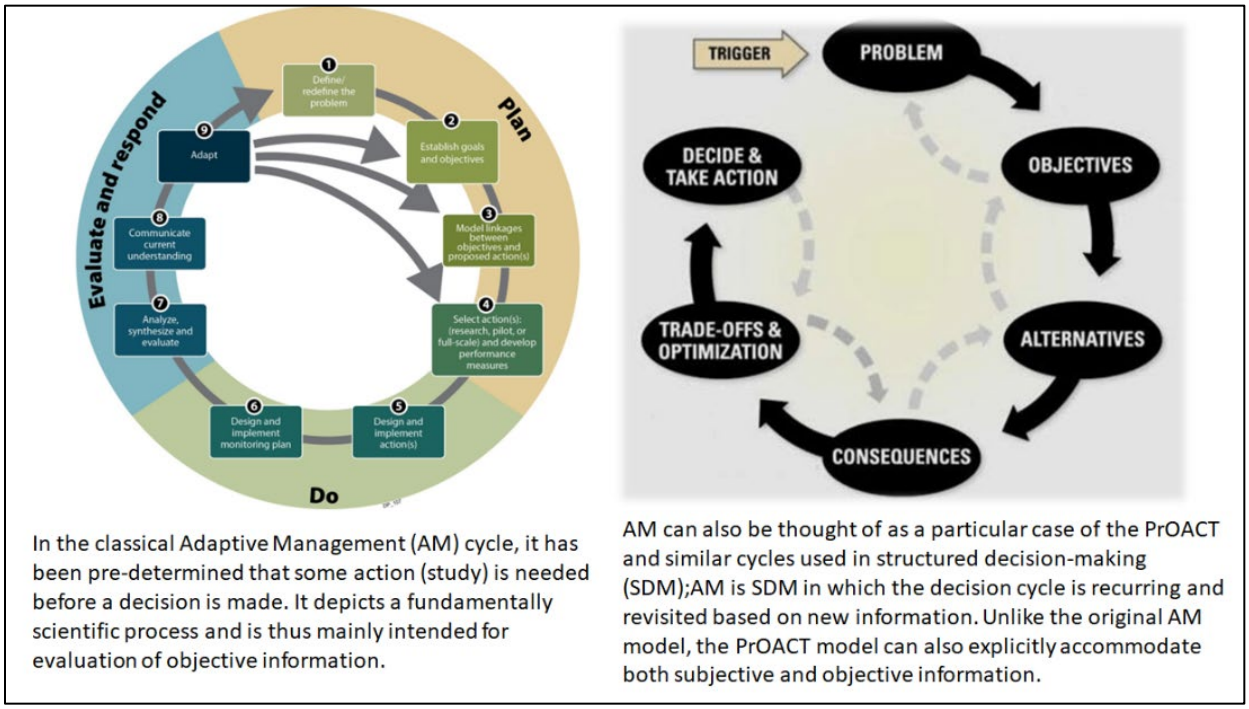


Figure A.2. Comparison of adaptive management as described by DSP (2013; derived from Walters and Hilborn (1978) and the PrOACT cycle, a variant of the general approach to structured decision-making.

The reason that SDM is needed for wicked problems is that they often do not "hold still" long enough to robustly apply scientific methods. Further, wicked problems involve subjective values dimensions that cannot be ignored. The "values" can be things like different agency perspectives on the relative importance of the objectives, or socio-political constraints on decision space (Figure A.1). SDM is a set of tools that has been developed to transparently combine objective and subjective information to make the best decision that can be made with the information available at the time. The repeated use of SDM applied to a wicked problem does not stop the problem from changing over time, but it can allow necessary adaptation as the problem develops new dimensions.

Endangered species consultations on the operation of the Projects involve navigation of an evolving social-ecological system with multiple, often competing objectives. Consultations under both ESA and CESA have been a facet of Project operations since the 1990s and are one of the drivers increasing decision complexity (Figure A.1). A conceptual model of CVP and SWP ESA/CESA consultations as a recurring decision is shown in Figure A.3. The conceptual model is superimposed on the PrOACT cycle, which is a predominant SDM framework. This is not done to imply that historical consultations have proceeded using decision analysis techniques, but rather to show how the process still has to move through the steps of a decision-analytic cycle. Here we use the word 'cycle' to describe each time a major new consultation has occurred. Several things have acted as drivers of a new consultation cycle; these are shown in yellow. In the broadest sense, the problem and the objectives do not change from cycle to cycle, but they do imply a decision involving multiple competing objectives. The Biological Assessment prepared by the US Bureau of Reclamation (Reclamation) and the incidental take permit (ITP) application prepared by the Department of Water Resources (DWR) constitute a negotiated alternative (collectively, proposed action); these documents and the resulting biological opinions issued

by the US Fish and Wildlife Service and National Marine Fisheries Service (BiOps) and ITP issued by CDFW (LTO ITP) provide the analysis of the alternative; the decision is the new BiOps and LTO ITP.

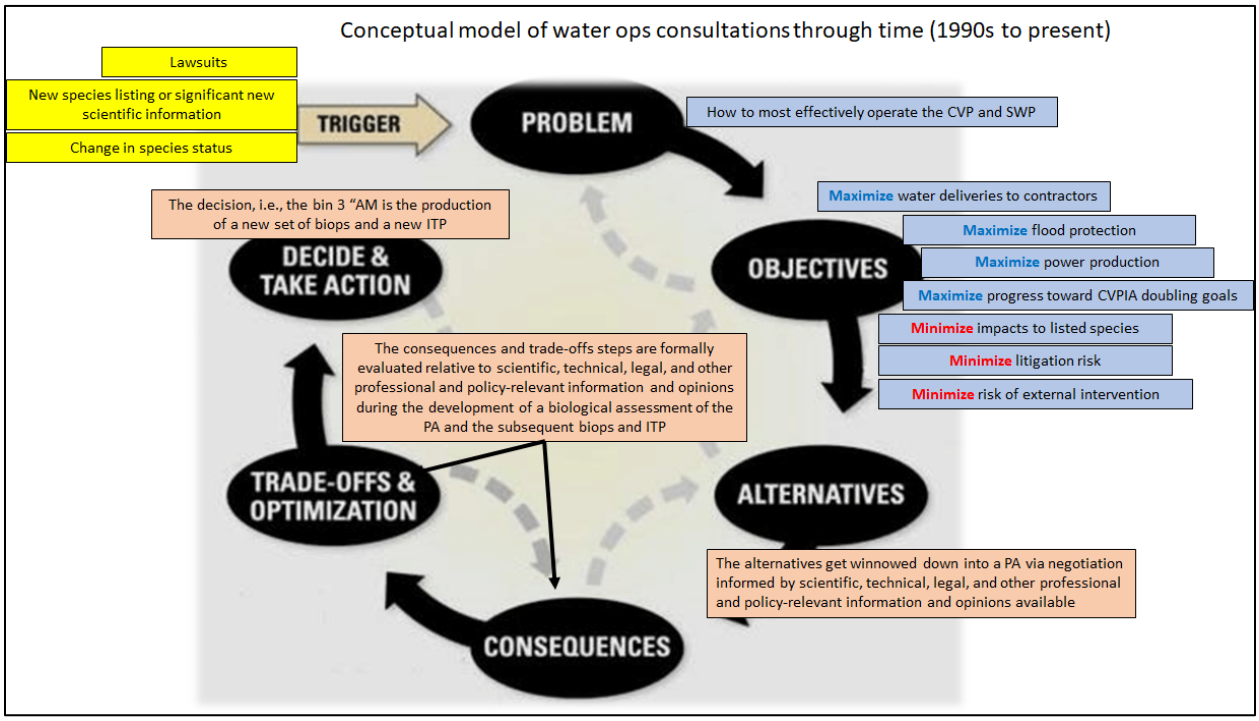


Figure A.3. Conceptual model of ESA/CESA water operations consultations as a recurring decision.

