RECLAMATION
Managing Water in the West

Administrative Draft Biological Assessment

Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project

Central Valley Project, California

Mid-Pacific Region

CLOSE HOLD - FOIA Exempt/Confidential Draft/Deliberative - Attorney Client Privileged

Incomplete Partially Annotated Outline for Discussion Purposes

Contents Subject to Change

U.S. Department of the Interior

Bureau of Reclamation **November 16, 2018**

Mission Statements

The mission of the Department of the Interior is to protect and manage the Nation's natural resources and cultural heritage; provide scientific and other information about those resources; and honor its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

1. Introduction

On August 2, 2016, the United States Department of the Interior, Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) jointly requested the Reinitiation of Consultation on the Coordinated Long-Term Operation (ROC on LTO) of the Central Valley Project (CVP) and State Water Project (SWP) (Project). The U.S. Fish and Wildlife Service (USFWS) accepted the reinitiation request on August 3, 2016, and the National Marine Fisheries Service (NMFS) accepted the reinitiation request on August 17, 2016. This biological assessment (BA) supports of Reclamation's consultation under Section 7 of the Endangered Species Act (ESA) of 1973, as amended. This BA documents the potential effects of the proposed action on federally listed threatened and endangered species that have the potential to occur in the action area and the potential effects on critical habitat for these species.

1.1 Background

This section will include the history of flood control, storage and diversion in California beginning in 1772. It also addresses historical stressors in the Action Area (e.g. gold rush and hydraulic mining, commercial harvest, exotic species).

1.1.1. Construction and Operation of the CVP and SWP

This section will include the authorizations, reauthorization, facility construction and historical requirements on the CVP and SWP.

1.1.2. Current Legal Requirements

This section will describe the current regulations and commitments associated with the CVP and SWP.

1.2 Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

1.3 Species Considered

Pursuant to the interagency consultation requirements of Section 7 of the ESA, this BA has been prepared to assess the effects of the proposed action on federally protected species and designated critical habitat.

1.3.1. Species Considered but Not Addressed Further

Reclamation has completed separate ESA consultations for contract renewals in 2004 and 2005, and those consultations addressed applicable CVP service area effects to federally listed upland species. In addition, several species can be considered as highly unlikely to occur in the action area and, therefore, do not warrant analysis of potential Project impacts.

1.4 Consultation History

This section will include the consultation history.

2. Status of the Species and Designated Critical Habitat

This section will include appropriate information on the species' life history, its habitat, its habitat and distribution, and other data on factors necessary to its survival, is included to provide background for analyses in later sections.

This section will describe the stressors to the species, including physical alteration, hydrological alteration, entrainment, contaminants, ocean harvest, hatcheries, non-native predators, invasive aquatic weeds, and clams.

CVP and SWP operations include a balancing of competing and conflicting laws, regulations, contracts, and agreements. These include conflicts between watersheds, between fish species, between authorized purposes, and between water users.

3. Environmental Baseline

The environmental baseline is the state of the world without the action under the review. The baseline includes past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process [50 CFR 402.02].

4. Proposed Action

Reclamation's mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. Reclamation is the second largest producer of hydroelectric power in the United States.

In California, Reclamation operates the CVP in coordination with DWR's SWP. The mission of DWR is to manage the water resources of California, in cooperation with other agencies, to benefit the State's people and to protect, restore, and enhance the natural and human environment.

The CVP consists of 20 dams and reservoirs that together can store nearly 12 million acre-feet (MAF). Through operation of the CVP, Reclamation delivers water to more than 270 contractors in 29 of California's 58 counties, providing an annual average of 5 MAF of water for farms; approximately 600 thousand acre-feet (TAF) of water for municipal and industrial uses (enough water to supply about 2.5 million people for a year); approximately 355 TAF of water for wildlife refuges, and water for maintaining water quality in the Sacramento-San Joaquin Delta.

Reclamation and DWR propose the coordinated long-term operation of the CVP and SWP to maximize water supply delivery and optimize power generation consistent with applicable laws, contractual obligations, and agreements; and to increase operational flexibility by focusing on non-operational measures to avoid jeopardy. Reclamation and DWR propose to store, divert and convey water in accordance with existing water contracts and agreements, including water

service and repayment contracts, settlement contracts, exchange contracts, and refuge deliveries, consistent with water rights.