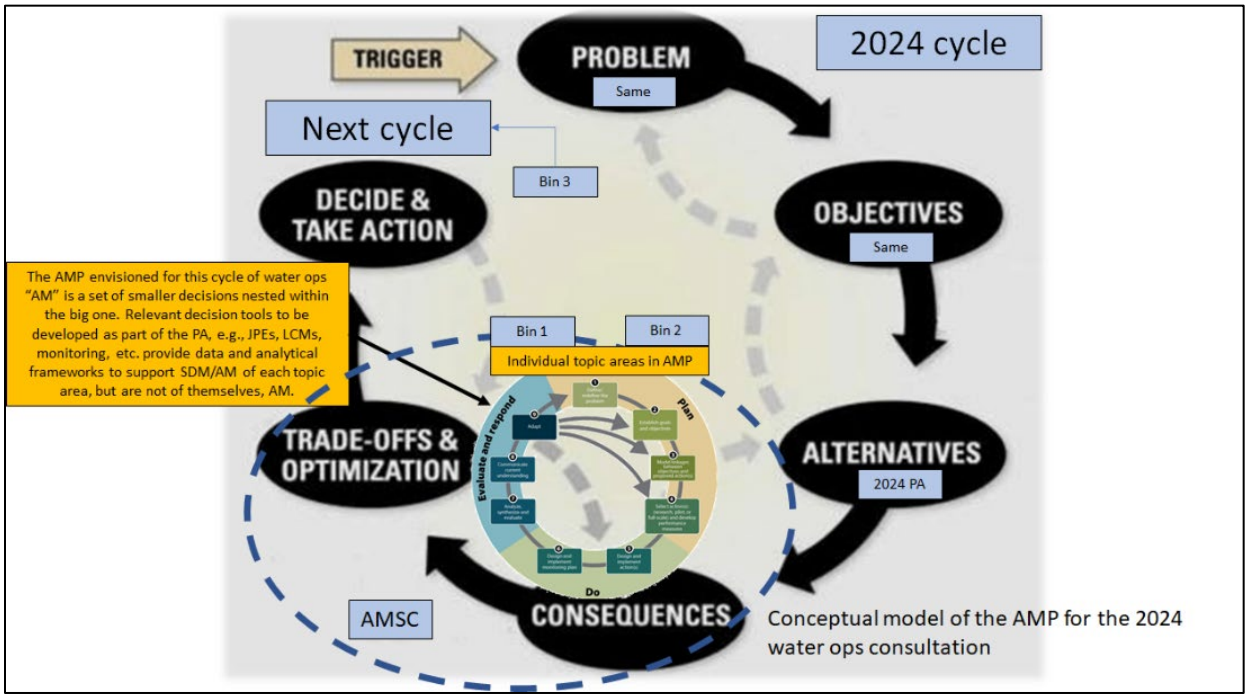


Figure A.4. Conceptual model of the Adaptive Management Program described in this appendix within the current consultation cycle. Refer to Figure A.3 for additional details.

The adaptive management framework envisioned for this cycle of water project consultations involves ongoing scientific re-evaluation of multiple topic areas that sit within the 'consequences' and 'trade-offs/optimization' steps of the current PA decision cycle (Figure A.4). The framework or 'Adaptive Management Program' (AMP) will be used for two major purposes. The first is to provide a potential path to modify water operations rules without a full new cycle (e.g. new full reinitiation of consultation or ITP development) if the existing and proposed studies, tools, and monitoring are developed and their use supports a change. The evaluation of changes that could be conducted within the current cycle are called Bin 1 and Bin 2 pathways and they are differentiated depending on their implementation timeline (see Appendix B). Bin 1 pathways may result in modifications within 3 years of issuance, while Bin 2 pathways may result in modifications but are not expected in fewer than 3 years of issuance. Bin 3 pathways are longer-term, and considerations are not expected to be complete within a single consultation cycle because they involve either or both long data evaluation timelines or substantial changes to authorized levels of listed species take. Topics in the Bin 3 category are included because they require continued data collection and analysis to inform their evaluation in the next consultation cycle.

2 AMP Framework and Implementation

The AMP will be used to evaluate and adapt the operations, actions, and related activities identified in Section 3a of the AMP and Appendix B. This evaluation will include addressing areas of known uncertainty, improving scientific understanding by filling data gaps, and weighing whether new information should be incorporated into the relevant ESA and CESA authorizations. To do so, an Adaptive Management Steering Committee (AMSC) will oversee efforts to monitor and evaluate existing

operations and related activities through existing technical teams (to the maximum extent practicable), make decisions at that level, and suggest to the Directors whether modifications or alternative actions may be warranted. The AMSC will utilize a structured decision-making process to assess the relative benefits or impacts of proposed operational changes and activities for listed species compared to what is being implemented at the time. Any proposed changes to project operations or related activities through adaptive management should provide equivalent or increased conservation benefits to the listed species.

Adaptive management typically utilizes a multi-step process. The following adaptive management framework includes elements from the Delta Plan (DSP 2013) and recommendations from the Delta Independent Science Board (2016). This framework is made up of three broad phases that are part of any scientific endeavor: (1) Plan; (2) Do; (3) Evaluate and respond. Within the phases are nine steps as represented in Figure A.2.

2.1 Phase 1: Plan

The first phase of an adaptive management process is to plan. The suite of tools to be developed and general adaptive management topics are described in Appendix B. As approved by the AMSC, Adaptive Management Teams (AMTs) will develop their own plan for each activity identified in Appendix B. Annual Presentations prepared by each AMT, as described in Section 2.3.1, will include the compilation of the individual actions covered under that AMT.

The planning process begins by clearly defining the problem or question to be addressed (*Step 1*), identifying goals and objectives (*Step 2*), and identifying the model linkages between the goals, objectives, and proposed actions (*Step 3)*. Models can be conceptual, statistical, physical, decision support, or simulation. The AMSC and its facilitator(s) will oversee steps 1 and 2, then the AMTs will take a lead role in step 3.

The proposed action, LTO ITP, and BiOps outline the problems to be addressed, the goals and objectives, and in some cases describe the conceptual linkage between the actions and the objectives. However, these steps should be formally evaluated by the AMSC and its facilitator(s) once the group is established. A list of the proposed tools to be developed as part of the AMP and the general topic areas addressed by this AMP are the subject of Appendix B; more detail about the goals, objectives, and rationale is in the text below and in the associated effects analyses of the proposed action, BiOps, and LTO ITP.

The first part of *Step 4* in the Adaptive Management cycle is to decide whether a change in an existing action(s) will be recommended based on the modeling results. The proposed action, BiOps, and LTO ITP are the starting point for AM actions. Future assessments may support keeping an action as is, or modifying it in some way. A key part of the AMP (coordinated through the AMSC) will be the development of performance metrics (response variables for each tool, study, monitoring program etc. associated with each adaptive management action) to guide the program (*Step 4*). Performance metrics would be measured utilizing a suite of activities including monitoring (long-term surveys; new measurements), experimental methods (e.g. fish enclosures), and modeling (e.g. 3-D modeling, life cycle modeling). Each operation and activity, and each adaptive management change must be accompanied

by a set of criteria that the implementing entities can use to determine whether the action is having the anticipated effects.

2.1.1 Structured Decision Making

The AMSC, and associated AMTs, will utilize decision-analytic tools or a structured decision-making process to define relevant uncertainty, develop action alternatives, estimate consequences and evaluate trade-offs and preferences when making choices between alternative courses of action (e.g., *Steps 1- 4* above*)*. Structured decision-making processes can include consideration of value-based objectives and priorities as well as science-based objectives. These processes also document the basis for decisions in a transparent, organized and repeatable framework. Below provides more detailed information on examples of structured decision-making processes currently being used by technical teams and CSAMP.

Structured decision making (SDM) is a collection of practices rooted in decision theory that provides a rational, organized framework for evaluating alternatives against consistent and explicit quantifiable objectives, encourages clear articulation of anticipated effects, and transparent consideration of trade-offs and uncertainty (Figure A.5). SDM can take many forms, depending on which of the six typical steps receive greater relative emphasis. SDM can be used to help build consensus if the SDM process includes deliberation about trade-offs and this deliberation informs the development of new alternatives that better address the range of interests represented.

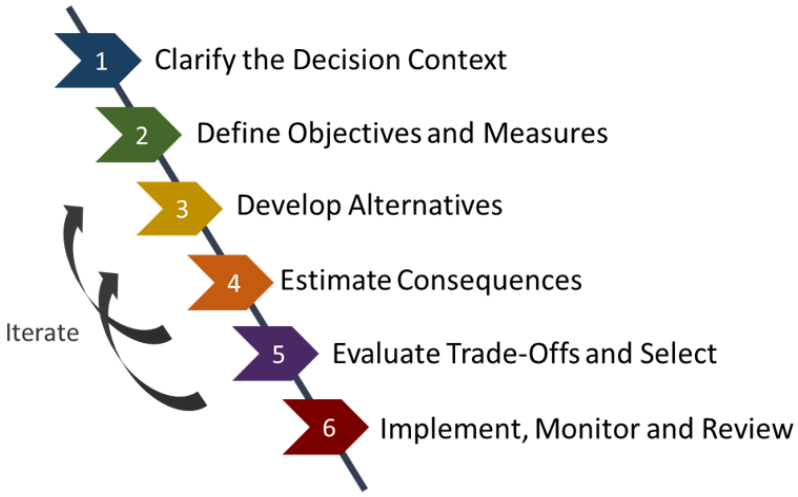


Figure A.5. Six steps of a typical SDM process (Gregory et. al. 2012).