DWR operates Oroville Dam, the Harvey O Banks Pumping Plant (Banks Pumping Plant), along with a network of canals and aqueducts and other facilities of the SWP to deliver 2.4 MAF annually with 5.7 MAF of storage. DWR holds contracts with 29 public agencies in the Upper Feather River Area, North Bay Area, South Bay Area, San Joaquin Valley, Central Coast, and Southern California for water supplies from the SWP. Water stored in the Lake Oroville facilities, along with excess water available in the Delta, is captured in the Delta and conveyed through several facilities to SWP contractors. Through the SWP, DWR provides flood control and water for agricultural, M&I, recreational, and environmental purposes. DWR conserves water in Lake Oroville and makes releases to serve three Feather River contractors. DWR serves contractors from the North Bay Aqueduct and South Bay Aqueduct and meets agreements to assure and protect water supply and water quality. DWR also pumps water at the Banks Pumping Plant in the Delta for delivery to the remaining 24 contractors in the SWP service areas south of the Delta.

4.1. Coordinated Operating Agreement

Reclamation and DWR propose to operate in accordance with the Coordinated Operating Agreement. The State Water Resources Control Board (SWRCB) conditioned Reclamation's and DWR's water rights individually to protect the beneficial uses of water within the CVP and SWP and jointly for the protection of beneficial uses in the Sacramento Valley and the Sacramento–San Joaquin Delta Estuary. Reclamation and DWR coordinate and operate the CVP and SWP to meet water right and obligations upstream of the Delta, Delta water quality and flow objectives, joint water right requirements in the Delta, and CVP and SWP water right and obligations that depend upon diversions from the Delta.

Congress authorized Reclamation to develop the Central Valley Project for the public good of delivering water and generating power while providing flood protection to downstream communities and protecting water quality for water users within the system. Congress envisioned a large, complex project integrated across multiple watersheds that Reclamation would operate to ensure the most beneficial use of water released into the system. As such, both the United States and the State have received permits from the SWRCB for appropriation of unappropriated water in furtherance of their respective projects.

Reclamation and DWR negotiated the Coordinated Operations Agreement (COA) in response to requirements imposed by the SWRCB in 1978 (D-1485, discussed above). COA was signed by both parties and authorized by Congress in 1986. Under COA, Reclamation and DWR operate the CVP and SWP as a single, integrated project with a shared water supply, shared responsibilities, and shared conveyance systems within the Sacramento River and Delta watershed. To beneficially use unappropriated water within the Sacramento River Basin and Delta Estuary, the coordinated operation of the project adheres to COA along with other applicable regulations. The 1986 COA envisioned Delta salinity requirements, but did not envision (or address) export restrictions.

Under COA, Reclamation and DWR agree to operate the CVP and SWP under balanced conditions in a manner that meets Sacramento Valley and Delta needs while maintaining each project's annual water supplies. The COA defines balanced conditions as periods when the two

projects agree that releases from upstream reservoirs, plus unregulated flow, approximately equal water supply needed to meet Sacramento Valley in-basin uses and project exports.

Reclamation and DWR use an accounting procedure based on the sharing principles outlined in the COA. During balanced conditions in the Delta when Reclamation and DWR must release water from storage to meet Sacramento Valley and Delta requirements, currently the CVP bears 75 percent of the responsibility to withdraw from storage and the SWP bears 25 percent. The COA also provides that during balanced conditions when unstored water is available for export, currently 55 percent of the sum of stored water and the unstored water for export is allocated to the CVP, and 45 percent is allocated to the SWP.

<POTENTIAL REVISIONS TO COA>

Implementation of the COA principles has continuously evolved since 1986 as changes have occurred to CVP and SWP facilities, to operating criteria, and to the overall physical and regulatory environment in which the coordination of CVP and SWP operations takes place. New water quality and flow standards (SWRCB Water Right Decision 1641 [D-1641]) have been adopted by the SWRCB; the Central Valley Project Improvement Act (CVPIA) has changed how the CVP is operated; and finally, ESA responsibilities have affected both CVP and SWP operations. The current COA includes an article requiring periodic review every 5 years unless otherwise requested. Although there have been many informal discussions regarding COA, it has not been formally reviewed since 1986.