1. Clarify the Context – The first step is to clearly establish the planning and decision-making context through answering questions such as: What decision needs to be made and who will make it? Who else needs to be involved or consulted? What is the scope and bounds of the process and the decision (e.g., what's in and what's out)? The initial structuring step lays out a road map for both the deliberations and the analysis that will follow.

2. Define Objectives and Measures – Objectives define the interests and values about the decision at hand. Measures define exactly what is meant by an objective and are used to estimate and report the predicted consequences of different alternatives for making a choice.

3. Develop Alternatives – Alternatives are the various actions or strategies that are under consideration. This step involves iteratively developing, comparing, and refining alternatives in the search for one(s) that offers the best balance across objectives.

4. Estimate Consequences – Consequences of the alternatives against each objective are estimated or characterized, including identifying uncertainties. Results are typically presented in a consequence table, which is a concise summary matrix illustrating the performance of each alternative with respect to each objective, as reported by the measures.

5. Evaluate Trade-offs and Preferences – Explicit choices must be made for preferred alternatives, based gains and losses for each objective. Each decision-maker is asked to make choices based on their own values and their understanding about the values of others. A variety of methods from the decision sciences are used to facilitate constructive deliberations about values and trade-offs and to ensure that tradeoff judgments are informed, thoughtful and transparent.

6. Decide, Monitor, and Learn – The focus at this stage of the process is on how to implement the decision in a way that reduces uncertainty, improves the quality of information for future decisions, and provides opportunities to revise and adapt based on what is learned. The SDM process should end with a formal transition into adaptive management and monitoring, and produce recommendations for the governance and oversight of monitoring programs, as well as triggers and mechanisms for review and amendment.

Example Applications of SDM

SDM is being utilized by the Delta Coordination Group (DCG) for the Summer-Fall Action. During 2022, Reclamation and DWR developed an SDM approach for informing decisions regarding the Delta Smelt summer-fall habitat actions. This modeling approach utilized existing and new modeling, data, and expert opinion on the impacts of the summer-fall habitat actions to provide information on the physical and biological consequences associated with implementing the various actions compared to a baseline of these outcomes without the summer-fall habitat actions. Through this SDM process, Reclamation and DWR also developed a multiyear monitoring and science plan that includes additional science that might be helpful to further investigate the spatial and temporal distribution of abiotic and biotic factors known to influence Delta Smelt habitat, including its food supply and access to those prey, Delta Smelt abundance, survival, and viability during the summer-fall time period.

2.2 Phase 2: Do

The 'Do' phase of adaptive management includes two steps that occur in parallel. The design and implementation of studies, monitoring, or modeling of actions as they are implemented with the explicit goal of improving the understanding of how strongly the action is affecting the vital rate or performance metric (*Step 5 and 6*).

Monitoring plans associated with each relevant operational or management action will include data management plans that describe the process for organizing and clearly documenting observations, including how data are collected; the methods, quality assurance, and calculations used; the temporal and spatial scales of the variables; and accurate site locations and characteristics. Monitoring must provide the data necessary to determine whether the performance metrics are responding to the management action(s). Monitoring plans may also include targeted research to better understand

observed results and further resolve key uncertainties. Results of monitoring and research must be clearly communicated so that the information gathered, and current understanding, is broadly understood.

2.2.1 Work Plan and Budget

2.2.1.1 AMSC Annual Work Plan and Budget

The planning and doing outlined in phases 1 and 2 will be described in an Annual Work Plan and Annual Budget prepared by the AMSC for the upcoming year. The Annual Work Plan will describe the proposed activities of the AMP. This plan will include 1) monitoring and research that are part of the proposed action or are otherwise required by the SWP ITP, BiOps, 2) needed facilitation services to coordinate and support implementation of the AMP, and 3) any additional monitoring and research that is planned, including any relevant monitoring and research that is part of the IEP annual work plan, as approved by the AMSC. The Annual Budget will set out projected expenditures and identify the sources of funding for those expenditures. If the Annual Work Plan describes activities that span multiple years, the budget for those activities will cover the entire period they will be implemented. The AMSC will ensure the Annual Budget accurately sets forth and makes adequate provision for the implementation of the BiOps and LTO ITP terms under which the CVP and SWP operate.

At a minimum, the Annual Work Plan and Annual Budget will contain the following information:

A. A description of the planned actions under the AMP including their goals, objectives, and performance metrics.

B. A description of the planned monitoring activities and the entities that will implement those activities.

C. A description of the anticipated research to be undertaken and the entities that will conduct the studies.

D. A budget reflecting the costs of implementing the planned actions.

E. A description of the sources of funds that will be used to support the budget.

The AMSC will develop and approve the Annual Work Plan and Annual Budget with support from independent facilitators. The first Annual Work Plan and Annual Budget will be completed within the first year the AMSC begins convening, and annually thereafter. Upon approval, the Annual Work Plan will be posted on a public website.

2.2.1.2 Individual AMT Work Plans

Within twelve months of their initial meeting, each AMT will develop a work plan that describes the timeline needed to gather and/or synthesize the needed information for its purpose, all reasonable hypotheses addressed for that action, and the timeline for incorporating information into individual SDM processes. The AMSC will review the work plans for each AMT, provide direction or edits as needed, and approve the final plan when they are satisfied with it. Thereafter, each AMT will provide a presentation to the AMSC at least annually to document progress toward addressing the relevant

hypotheses (see Section 2.3.1 below). The work of individual AMTs and associated annual presentations can cease if a team has achieved what it was tasked to do.

2.3 Phase 3: Evaluate and Respond

The 'evaluate and respond' phase of adaptive management includes three key steps. Analysis, synthesis, and evaluation of the action(s) (*Step 7*) are critical for improving current understanding. Analysis and synthesis will incorporate information on how conditions have changed, expectedly and unexpectedly, as a result of implementing the action(s). Because measurable improvement in conditions for covered species might not occur on short timescales, evaluations will also examine whether actions taken prevented deterioration of conditions that may have occurred if no actions were taken or if the action is resulting in species responses trending in the desired direction. The evaluation will examine whether performance metrics indicate that one or more of the objectives have been met as a result of the implemented action(s). If an objective is not met, the potential reasons why it was not met will be identified. As each year's data become available, recognizing that specific actions may not be required in that particular year or sequence of years, analyses should assess whether the probability of the desired outcome has changed and, if so, how this affects decisions about the action. Within the AMP it is anticipated that the AMTs will be primarily responsible for the "evaluation" step, while the AMSC will be primarily responsible for the "response" step.

Communication (*Step 8*) of current understanding gained through analysis, synthesis, and evaluation of implemented actions and monitoring will occur through a variety of channels including: 1) regular back and forth communication between the AMSC and AMTs via the floating facilitators, and when relevant, between the AMSC and the Directors, 2) annual presentations from each AMT to the AMSC, and 3) with interested parties external to the AMP by posting meeting notes on websites, giving presentations, preparing white paper reports, ensuring transparency of independent peer review materials and recommendations, and publication in peer reviewed scientific journals.

2.3.1 Annual Presentations by AMTs

During each implementation year, each AMT will provide at least one presentation (Annual Presentation) to the AMSC. The Annual Presentation will provide an overview of the AMT activities carried out during the previous implementation year.

Each AMT Annual Presentation will include, among other things, the following types of information:

1. An assessment of the implementation and efficacy of studies, monitoring, and modeling of actions during the prior reporting period, including new information gained.

2. Identification of tasks that have not been implemented on schedule and an explanation for the deviation from schedule. For actions that are behind schedule, a suggested schedule or process for completing them will also be included.

3. Adaptive management changes to actions resulting from the SDM process and proposed by an AMT for consideration by the AMSC, including the scientific rationale for the action.

2.3.2 Adapt

When it is informed and equipped with new results and better understanding, the AMSC will re-examine the actions it has been evaluating (e.g., see Appendix B). It is possible that revisions may be suggested when current information suggests doing so (*Step 9*). Possible adaptations could include anything from staying the course, to making a minor modification that can be made without formal changes to the existing LTO ITP and BiOps, to considering reinitiation or an LTO ITP amendment as mechanisms to enable a new management action or paradigm to be implemented.

Decisions to adapt are anticipated to be needed at various time intervals depending on the action or environmental conditions which may delay implementation of certain actions in any particular year or series of years. Appendix B contains a description of the planned timeframe for each action that estimates when decisions regarding AMP actions may be ready to evaluate for potential changes. In general, one year's results, however anomalous, are seldom enough to demonstrate that an action should be subject to change as a part of the adaptive management process. Furthermore, when the analysis, synthesis, and evaluation of information learned from implementing an action over time indicates that no benefit accrues, resources should no longer be spent on that action no matter how popular the action might be.

References Cited

DeFries, R. and Nagendra, H., 2017. Ecosystem management as a wicked problem. *Science*, *356*(6335), pp.265-270.
Rittel and Webber 1973

Delta Independent Science Board. 2016. Improving adaptive management in the Sacramento-San Joaquin Delta. Sacramento, CA.

Delta Science Program. 2013. Delta Plan. Appendix C: Adaptive management and the Delta Plan. Sacramento, CA.

Gregory R., Failing L., Harstone M., Long G., McDaniels T. and Ohlson D. 2012. Structured Decision Making: A practical guide to environmental management choices. Sussex, UK.

Luoma, S. N., Dahm, C. N., Healey, M. and Moore, J. N. 2015. Challenges facing the Sacramento-San Joaquin Delta: Complex, chaotic, or simply cantankerous? San Francisco Estuary and Watershed Science 13(3): 1-25

Rittel, H. W. J. and Webber, M. M. 1973. Dilemmas in a general theory of planning. Policy Sciences 4:155-169

Walters, C. J. and Hilborn, R. 1978. Ecological optimization and adaptive management. Ann. Rev. Ecol. Syst. 9:157-188

recommendations from the Delta Independent Science Board (2016)

Appendix B: Adaptive Management Actions and Programs

A. Timeframe of implementation and evaluation of individual Adaptive Management Actions

Bin 1: Evaluation occurs annually - biannually by technical teams.
Actions for which agencies evaluate recent data to determine how to proceed before the action is conducted again. Refinement of the approach is expected to occur regularly based on prior data and targeted research. There is an expectation that Bin 1 Adaptive Management Actions or Programs (collectively AMAs) have defined objectives and performance metrics with associated monitoring occurring during the implementation of the action. Consultation and incidental take permit (ITP) amendment inquiries will be conducted, but reinitiation of consultation or an ITP amendment is not expected to be required to refine the approach to implementation after each evaluation.

Bin 1 AMAs will require components of a Structured Decision Making (SDM) process to maintain an organized approach for agency collaboration and to ensure transparency in determinations. However, Bin 1 AMAs will be managed adaptively based on present conditions, such as hydrology or annual species status, and will require quick decision-making relative to full SDM. It is not anticipated that Bin 1 AMAs will require long-term action objectives or performance measures to be determined prior to implementation nor will they require identification or evaluation of long-term alternatives. Decision support tools such as utilization of an independent facilitator and Adaptive Management Technical Team (AMT) evaluation of near-term implementation alternatives and tradeoffs will guide the Adaptive Management Steering Committee (AMSC) annual or biannual implementation action decision.

Bin 2: Evaluation and potential refinement occurs within the timeframe of the Biological Opinions and ITP.
Actions for which agencies evaluate data from multiple years of implementation. There is an expectation that coordinated science and monitoring is occurring during implementation of these actions. The evaluation may trigger re-initiation of consultation or an ITP amendment for the actions, or not, depending on scope and scale of recommended change.

Bin 2 will apply to those AMAs that are iterated or linked over time whereby actions taken early on may result in learning that improves management within the next 3-8 years. It is anticipated that Bin 2 AMAs have existing AMTs and/or have some understanding of action objectives and performance measures and have already undergone some evaluation of alternatives and trade-offs. However, it is acknowledged that Bin 2 AMAs may need refinement once implementation has occurred to minimize uncertainties associated with known data gaps. Independent facilitators and AMTs will utilize decision support tools to assess monitoring data obtained, evaluate updated knowledge base against action objectives and performance measures, develop and evaluate new alternatives if warranted, and present action implementation trade-offs to the AMSC for consideration.

Bin 3: Evaluation and potential refinement occurs in a longer timeframe on the order of 10 – 15 years and may inform the next section 7 consultation and development of a new ITP.
Actions for which agencies evaluate data over longer periods of implementation, on the order of 10-15 years. There is no expectation of an ongoing evaluation to occur during the time period of the ITP or Biological Opinions (BiOps) for long-term operations of the State Water Project (SWP) and Central Valley Project (CVP). However, there is an expectation that science and monitoring is occurring during the timeframe of the ITP and BiOps to support evaluation and refinement during the development of a new ITP and BiOps.

Bin 3 AMAs may have complex objectives, unknown alternatives, significant uncertainty in outcomes, and or large data gaps. These AMAs require a full SDM process whereby qualified and independent facilitators will guide the AMSC and associated AMTs and utilize decision-analytic tools or a structured decision-making process to define relevant uncertainty, develop action alternatives, estimate expected consequences of the alternatives, and evaluate trade-offs and preferences when making choices between alternative courses of action. It is anticipated that Bin 3 AMAs will require substantial time to plan, evaluate, and implement to facilitate learning opportunities for future action management.

Some AMAs may have components that fall in different Bins. For example, some AMAs in Bins 1 and 2 may yield the development of a decision support tool for use in an AMA in Bin 3 during future consultation. Therefore, it is important all AMAs use components of structured decision-making and apply a consistent and coordinated approach to monitoring performance metrics identified so that results from various AMAs can be comprehensively evaluated when related.

B. Adaptive Management Actions

1) Winter-run Old and Middle River Flows Management
   a) *Brief Description:* Onramping and offramping Old and Middle River Flows (OMR) management for winter-run Chinook Salmon is currently informed by the Salmon Monitoring Team (SaMT). The SaMT is a technical advisory team made up of technical staff from the US Bureau of Reclamation (Reclamation), the Department of Water Resources (DWR), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) that synthesizes recent field monitoring data and historical long-term monitoring data, along with expert opinion to inform the Water Operation Management Team (WOMT). Specifically, the SaMT will evaluate real-time data, including the Salmonid Distribution Table, and the weekly loss threshold table, which classifies the winter-run Chinook salmon population as the percent in the Delta. This information is used to implement the winter-run weekly loss thresholds and to minimize the effects of water operations on winter-run Chinook Salmon.

      Proposed Action (PA) Sections 3.7.4.1 and 3.7.4.5.3 describe the use of winter-run Chinook Salmon weekly and annual loss thresholds to trigger actions aimed to minimize entrainment and loss of juvenile out-migrants. However, it is anticipated that the criteria associated with the Winter-Run Chinook Salmon Machine Learning Model will need to be reassessed using the genetics-based run-identification loss dataset currently available (Section 3.7.4.1) and a larger effort to develop a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the south Delta well before salvage events occur.

   b) Assigned AM Bin: **Bin 2**
      i. The development of a model explicitly predicting daily winter-run Chinook Salmon migration timing using historical long-term monitoring data and environmental variables is necessary to reduce uncertainty in the weekly Salmonid Distribution Table and the estimated percent of winter-run present in the Delta. This model needs to be made readily available as a transparent prediction tool that leverages recent biotic and abiotic

data to predict current and near-future migration timing and provided to the SaMT to inform their discussions prior to WOMT. This effort should be completed and implemented no later than 2026.

ii. The explicit rate of winter-run Chinook Salmon juvenile out-migrant entrainment into the South Delta, the fate of individuals entrained due to OMR management, and the effects of the State Water Project (SWP) and Central Valley Project (CVP) south Delta water operations is a topic area in OMR management that has been studied in the past and merits further investigation. Loss associated with salvage events at the SWP and CVP facilities is currently used to trigger OMR management actions, but these detections in salvage occur days or even weeks after individuals were initially entrained into the South Delta and account for only a proportion of entrained individuals lost to the population. A new modeling framework is necessary for more effective real-time OMR management actions to be used to minimize winter-run Chinook Salmon entrainment into the South Delta. Specifically, the modeling framework should integrate a winter-run Chinook Salmon distribution model (e.g., Bin 2 item *i* above) with particle tracking model outcomes (potentially the individual-based ECO-PTM model developed by USGS and DWR) to estimate the proportion of the out-migrant population vulnerable to entrainment into the South Delta per day, the probability of entrainment into the South Delta given current hydrologic conditions, and the travel time to the water export facilities. Such a modeling framework should be converted into a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the South Delta well before salvage events occur.