The 1986 COA envisioned Delta salinity requirements, but did not envision (or address) export restrictions. Both D1641 and the 2008 and 2009 Biological Opinions included various export restrictions which were not explicitly addressed in the 1986 COA, and have not been addressed in a formal update to COA. However, export restrictions have been shared equally between the projects.

Reclamation and DWR propose modifying four key elements of the COA to address changes since COA was originally signed: (1) in-basin uses; (2) CVP use of Banks pumping plant: (3) export restrictions; and (4) the periodic review. These elements are proposed to be updated as follows:

- In-basin use (Article 6(c) of the 1986 agreement) - Sharing of responsibility for meeting Sacramento Valley In-basin use with storage withdraws during balanced water conditions will be changed from 75% United States /25% State of California to the following:

Water Year Type*	United States	State of California
Wet	80%	20%
Above Normal	80%	20%
Below Normal	75%	25%
Dry	65%	35%
Critical	60%	40%

*Water year types will be determined by the Sacramento Valley 40-30-30 index.

- CVP use of Banks Pumping Plant

DWR will convey up to 195 TAF of CVP water through SWP facilities (including Banks Pumping Plant and portions of the California aqueduct) during the months of July through November provided that conveying this water does not adversely affect the SWP or conflict with SWP contract provisions through November.

- Sharing of Export Restrictions

  When exports restrictions are in place, and the Delta is in balanced water conditions, the Projects will share the total export capacity with Reclamation pumping up to 65% of the allowable total exports and DWR pumping the remaining capacity, but no less than 35%.

  When restrictions are in place and the Delta is in excess water conditions, the Projects will share the available capacity with Reclamation pumping 60% and DWR pumping 40% of available water.

- Periodic review (article 14(b)(2) on page 24)

  The process referred to in article 14(b)(2) will be modified to shorten the required review period to one year rather than the two years currently specified.

4.2. CVP Water Contracts

The CVP delivers water pursuant to two main types of contracts: 1) water service contracts and 2) settlement and exchange contracts. This consultation covers the operation of the CVP and SWP, but does not cover the execution of water contracts.

Reclamation and DWR propose to operate the CVP and SWP to deliver water to both senior water right holders who received water prior to construction of the CVP and SWP and to water service contractors. The pattern of diversion of water under a water service contract depends on the use of the water, with irrigation water typically diverted and used during the irrigation season (March through October), and M&I water diverted and used year-round. All water service contracts contain a shortage provision allowing Reclamation to reduce the amount of water made available for a variety of reasons, such as droughts.

The following table summarizes the number of CVP water service contracts, the amount of water under contract, and the average delivery made pursuant to these contracts.

CVP Division	**Number of Contracts**	**Contract Quantity (Acre-feet)**	**Average Delivery WY2010-WY2017 (Acre-feet) Irrigation & M&I**
North of Delta	36	468,890	107,874
American River	8	313,750	275,287

CVP Division	Number of Contracts	Contract Quantity (Acre-feet)	Average Delivery WY2010-WY2017 (Acre-feet) Irrigation & M&I
New Melones/Eastside Contracts	2	155,000	40,442
South of Delta	44	2,112,898	594,724
Friant Division	27	2,249,475	636,996
Contra Costa WD	1	195,000	121,106
North of Delta Refuges - Level 2 Contracts	2	151,250	86,515
South of Delta Refuges - Level 2 Contracts	3	271,001	202,972
TOTALS	**123**	**5,917,264**	**2,065,916**

Reclamation and DWR propose to operate the CVP and SWP in accordance with contracts with senior water right holders both upstream and downstream of most CVP and SWP facilities. The contracts contain different terms, but the largest contracts belong to the Sacramento River Settlement Contractors (approximately 2.1 MAF), the San Joaquin River Exchange contractors (approximately 840 TAF), and the Feather River Service Area contractors (approximately 983 TAF). In very dry years, Reclamation and DWR often operate the CVP and SWP solely to meet these, and other, senior water right requirements along with minimum instream and Delta flows. In recent drought years, limited water supplies and dry hydrology made it difficult for Reclamation to make water available to satisfy contracts already reduced by 25 percent.

Contractor	Number of Contracts	Contract Quantity (Acre-feet)	Average Delivery WY2010 - WY2017 (Acre-feet)
Sacramento River Settlement (SRS)	132	2,112,194 (1,775,313 Base + 336,881 Project)	1,290,954 (Base +Project)
San Joaquin River Exchange	4	840,000	
Oakdale/S. San Joaquin ID Stipulation Agreement	1	≤ 600,000	453,201
American River Contracts	13	578,441	
Friant Division Riparian Holding Contracts	n/a	5 cfs past each diversion	116,945
South of Delta Settlement Contractors	9	35,623	
TOTALS	**157**	**4,283,203**	

4.3. SWP Water Contracts

In 1994, DWR and certain representatives of the SWP contractors negotiated a set of principles designed to modify the long-term SWP water supply contracts. This set of principles, known as the Monterey Agreement, helped to settle long-term water allocation disputes and established new water management strategies for the SWP.

Under State Water Contracts, DWR allocates Table A water as an annual supply made available for scheduled delivery throughout the year. Table A contracts total 4,173 TAF, with over 3 MAF for San Joaquin Valley and Southern California water users.

Article 21 of the long-term water supply contracts provides an interruptible water supply made available only when certain conditions exist. Reclamation and DWR generally fill San Luis Reservoir in the spring or even earlier in some years. DWR proposes to offer Article 21 water when all of the following conditions exist: (1) the SWP share of San Luis Reservoir is physically full, or projected to be physically full; (2) other SWP reservoirs south of the Delta are at their storage targets or the conveyance capacity to fill these reservoirs is maximized; (3) the Delta is in excess condition; (4) current Table A demand is being fully met; and (5) Banks has export capacity beyond that which is needed to meet current Table A and other SWP operational demands.

4.4. D-1641

Reclamation and DWR propose to operate in accordance with D-1641 and the requirements that address the standards for fish and wildlife protection, M&I water quality, agricultural water quality, and Suisun Marsh salinity.

After the extreme drought conditions of 1987-1992, Reclamation worked with DWR, local water users, and other interested parties to develop flow and water quality objectives designed to protect fish without jeopardizing agriculture and M&I uses, beyond those objectives proscribed in previous water right permits (e.g. D-1485). The San Francisco Bay-Delta Agreement (Bay-Delta Accord, 1994) embodied the principles and Reclamation began voluntarily implementing the Bay-Delta Accord in 1994. The Bay-Delta Accord committed the CVP and SWP to a set of Delta habitat-protective water quality objectives that the SWRCB largely incorporated into the 1995 Bay-Delta Water Quality Control Plan (Bay-Delta Plan). The SWRCB incorporated the Bay-Delta Plan along with the temporary Vernalis Adaptive Management Plan (VAMP) (since expired), into D-1641 (December 29, 1999 and revised on March 15, 2000) amending the water rights of the Projects. Reclamation and DWR's request to incorporate the voluntary Bay-Delta Plan into the CVP and SWP water rights, and the SWRCB's action with D-1641, updated the CVP and SWP water rights to reflect the new beneficial uses under State water law. The requirements in SWRCB D-1641 include specific outflow requirements throughout the year, specific export limits in the spring, and export limits based on a percentage of estuary inflow throughout the year.

D-1641 granted Reclamation and DWR the ability to use or exchange each Project's diversion capacity capabilities to enhance the beneficial uses of the CVP and SWP. The SWRCB conditioned the use of Joint Point of Diversion (JPOD) capabilities based on staged implementation and conditional requirements for each stage of implementation. The stages of JPOD in SWRCB D-1641 are:

- Stage 1—for water service to Cross Valley Canal contractors, Tracy Veterans Cemetery and Musco Olive, and to recover export reductions taken to benefit fish.
- Stage 2—for any purpose authorized under the current Project water right permits.
- Stage 3—for any purpose authorized, up to the physical capacity of the diversion facilities.

Each stage of JPOD includes terms and conditions to implement JPOD.