c) *Adaptive Management Technical Team:* The existing Winter-run Chinook Machine Learning Interagency Team will lead analysis and development of all winter-run Chinook salmon OMR management sub-actions in coordination with other interested agencies and stakeholders. Specific work pertaining to this action should be conducted by the current Winter-run Chinook Machine Learning Interagency Team. The team has welcomed input from a diverse array of agency and stakeholder representatives since its inception to provide critical guidance throughout model development and interpretation. This role would continue with the addition of SDM processes as needed.

d) Tools: Winter-Run Chinook Salmon Machine Learning Model

2) Spring-run OMR Management

1) Brief description: Spring-run OMR Management, Science, and Monitoring: Section 3.9.2 of the Proposed Action describes an approach to minimize impacts of SWP and CVP operations in the South Delta on Sacramento River origin spring-run Chinook Salmon that relies on detection of hatchery-origin Chinook Salmon (spring-, fall-, and late fall-run) in salvage at the SWP and CVP facilities as surrogates for entrainment of natural-origin spring-run in the Central and South Delta. While implementing the Spring-run Hatchery Surrogate measure a parallel effort is ongoing to develop an annual Spring-run Juvenile Production Estimate (JPE) (PA Section 3.9.2). PA Section 3.9.2 describes the timeline for initial program development (interim monitoring, special studies, and development of the JPE database and model) and the intention to utilize independent peer reviews. The Spring-run JPE Core Team is also responsible for evaluating the

existing Spring-run Hatchery Surrogate measure (PA Section XX). Recommendations from these reviews will inform considerations for future reinitiation of consultation and ITP amendments with NMFS and CDFW. A subsequent independent peer review will be considered to continue to evaluate monitoring and special study data available through implementation of the Spring-run JPE as well as the initial Spring-run Lifecycle Model.

2) *Assigned AM Bin*: **Bin 2**
Development of an interim Spring-run JPE is ongoing and independent peer reviews of the Spring-run JPE program will be considered in the near-term. Additionally, the Spring-run JPE Core Team is tasked with reviewing the Spring-run Hatchery Surrogate measure (see Special Studies Section) in early 2025.

3) *Adaptive Management Technical Team*: The Spring-run JPE Core Team is responsible for implementing the Spring-run JPE program, and collaborating with the AMSC to charter independent peer review panels when initiated, and evaluating the Spring-run Hatchery Surrogate measure. After these reviews DWR and Reclamation will continue to convene the Spring-run JPE Core Team and subteams in coordination with CDFW, NMFS, and the US Fish and Wildlife Service (USFWS), and support implementation of the Spring-run JPE Science Plan, the Spring-run JPE Monitoring Plan, the Spring-run JPE Race ID Program Development Plan, the Spring-run JPE Data Management Strategy, and updates to those plans.

4) *Tools:* The Spring-run JPE and the Spring-run Lifecycle Model are key tools needed to reduce uncertainty regarding the timing and abundance of young-of-year and yearling life stages entering the Delta from the Sacramento River and assess impacts of a variety of stressors on spring-run Chinook Salmon.

3) **Larval and Juvenile Delta Smelt OMR Management**

a. *Brief Description:* The Larval and Juvenile Delta Smelt Protection Action in Chapter 3 of the ITP Application describes an approach to minimize the impacts of the SWP and CVP operations in the south Delta on larval and juvenile Delta Smelt that relies on the collection of Secchi depth data by field surveys. While this metric of water clarity is based upon the best available science, it is anticipated that an evaluation of turbidity data from telemetered water quality stations across the south and central Delta could yield a trigger that would be more responsive to real-time conditions and would eliminate the need for field crews to conduct additional Secchi depth surveys when data is needed more frequently than biweekly. The turbidity-based trigger level will be as close as is feasible to matching the existing Secchi depth trigger of 1 meter, including using multiple turbidity stations to match the geographic scope of the 12 stations used for the Secchi depth trigger.

b. *Assigned Adaptive Management Bin:* **Bin 2**

Development of a turbidity-based trigger to replace the Secchi depth trigger will be considered in the near term.

c. *Adaptive Management Technical Team:* A team of technical staff from CDFW, USFWS, DWR, and Reclamation will convene to discuss analytical approaches to developing a turbidity-based trigger that provides the same level of minimization as the Secchi depth trigger.

d. *Tools:* The Delta Smelt Life Cycle Model informed the development of the Secchi depth trigger and may be used to evaluate a turbidity-based trigger.

4) Larval and Juvenile Longfin Smelt OMR Management

a. *Brief Description:* The Larval and Juvenile Longfin Smelt Protection Action in Chapter 3 of the ITP Application describes an approach to minimize the impacts of the SWP and CVP operations in the south Delta on larval and juvenile Longfin Smelt that relies on paired real-time hydrologic and monitoring triggers. While these OMR management triggers are designed to provide entrainment minimization for larval and juvenile Longfin Smelt, the inclusion of new monitoring data and quantitative tools could provide further evaluation of environmental and monitoring data that could potentially yield an action that would be more responsive to real-time conditions and be more effective at minimizing entrainment.

b. *Assigned Adaptive Management Bin:* **Bin 2**

Development of a new OMR management trigger will be considered in the near term.

c. *Adaptive Management Technical Team:* A team of technical staff from CDFW, USFWS, DWR, and Reclamation will convene to discuss analytical approaches to analyzing water quality, hydrologic, and distribution data to inform the creation of a new trigger framework initiating OMR management.

d. *Tools:* Available water quality, hydrologic, and fish monitoring datasets will be analyzed, as well as relevant flow and particle tracking models, as appropriate. New Longfin Smelt life cycle model tools will be utilized, as available.

5) Summer-Fall Habitat Action for Delta Smelt

To study habitat effects on Delta Smelt survival and evaluate effectiveness of mitigation actions in improving habitat and food availability, DWR and Reclamation have proposed the Summer Fall-Habitat Action (SFHA). The SFHA includes, but is not limited to, the actions described below. The Delta Coordination Group (DCG) will a) develop a multi-year science and monitoring plan for the Summer-Fall Habitat Action including focused studies and b) conduct reviews of action plans and seasonal action results to inform future summer-fall actions or improvements to science and monitoring to inform uncertainties in evaluation. The DCG will utilize project-specific and technical teams for coordination on the adaptive management framework as described in the AMP. Specific adaptive management plans for the Summer-Fall Habitat Actions will be reviewed by the AMT (where applicable), and coordination with the AMT may differ for actions based on assignment of AM bins.

Fall X2

a) *Brief Description:* To increase the amount of low-salinity zone habitat for Delta Smelt in wet and above normal hydrologic year types, DWR and Reclamation will maintain a 30-day average X2 ≤ 80 km from September 1 through October 31.

In 2012, USFWS initiated the development of several life cycle modeling efforts to better understand the factors that affect Delta Smelt population growth rates. These efforts led to two published life cycle models. The results of these life cycle model variations support the hypothesis that Delta outflow in the summer has a stronger effect on Delta Smelt survival than Delta outflow in the fall. The best information currently available suggests that high summer flows help align habitat needs of Delta Smelt in the Suisun Marsh and Suisun Bay region, including turbidity and water temperature, while also increasing food subsidies, supporting Delta Smelt growth and survival. The same outcome is expected if flows are high enough in the fall, but the response of Delta Smelt is expected to be less, because ambient air temperatures cool into more appropriate ranges and the prey subsidy is reduced as prey populations seasonally senesce. These changes in fall habitat conditions are expected to occur part way through the September – November time period considered in the Delta Smelt lifecycle models. This newer information merits a robust synthesis effort to bring together available modeling tools, including the Delta Smelt lifecycle model, and monitoring data.

b) *Assigned AM Bin:* **Bin 1**
While science and monitoring in the summer and fall will occur each year (during implementation and non-implementation years), evaluation of the Fall X2 action will occur on a shorter timeframe, after multiple years of implementation since its inception in 2008. The AMT will work with described technical teams to develop a comprehensive synthesis of summer-fall habitat conditions to inform the development of an adaptive management plan. The AMT may recommend an independent workshop or review of the Fall X2 action following sufficient a robust evaluation and synthesis effort. The AMSC may also request that the AMT develop alternative X2 actions to implement during the summer-fall time period that provide equal or better benefits to Delta Smelt as the Fall X2 action originally developed in 2008.

c) *Adaptive Management Technical Team:* The Delta Coordination Group (DCG), in collaboration with DCG technical teams (Science and Monitoring Workgroup and Hydrology and Operations Workgroup) will be responsible for developing adaptive management plans specific to the Fall X2 including describing AM objectives, hypotheses, and performance metrics for evaluation.