4.5. Central Valley Project Improvement Act

Reclamation and DWR propose to modify the priorities for implementing the CVPIA as described in the basin specific sections in this Proposed Action. Public Law 102-575 (Reclamation Projects Authorization and Adjustment Act) was passed on October 30, 1992. The Act included Title 34, the Central Valley Project Improvement Act. The CVPIA amended previous authorizations of the CVP to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic water supply uses, and fish and wildlife enhancement as having an equal priority with power generation. The CVPIA added the ability of water users to transfer water supplies, mandated water conservation, and other water contract requirements. The CVPIA proscribed a number of actions to improve anadromous fish and provide other fish and wildlife benefits. The CVPIA modified the beneficial uses of the CVP and SWP; but changes were not reflected in the water right permits for the CVP and SWP. The Final Programmatic Environmental Impact Statement (PEIS) was released in October 1999 and the CVPIA Record of Decision (ROD) was signed on January 9, 2001. The BOs were issued on November 21, 2000.

4.6. Allocation and Forecasts

Reclamation proposes to make water service contract allocations on an annual basis in accordance with contracts. Reclamation bases North of Delta allocations primarily on available water supply within the north of Delta system along with expected controlling regulations throughout the year. For South of Delta allocations, Reclamation relies on upstream water supply, previously stored water south of the Delta (in San Luis Reservoir) and conveyance capability through the Delta. Flows on the San Joaquin River often limit conveyance, as these flows are a primary driver of the flow direction within the Delta and through their influence on Old and Middle Reverse Flows, affect entrainment levels at the State and Federal pumps.

The water allocation process for the CVP begins in the fall when Reclamation makes preliminary assessments of the next year's water supply possibilities, given current storage conditions combined with a range of hydrologic conditions. Reclamation may refine these preliminary assessments as the water year progresses. Beginning February 1, Reclamation prepares forecasts of water year runoff using precipitation to date, snow water content accumulation, and runoff to date. All of the CVP's Sacramento River Settlement water rights contracts and San Joaquin River Exchange contracts require that contractors be informed no later than February 15 of any possible deficiency in their supplies. Reclamation targets February 20 as the date for the first announcement of all CVP contractors' forecasted water allocations for the upcoming contract year. Reclamation updates forecasts of runoff and operations plans at least monthly between February and May.

Reclamation bases forecasts initially on runoff volumes that would occur naturally and considers potential upstream operations where relevant. For the February through May period, the runoff volume estimates are based on the observed inflow to date and current snowpack measurements made at the end of each preceding month. These forecasts represent the uncertainty inherent in making runoff predictions. This uncertainty may include sources such as unknown future weather conditions, the various prediction methodologies and the spatial coverage of the data network in a given basin. Reclamation's Central Valley Operations office (CVO) performs operations forecasting on a 12-month ahead cycle each month to determine how the available water resources can best be used to meet project objectives and requirements.

The CVP meets its downstream demands through a combination of reservoir releases. In most years, the combination of carryover storage and runoff into CVP reservoirs and the Central Valley is not sufficient to provide the water to meet all CVP contractors' contractual demands. Since 1992, increasing constraints placed on operations by legislative and ESA requirements removed significant operational flexibility to deliver water to all CVP contractors located north and south of the Delta. This decreased flexibility affected Reclamation's ability to make water available to meet the demands of CVP contractors.

4.6.1. Real-time Operations

Reclamation and DWR coordinate on a daily basis to determine target Delta outflow for water quality, reservoir release levels necessary to meet in-basin demands, schedules for joint use of the San Luis Unit facilities, and for the use of each other's facilities for pumping and wheeling.

During balanced water conditions, Reclamation and DWR maintain a daily water accounting of CVP and SWP obligations. This accounting allows for flexible operations and avoids the need to change reservoir releases made several days in advance (due to travel time from the Delta). Therefore, adjustments can be made "after the fact," using actual observed data rather than by prediction for the variables of reservoir inflow, storage withdrawals, and in-basin uses. This iterative process of observation and adjustment results in a continuous truing up of the running COA account. The project that is "owed" water (i.e., the Project that provided more or exported less than its COA-defined share) may request the other Project adjust its operations to reduce or eliminate the accumulated account within a reasonable time.

The COA provides the mechanism for determining each Project's responsibility for Delta outflow influenced standards, but real-time operations dictate actions. For example, conditions in the Delta can change rapidly. Weather conditions combined with tidal action can quickly affect Delta salinity conditions, and therefore, the Delta outflow required to maintain joint standards. If, in this circumstance, Reclamation decides the reasonable course of action is to increase upstream reservoir releases, then the response may be to increase Folsom Reservoir releases first because the released water will reach the Delta before flows released from other CVP and SWP reservoirs. Lake Oroville water releases require about three days to reach the Delta, while water released from Shasta Lake requires five days to travel from Keswick Reservoir to the Delta. As water from the other reservoirs arrives in the Delta, Reclamation can adjust Folsom Reservoir releases downward. The COA accounting captures any imbalance in meeting each Project's initial shared obligation.

Reservoir release changes are one means of adjusting to changing in-basin conditions. Increasing or decreasing project exports can also immediately achieve changes to Delta outflow. As with changes in reservoir releases, imbalances in meeting each project's initial shared obligations are captured by the COA accounting. One of the principal considerations when determining which reservoir to make releases from is the reservoir refill potential, i.e., the probability that a reservoir will, over the course of a year's inflow and releases, return to a desirable carryover storage. The refill potential is approximated by the average annual runoff divided by the total reservoir storage. Reservoirs that are large compared to the average runoff of their watershed, such as New Melones, have a small refill potential (0.5). Reservoirs that are small compared to the average runoff of their watershed, such as Folsom, have a large refill potential (2.5). Folsom Reservoir generally has the best refill potential of the CVP reservoirs. Refill potential also is a consideration when evaluating how much water to move from Trinity Reservoir (0.5) to the

Sacramento River side. Shasta Lake has an average annual runoff of approximately 8,476 TAF, with 4,500 TAF of storage, meaning an approximate refill potential of 2, so releases from Shasta Reservoir are more likely to be replaced with new inflow and bring storage back up than releases from Trinity Reservoir.

The duration of balanced water conditions varies from year to year. Balanced conditions never occur in some very wet years, very dry years may have long continuous periods of balanced conditions, and still other years may have had several periods of balanced conditions interspersed with excess water conditions. Account balances continue from one balanced water condition through the excess water condition and into the next balanced water condition. When the Project that is owed water enters into flood control operations, Shasta Lake and Folsom Reservoir for the CVP and Lake Oroville for the SWP, the accounting is zeroed out for that Project.

CVO staff meets daily to discuss and coordinate CVP daily system operations. A number of items are discussed at this daily meeting including:

- Current reservoir conditions
- Current outages (for both the CVP and the SWP and how they are affecting project operations
- Upcoming planned outages (CVP and SWP) and what that means for future operations
- Current reservoir releases and what changes may be planned.

CVO discusses Delta conditions to determine if CVP and SWP pumping makes use of all available water. CVO shares CVP pumping status and planned changes as soon as possible with SWP operators, so DWR can make associated changes at their facilities. CVO and DWR share release information to ensure that Delta requirements are met, as the SWRCB assigned both Reclamation and DWR joint responsibility for Delta requirements.

CVO also coordinates with the CVO Hydrosystem Controllers and Area Offices to ensure that, if necessary, area office personnel are available to make the desired changes. Once Reclamation decides on a plan for that day and completes all coordination, Reclamation issues change orders to effectuate the decisions, if necessary.

CVO is co-located in the Joint Operations Center (JOC) with the operators from the State Water Project. This allows Reclamation to meet as needed with the SWP, usually on a daily basis, if not multiple times a day. Additionally, the California Data Exchange Center, California-Nevada River Forecast Center and the DWR Flood Management Group are also co-located in the JOC. This enables efficient and timely communication during flood events.

4.7. Key New Science

On August 2, 2016, Reclamation reinitiated consultation on the coordinated long-term operation of the CVP and SWP, in part, because of new information. The key studies below inform Reclamation's proposed action:

- Martin, 2017: Based on firsts principles of egg metabolism and oxygen flux in redds, Martin, et. al. concluded that the lethal incubation temperature for eggs in the river was 12 degrees Celsius or 53.6 degrees Fahrenheit, which is 3 °C lower than that determined in laboratory studies.

- Anderson, 2018: Anderson reviewed Martin, 2017 and found shifting the focus of management from meeting compliance points on the Sacramento River to meeting the

metabolic needs of the organisms' yields efficiencies for when cold water from Shasta is needed and when water from Shasta can be saved.