Suisun Marsh Salinity Control Gate

a) *Brief Description:* To improve Delta Smelt habitat in Suisun Marsh and Grizzly Bay during summer-fall, Suisun Marsh Salinity Control Gates (SMSCG) will be operated as described in PA Section XX to maximize the number of days at Belden's Landing where the 3-day average of salinity is equal or less than 4 psu during Above Normal and Below Normal years and 6 psu in Dry years with the goal of maximizing the amount of suitable habitat available to Delta Smelt in Suisun Marsh and Grizzly Bay.

b) *Assigned AM Bin:* **Bin 3**
While science and monitoring will occur each year (during implementation and non-implementation years), evaluation of SMSCG operation efficacy will occur on a longer timeframe

after multiple years of implementation across a range of hydrologic conditions, within 10-15 years. The AMT will work with described technical teams to review monitoring plans and focused research as needed within the larger SDM process. They may recommend an independent workshop or review of the action following sufficient implementation and monitoring for a robust evaluation.

c) *Adaptive Management Technical Team:* The Delta Coordination Group (DCG), in collaboration with DCG technical teams (Science and Monitoring Workgroup and Hydrology and Operations Workgroup) will be responsible for developing adaptive management plans specific to the SMSCG action including describing AM objectives, hypotheses, and performance metrics for evaluation.

Experimental Food Enhancement Actions

a) *Brief Description:* Each year food subsidy measures to augment the SFHA will be considered. Food actions may include a number of implementation alternatives (e.g., water source, timing, intensity, etc.) which have been evaluated by the Delta Coordination Group (DCG) to inform future implementation plans. 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. Food actions include North Delta Food Subsidy Action, Managed Wetland reoperation in Suisun Marsh, and Sacramento Deepwater Ship Channel Food Subsidy Action.

b) *Assigned AM Bin:* **Bin 2**
Following multiple years of implementation, data collection, and results, the DCG may suggest convening an independent workshop or review panel within the timeframe of the consultation and ITP. Results will be included in seasonal reporting and adaptive management reviews 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 by the AMSC.

c) *Adaptive Management Technical Team:* Food subsidy action plans, monitoring plans, focused research and reports will be developed by the DCG, in collaboration with DCG technical teams (Science and Monitoring Workgroup and Hydrology and Operations Workgroup). Together, teams will be responsible for developing adaptive management plans specific to food actions including describing objectives, hypotheses, performance metrics for evaluation, and timeline.

6) Tidal Habitat Restoration Effectiveness for Smelt Fishes

a) *Brief Description:* DWR and Reclamation propose to carry forward habitat restoration acre targets identified from the 2008 and 2019 FWS Biological Opinions (8,000 acres) and the 2020 ITP (396.3 acres) to complete mitigation requirements for Delta Smelt and Longfin Smelt (per the 2020 ITP). DWR and Reclamation propose to meet the total acreage requirement (8,396.3 acres) through completion of habitat restoration projects. The projects identified in the PA are

in different phases of completion: 1) constructed (3,584 acres), 2), in construction (3,490 acres) or 3) planned (1,662 acres). All identified restoration projects are located in the northern arc of the upper estuary and are designed to enhance food production and rearing habitat for Delta Smelt and Longfin Smelt (per the 2020 ITP). DWR and Reclamation will complete its 8,396.3 acre restoration requirements by 2026.

b) *Assigned AM Bin:* **Bins 1 and 3**

Bin 1*:* Some actions involving treatment or clearing of invasive vegetation, use or presence of livestock, or other land management actions will be evaluated on an annual or biannual basis. These evaluations may inform revisions to site-specific Long-term Management Plans, which are required of DWR and Reclamation as part of the mitigation.

Bin *3:* To understand the effectiveness of tidal wetland restoration for providing a food subsidy for pelagic areas to benefit Delta Smelt as well as juvenile rearing habitat for Chinook Salmon, monitoring occurring as part of the DWR-CDFW Fish Restoration Program will continue throughout the permitted period. Monitoring will allow assessment of the biotic and abiotic capacity of restored tidal wetlands to support listed fish species, the opportunity for fish to access wetland-derived resources, and actual use of those resources. Reference wetlands will continue to be monitored concurrently to account for dynamic regional conditions that also impact restored habitats. Following multiple years of monitoring and targeted studies to address specific uncertainties regarding effectiveness of tidal wetland restoration, such as the ability of restoration locations to provide food resources to Delta Smelt at critical times of the year, observations of Delta Smelt or juvenile Chinook Salmon occupying restoration sites or utilizing restored resources, and retrospective evaluation of the tidal marsh restoration site quality and or effectiveness relative to targets identified, the AMSC will provide guidance to the AMT in prioritizing data and information for synthesis work. Syntheses for understanding efficacy of tidal wetland restoration may regard food subsidy, effects of restoration on water quality, prevalence of invasive aquatic vegetation, utilization of restored habitat by Delta Smelt and listed salmonids, as well as evaluations of site design and local geomorphology on tidal wetland function as a food web subsidy. Based on the data resources and information available, the AMT may recommend that an independent workshop or peer review panel be convened to assist with evaluation and collecting lessons learned. Information gathered through syntheses, workshops, and/or independent review panels will be used to inform future tidal wetland restoration designs and future reinitiation of consultation for the SWP and CVP with USFWS and NMFS and ITP amendments for the SWP with CDFW.

c) *Adaptive Management Technical Teams:*

i. DWR and CDFW will lead evaluations of land management actions to inform and develop changes to site specific Long-term Management Plans based on information gained through evaluation of specific management practices and will coordinate accordingly with Reclamation, USFWS and NMFS on plan revisions.

ii. An inter-agency technical team composed of scientists from DWR, Reclamation, CDFW, USFWS, and state and federal water contracting entities, as well as any consultants contracted for focused research on specific uncertainties regarding tidal wetland restoration will be responsible for data analyses and synthesis work. This team will work with the AMSC to prioritize data analyses that are responsive to specific hypotheses

regarding tidal wetland restoration effectiveness as a food subsidy and juvenile salmon rearing habitat. At milestones for analysis and reporting of special studies or multi-year syntheses, the inter-agency technical team will present its findings to the Interagency Ecological Program's Tidal Wetland Project Work Team, which is an open and collaborative venue for exchange of scientific ideas and information.

7) Tributary Habitat Restoration Effectiveness for Salmonid Fishes

a) Brief Description: 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 (referred to Project henceforth) 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.

b) Assigned AM Bins: ***Bin 1 and 3***

Bin 1: Some actions involving annual land management practices will be evaluated on an annual or biannual basis. These evaluations may inform revisions to site-specific Long-term Management Plans, which are required of DWR and Reclamation as part of the mitigation.

Bin 3: Monitoring and targeted studies to address specific uncertainties regarding effectiveness of tributary habitat restoration inform the Science Integration Team's decision support models. The AMT will review recommendations from decision support models to assess critical uncertainties to understand the effectiveness of tributary habitat restoration in providing spawning and refuge habitat to benefit Chinook Salmon, monitoring occurring as part of the Anadromous Fish Habitat Restoration Program throughout the permitted period.

c) *Adaptive Management Technical Team:* 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.

8) Shasta Spring Pulse Studies

a) Brief Description: Reclamation will release up to 150 thousand acre feet (TAF) in pulse flow(s) each water year to benefit Chinook Salmon in the Sacramento River watershed. In 2021, a multi-year Upper Sacramento River Spring Pulse Flow Study Plan was developed by Reclamation in coordination with CDFW, USFWS, NMFS, SWRCB, UCSC, and SRSC. The timing, magnitude, duration, and frequency of the pulse flows will be evaluated and refined by the Sacramento River Group (SRG) on an annual basis and with the intent of maximizing multi-species benefits,

which may include coordinating timing of pulse flows with natural flow events and/or pulse flows in tributaries. The pulse flow schedule will be planned by the agencies and stakeholders in the SRG and implemented annually by Reclamation. Reclamation will reduce the volume of a pulse flow, not release a pulse flow, or apply the water to another purpose only if CDFW, NMFS, or USFWS determines that these alternatives will be more beneficial to fish species. CDFW or NMFS would consider reducing the volume of a pulse flow or not releasing a pulse flow if, for example:

i. the releases would increase the forecasted winter-run Chinook Salmon mean annual temperature dependent mortality (TDM) by 10% or more, or

ii. the 150 TAF pulse flow volume (regardless of when it is released) would decrease the forecasted end of April Shasta storage to below 2.2 MAF using the February 90% exceedance forecast.

b) Assigned AM Bin: **Bins 2 and 3**

Bin 2: 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.