- Grimaldo, 2017: Models of both CVP and SWP showed salvage of Delta Smelt increased at OMR more negative than -5,000 cfs, when all other variables were held at their averages. While OMR flow was the second most important predictor of CVP salvage, more important than even CVP exports, the OMR threshold of -5,000 cfs was most notable in SWP salvage" p. 10.
- Perry, 2018: Statistical modeling of the relationship between flow and survival in the North Delta revealed that significant relationships exist in reaches that change from bidirectional to unidirectional as flow increases.
- SST, 2017: Neither Coded Wire Tag (CWT) nor acoustic tag (AT) data show a strong and consistent relationship between survival of fish from the San Joaquin River and exports at Jones and Banks Pumping Plants.
- Buchannan, 2018: The 6-Year Steelhead Telemetry Study monitored steelhead migrating through the San Joaquin River versus Old River and found no meaningful difference in survival. In the San Joaquin River, survival in reaches from release to Turner Cut and from release to the export facilities were greater when flow was higher whereas survival downstream of those areas was consistently low regardless of flow. Exports primarily affect fish in the channels just downstream from the facilities. Exports did not appear to have an effect on steelhead route entrainment or survival at the head of Old River, but flows, or rather, flow and stage does.
- Slater and Baxter, 2014: Slater and Baxter (2014) suggest low calanoid copepod abundance in August and September appeared likely to have affected feeding and survival in 2005 and 2006. Like MacNally et al. (2010), expressed feeding conditions in June and July can affect fall abundance of Delta Smelt presumably because all calanoid copepod species are not consumed equally as prey.
- Bush, 2012: Using isotopic analysis of otoliths from over a thousand Delta Smelt, Bush (2012) found the species exhibits partial migration through three different life history phenotypes, which include a freshwater resident fish, a brackish water resident fish, and a migratory phenotype, hatching in fresh water then occurring in brackish water during the juvenile and sub-adult stage. The relative abundance of each life history phenotype varied inter-annually with the latter most abundant, but not always dominant, in all years studied. The yearly contributions from each phenotype were found to vary with freshwater flows and temperature.

Additional studies and monitoring information have informed the proposed action and are described in Appendix XX.

4.8. Proposed Action by Basin

The proposed action for each basin is described in more detail below. These sections give some background for context along with a description of the proposed seasonal operations.

4.8.1. Upper Sacramento (Shasta and Sacramento Divisions)

Reclamation proposes to continue to operate the CVP Shasta Division for: (1) flood control; (2) navigation; (3) agricultural water supplies, (4) M&I water supplies; (5) hydroelectric generation; (6) fish and wildlife; and (7) protection of the Delta from intrusion of saline ocean water. Water rights, contracts, and agreements specific to the Upper Sacramento include SWRCB Decisions 990, 90-5, 91-1, and 1641, Settlement Contracts, Exchange Contract, and Water Service Contracts. Facilities include the Shasta Dam, Lake (4.552 MAF capacity), and Power Plant; Keswick Dam, Reservoir, and Power Plant, and the Shasta Temperature Control Device. The Sacramento Division includes the Red Bluff Pumping Plant, the Corning Pumping Plant, and the Corning and Tehama-Colusa Canals, for the irrigation of over 200,000 acres of land in Tehama, Glenn Colusa, and Yolo counties.

Flood control limits releases to less than 79,000 cfs at the tailwater of Keswick Dam and a stage of 39.2 feet in the Sacramento River at Bend Bridge gaging station (~100,000 cfs) to avoid inundating populated areas downstream. Flood control operations are based on regulating criteria developed by the United States Army Corps of Engineers (USACE) pursuant to the provisions of the Flood Control Act of 1944. Flood control may reserve up to 1.3 MAF of storage behind Shasta.

Historical commerce on the Sacramento River resulted in a CVP authorization to maintain minimum flows of 5,000 cfs at Chico Landing to support navigation in accordance with the River and Harbors Acts of 1935 and 1937. Although no commercial traffic persists, long-time water users diverting from the river have set their pump intakes based on minimum navigation flows; therefore, the CVP operates to approximately 5,000 cfs at the Wilkins Slough gage during periods when the intakes are being operated. This flow is often a challenge to meet under critical water supply conditions due to both water supply and cold water pool limitations.