Bin 3: If Bin 2 evaluations indicate a set of triggers and or the timing and magnitude of spring pulse flows are beyond what was considered in the Proposed Action or review of conditions, triggers, and effects after multiple years of implementation across a range of hydrologic conditions determines there is new understanding and/or information that is significantly different from what was applied to the effects analysis at the time of ESA consultation initiation. Reviews will also provide an opportunity to consider refined understanding and potential applications to other tributaries, divisions, or systems.

c) Adaptive Management Technical Team:

Bin 2 responsibilities would be assigned to the SRG.

Bin 3 responsibilities would be assigned to the SRG, SHOT, and the AMSC.

9) Winter-run Chinook Salmon Through-Delta Survival and Salvage Thresholds

a) Brief Description: There is considerable uncertainty surrounding the implications of facility loss of juvenile Sacramento River winter-run Chinook Salmon at CVP and SWP facilities for through-Delta survival in the Central Valley Bay-Delta. Juvenile salmon through-Delta survival, as measured at Chipps Island (Delta exit), accounts for route-specific survival and migration routing through different migratory pathways. Field and modeling studies will address these uncertainties by conducting the following analyses: 1) an acoustic receiver network and associated real-time modeling of the data, 2) targeted acoustic telemetry studies (i.e., tag fish and release them in the Delta, 3) retrospective analyses of data to evaluate through-Delta survival due to LTO operations, 4) incorporation and consideration of any additional routing and survival data obtained, 5) evaluation of the sensitivity of winter-run Chinook Salmon population dynamics, relative to recovery and viability criteria, to through-Delta survival using lifecycle modeling, and 6) analyses of the relationship between loss at facilities and broader Delta

conditions using a combination of particle tracking models. Several lifecycle models, including simplified simulation-based approaches, the CVPIA SIT DSM, and the SWFSC Winter-run Chinook Salmon Lifecycle Model, may be considered to evaluate winter-run Chinook Salmon population responses to varying Delta conditions and identify a target Delta survival. We propose using multiple particle tracking models (e.g., PTM, ecoPTM, ePTM), with competing tradeoffs related to ease of implementation and assumptions about particle movement and mortality, to assess relationships between loss at facilities and Delta survival.

b) *Assigned AM Bin:* **Bin 2**
Studies will be completed to address uncertainties in the estimation of through-Delta survival. These newly generated modeling results will be used to propose and update decision support tools for juvenile Chinook Salmon related to outmigration survival and entrainment risk and may change the triggers for export reductions. This work may be of interest to independent review panels. New information and its application may inform future reinitiation of consultation and ITP amendments.

c) *Adaptive Management Technical Team:* This work has been of interest to the Science Integration Team (SIT), which has identified these studies as critical for reducing uncertainty in entrainment risk management. Field coordination and implementation of these studies has occurred through the Interagency Telemetry Advisory Group (ITAG) since 2018. Technical review may occur through the SIT and/or ITAG.

10) Longfin Smelt Science Plan Actions
a) *Brief Description:* The Special Studies Section of the Proposed Action describes the continued implementation of the Longfin Smelt Science Program and updating its science plan. The science plan is a roadmap for addressing substantial gaps in our understanding of the biology and ecology of Longfin Smelt, which include management activities needed to prevent further decline of the species within the San Francisco Estuary. To accomplish this, the Longfin Smelt Technical Team (LFSTT) will continue to develop and support the ongoing activities of the Longfin Smelt Science Program. These activities will address one or more of the seven Priority Areas of the science plan and are expected to produce valuable information for resource managers. These Priority Areas are: 1) continued development of the Longfin Smelt lifecycle model, 2) providing input and guidance for the Longfin Smelt culture program, 3) improved distribution monitoring, 4) improved larval entrainment monitoring, 5) improved understanding of spawning and rearing habitat, 6) understanding migration and movement behaviors, and 7) factors which affect abundance, growth, and survival. Findings from the scientific activities conducted within the program will inform considerations for future consultations and ITPs. However, if new information pertinent to real-time operations for Longfin Smelt entrainment or if LFSTT provides other information relevant to management actions for Longfin Smelt during the term of the BiOp or ITP, trigger re-initiation of consultation or an ITP amendment for the actions.

b) *Assigned AM Bin:* **Bin 2**
A Longfin Smelt Science Plan has been developed and implementation of high priority individual science actions has begun. Actions already underway include development of a Longfin Smelt

lifecycle model, establishing Longfin Smelt in culture, and improved distribution monitoring. The LFSTT has prioritized science actions to allow for sequenced implementation and completion over the course of the next eight years. As a result, actions will be ready for evaluation and be available to inform development of a subsequent permit/consultation.

c) *Adaptive Management Technical Team:* The Longfin Smelt Technical Team (LFSTT) would be assigned all responsibilities for guiding implementation of each Longfin Smelt Science Action identified in the Longfin Smelt Science Plan. The LFSTT is co-lead by DWR and CDFW and includes representatives from USFWS, Reclamation, and the State/Federal Water Contractors.

11) Delta Smelt Supplementation

a) *Brief Description:* DWR and Reclamation propose to support continued experimental releases and the development of a program to conduct supplementation of the wild Delta Smelt population with propagated fish consistent with USFWS' Supplementation Strategy (USFWS 2020). Reclamation and DWR will ensure production ramps up to a minimum of 125,000 fish by water year 2024, a minimum of 150,000 fish by water year 2025 and a minimum of 200,000 fish by water year 2026 that are at least 200 days post-hatch (dph) or equivalent as informed by CDFW and USFWS. USFWS and CDFW, in coordination with Reclamation and DWR, will update the Supplementation Strategy to incorporate new findings from the program and update performance metrics used to guide production targets and methods development.

b) *Assigned AM Bin:* **Bins 1 and 2**

Bin 1: A process to evaluate production targets to support supplementation will be developed and implemented no less than annually via the existing Culture and Supplementation of Smelt (CASS) Steering Committee. Outcomes of the review may include but are not limited to revisions of production numbers, timeline, release methods, monitoring, and genetic management strategies. These findings will be incorporated into the Supplementation Strategy and will serve as guidance for the program.

Bin 2: Additionally, an independent peer review of the program may be conducted on a 5-year basis at the discretion of the AMSC.

c) *Adaptive Management Technical Team:* The CASS group was created in 2019 and is comprised of participants from Reclamation, DWR, CDFW, and USFWS. This body provides oversight in advancing science-based management activities to secure and stabilize the Delta Smelt population through a coordinated propagation and supplementation program. The CASS Steering Committee shall continue to provide guidance to its three working groups: 1) Captive Propagation Working Group, 2) Research Working Group, and 3) Regulatory Working Group. The CASS Steering Committee may be integrated into the AMSC following formation of the AMSC.

12) Steelhead JPE

a) *Brief description*: 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.

b) *Assigned AM Bin*: **Bin 2**
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. 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.

c) *Adaptive Management Technical Team*: Reclamation and DWR, in coordination with USFWS, NMFS, CDFW, and interested stakeholders will create or use an existing technical team should one be later identified to develop the steelhead JPE framework and incorporate feedback from the 2024 and 2028 panel reviews.

13) Alternative Salmonid Loss Estimation Pilot Study

a) *Brief description*: DWR, in coordination with Reclamation, has completed a draft updated Alternative Loss Equation (ALE-22) software tool for estimating winter-run and spring-run Chinook Salmon and Central Valley steelhead losses at the SWP and CVP export facilities. DWR, in coordination with Reclamation and the Alternative Loss Equation Technical Team (ALE-TT), a proposed new sub-team of the Central Valley Fish Facilities Review Team (CVFFRT), will 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 and incorporate SDM to prioritize the implementation of loss component studies and performance evaluation studies. The goal of this pilot study is to provide a more accurate estimates of salmonid 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.

b) *Assigned AM Bin*: **Bin 2**
Within the first year of the effective date of the ROD or ITP, DWR, in collaboration with Reclamation, will convene the ALE-TT and conduct a knowledge transfer and methods workshop for the ALE-22 tool and prepare a draft ALPS-IP for ALE-TT review. Within the second year of the effective date of the ROD or ITP, DWR will submit the final draft ALPS-IP for both the ALE-TT and AMSC review. DWR will finalize the ALPS-IP once approved by the AMSC and establish priorities for implementation (e.g., loss parameter studies) using SDM within the ALE-TT. The ALE-TT may utilize an independent science panel review to further enhance the SDM prioritization process. In the third year of the effective date of the ROD or ITP, DWR will submit prioritized ALPS-IP recommendations, informed by the ALE-TT SDM process, to the AMSC for approval. The permittee shall then update the loss equation with refinement to the loss equation components as approved by CDFW.

c) *Adaptive Management Technical Team*:
    i. Knowledge transfer and methods workshop: DWR and Reclamation will convene the ALE-TT, with membership comprised of DWR, Reclamation, CDFW, USFWS, NMFS, and State/Federal Water Contractors representatives, as well as other interested stakeholders.
    ii. Review of the initial draft ALPS-IP: ALE-TT
    iii. Review of the final draft ALPS-IP: ALE-TT, AMSC, as well as input from the CVFFRT and Salmonid Monitoring Team (SaMT)
    iv. SDM Prioritization of ALPS-IP: ALE-TT, with support from an independent review panel if requested.

14) Shasta Cold Water Pool Management
    a) *Brief Description:* Reclamation will operate Shasta Reservoir to build a cold-water pool and use the Temperature Control Device (TCD) on Shasta Dam to blend water from different reservoir strata to protect downstream winter-run Chinook Salmon returning adults and incubating eggs from temperature stressors. An annual operation of the Shasta TCD and the development of the temperature management plan will be developed as part of real-time operations. Shasta Reservoir cold water pool management will rely on an objectives-based management framework adapted from the multi-year drought sequence experienced in Victoria, Australia (Mount et al. 2016) that considers the available hydrology to "Protect," "Maintain," "Recover," and "Enhance," protected species, habitats, and water deliveries. An initial set of objectives and metrics will be further refined according to increased understanding of species needs, interannual hydrologic conditions (e.g., drought) and operational limitations.

    b) *Assigned AM Bin:* **Bin 2**
    Hindcast evaluation of action effectiveness that includes a review of the objectives and metrics used to guide annual temperature planning. Objective-based storage targets and temperature dependent mortality will be considered with regards to their ability to support species viability and water delivery performance.

    c) *Adaptive Management Technical Team:* Evaluation of action effectiveness and objective-based criteria would be assigned to the SRG.

15) Georgiana Slough Salmonid Migratory Barrier Effectiveness for salmonid fishes
    a) *Brief Description:* DWR in coordination with Reclamation will continue to seasonally install and operate a salmonid migratory barrier at Georgiana Slough each year to reduce entrainment into the Central and South Delta of emigrating juvenile salmonids. 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.

b) *Assigned AM Bin:* **Bin 2**
Triennial report of GSSMB operations and monitoring that can be used to inform necessary changes/updates to the Operations and Monitoring Plans.

c) *Adaptive Management Technical Team:* Triennial report and updating the GSSMB Operations and Management Plan would be assigned to the GSSMB Coordination Group.

16) Spring Outflow

a) *Brief Description:* Reclamation and DWR will supplement Delta outflow during spring months per the terms of the Voluntary Agreements (VAs) as described in the March 2022 Voluntary Agreement Term Sheet, revised in November 2022. Actions that will support the additional Delta outflow include Reclamation and DWR south of Delta export modifications, Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds and passing Delta inflow from water made available by VA Parties. In the latter case, spring flow pulses on VA tributary systems (Sacramento, American, Feather, Mokelumne, Yuba, and Tuolumne rivers and Putah Creek) are intended to benefit juvenile Chinook Salmon growth and survival in the tributaries while also contributing to increased Delta outflows. The increased Delta outflows are intended to benefit Chinook Salmon outmigration survival in the Delta and enhance habitat for native estuarine fishes, including Delta Smelt and Longfin Smelt. The amount of supplemental Delta outflows will vary by water year type, with 750 – 825 TAF provided in Dry, Below Normal, and Above Normal years, and approximately 150 TAF provided in Critical and Wet years. The supplemental flows will occur during the months of March through May and prioritized during the period of April 1 – May 31. The details of flow amounts by source and water year type are provided in Section XX the PA and in the November 2022 revision of the March 2022 Voluntary Agreement Term Sheet. Supplemental spring Delta outflows are proposed as part of a path of implementation for an updated SWRCB Bay-Delta Water Quality Control Plan. In advance of the SWRCB's decision regarding the VA proposal, the supplemental Delta outflows will occur as an early implementation action and continue if and when the SWRCB incorporates the VA actions into an updated Water Quality Control Plan. During implementation, supplemental spring flows will be managed by real-time operation groups to determine the source, schedule, and amount of water to ensure consistency with proposed flow levels as described in the Voluntary Agreement Term Sheet.

b) *Assigned AM Bin:* **Bin 3**
For a synthetic, multi-year evaluation of the performance of increased spring Delta outflows to inform the next reinitiation of consultation for long-term operations of the SWP and CVP and development of a California Endangered Species Act ITP.

c) *Adaptive Management Technical Team:* The Voluntary Agreement Science Committee (VASC) is facilitated by an independent third party and is comprised of scientists and science managers from DWR, Reclamation, CDFW, NMFS, USFWS, and the Public Water Agency organizations of the VA Parties, with staff from the SWRCB participating in an advisory capacity. The Voluntary Agreement Term Sheet includes provisions for a VA Science Program to support adaptive

management of VA actions, including increased spring flows on tributaries and Delta outflow. The VASC intends to use quantitative decision-support tools (e.g., lifecycle models for Chinook Salmon) and SDM processes to provide recommendations to the VA Program's decision-making body, the Systemwide Governance Committee. To support the VA program's adaptive management process, the VASC has developed a draft VA Science Plan, which contains hypotheses, metrics, and baselines for evaluating increased spring Delta outflows and pulse flows on tributaries. The draft VA Science Plan thus provides a framework for a multi-year evaluation of whether supplemental spring flows are performing according to expectations and will inform the SWRCB evaluation of the VA Program in Years 6 – 8 of the program, including how and whether the VA Program should continue after Year 8. The VASC will support adaptive management of spring outflows for the Biological Opinion by providing the multi-year, synthetic evaluation developed for the VA Program to the AMSC to inform future major reinitiation of consultation and ITP amendments.

17) Clear Creek

a) Brief Description: A draft proposal from Reclamation for long term Clear Creek/Whiskeytown Reservoir operations includes a novel approach to exerting desirable intra-annual flow variability. A draft new flow regime would implement variable flows over the course of a year that would range from flow releases as low as 100 cfs in late summer, adapting flow needs during spring-run Chinook Salmon spawning/the onset of fall-run spawning in September/October, and (ultimately) slowly ramping up to 300 cfs in the winter when fry could benefit from seasonally inundated surfaces, then ramping back down to 100 cfs the following summer to start again. This flow variability will create a more natural seasonally variable hydrograph and is expected to provide opportunity for gravel augmentation or other restoration to target surface elevations and channel form for seasonal inundation to benefit salmon rearing. There are expected benefits and potential consequences from these changes. Continuation of existing, and some proposed, monitoring efforts including but not limited to RBFWO maintained temperature loggers, Potential Spawning Area Mapping (PSAM), Spawn Area Mapping (SAM), rotary screw trapping, spawning surveys, snorkel surveys, video weir, redd mapping, and proposed habitat monitoring will be important for evaluation of these management actions.

b) Assigned AM Bin: **Bin 2**

An adaptive management and monitoring approach to the new flow regime and/or temperature criteria will be useful for determining if the flow variability indeed provides viable opportunity to contribute to restoring channel form and floodplain elevations to targeting rearing habitat and improved growth and survival for juvenile salmon, and for guiding adjustments to flow and temperature criteria if necessary. It is anticipated that adaptive management refinements would occur at approximately three-year intervals, although more frequent refinements may be necessary in the first few years of implementing the new flow regime.

c) Adaptive Management Technical Team: Field coordination and implementation of monitoring studies would occur though the existing Clear Creek Technical Team (CCTT) work team. The CCTT, with representatives from Reclamation, USFWS, NMFS, DWR, CDFW and others, provides Central Valley Operations with an annual pulse flow and temperature management proposal. This proposal details the CCTT's request for pulse flow releases from Whiskeytown Dam (e.g., flow schedule, ramping rates, peak flow) and water temperature management, as well as

background information on fish monitoring and proposal rationale. It is anticipated that the CCTT will continue to provide annual proposals and that they will include details on how best to implement the variable flow regime and meet water temperature criteria. Additionally, the CCTT is anticipated to review outcomes of the flow regime and make suggestions to improve future management actions for the benefit of fish and wildlife on Clear Creek. Additionally, the CCTT provides Reclamation with an annual summary of management activities on Clear Creek. These reports highlight the past water year's conditions, management actions and results, habitat restoration projects, fisheries monitoring data, and the CCTT's meeting discussions. It is anticipated that these annual summaries will continue to provide evaluations and potential refinements for future year's implementation of flow and temperature management.