The intake for the Tehama-Colusa Canal and the Corning Canal is located on the Sacramento River approximately two miles southeast of Red Bluff. Water is diverted from the Sacramento River through a 2,500 cfs pumping plant into a settling basin for continued conveyance in the Tehama-Colusa Canal and the Corning Canal.

Anderson Cottonwood Irrigation District (ACID) holds senior water rights and has diverted into the ACID Canal for irrigation along the west side of the Sacramento River between Redding and Cottonwood since 1916. The United States and ACID signed a contract providing for the Project water service and agreement on diversion of water. ACID diverts to its main canal (on the right bank of the river) from a diversion dam located in Redding about 5 miles downstream from Keswick Dam. Reclamation proposes to continue coordinating with ACID to ensure safe operation of ACID's diversion dam during the irrigation season, from April through October.

The Shasta Power Plant consists of 5 generators capable of producing up to 710 megawatts. The Western Area Power Administration is responsible for selling federally produced power to non-profit entities in the West.

In 1990 and 1991, SWRCB issued Water Rights Orders 90-05 and 91-01 modifying Reclamation's water rights for the Sacramento River. The orders stated that Reclamation shall operate Keswick and Shasta Dams and the Spring Creek Power Plant to meet a daily average water temperature of 56°F as far downstream in the Sacramento River as practicable during periods when higher temperature would be harmful to fisheries. Under the orders, the water

temperature compliance point may be modified to an upstream location when the objective cannot be met at Red Bluff Pumping Plant. In addition, Order 90-05 modified the minimum flow requirements initially established in the 1960 MOA for the Sacramento River below Keswick Dam. The water right orders also recommended the construction of a Shasta Temperature Control Device (TCD) to improve the management of the limited cold water resources, and monitoring and coordination.

Shasta Dam is equipped with a Temperature Control Device (TCD) that allows temperature operations without impacting power generation. This allows Reclamation to control the temperature of the water released from Shasta Dam. The temperature control device has four levels of gates from which water can be drawn, upper gates, middle gates, PRG gates (e.g., lower gates) and the Side Gates (coldest configuration). When the TCD is in the full side gate position, there is nothing else Reclamation can do to control release temperatures. Reclamation must balance the objectives of pulse flows or water supply releases early in the season which can conflict with the goal of maintaining a cold water pool for the sufficient to meet species' needs toward end of spawning and incubation season in the fall.

Table XX. Shasta Temperature Control Device Gates with Elevation and Storage

TCD Gates	Shasta Elevation with 35 feet of Submergence (feet)	Shasta Storage (MAF)
Upper Gates	1,035	~3.65
Middle Gates	935	~2.50
Pressure Relief Gates	840	~0.67
Side Gates	720*	~0.01

*Low level intake bottom

4.8.1.1. Seasonal Operations

Reclamation operates in the winter for flood control, including both the channel capacity within the Sacramento River and Shasta Lake flood conservation space. The USACE is responsible for developing and maintaining the Water Control Manual (WCM) for Shasta Reservoir. The WCM provides that the top of conservation pool (TOC) will set the storage amount that Reclamation is not to exceed on a given date. Releases for flood control will vary dependent upon the current storage, the forecasted inflow, and the flow in the mainstem Sacramento River at Bend Bridge. Reclamation operates Shasta releases to keep flows at Bend Bridge below 100,000 cfs, and therefore Reservoir elevations may temporarily exceed the TOC storage to protect downstream populated areas. During the winter period, there can be significant flow fluctuations from Keswick Dam due to the flood control operations. When not operating for flood control, Shasta is operated primarily to conserve storage while meeting minimum flows both down the

Sacramento River and in the Delta. These minimum flows are held until demands require increased releases.

In the spring, releases are fairly steady until flows are needed to support in stream demands on the mainstem Sacramento River and Delta Outflow requirements. Reclamation's goal is to be able to use the upper shutters on the Shasta Dam TCD by the end of May.

Reclamation proposes to make pulse releases from Shasta in March and April for the purpose of increasing spring-run Chinook salmon survival in the lower Sacramento River if Reclamation determines that projected inflows to Shasta Reservoir allow sufficient certainty for Shasta cold water pool summer temperature management, meet water supply allocations, and does not interfere with other system-wide factors.

Currently, the seasonal operation of the TCD is generally as follows: during mid-winter and early spring the highest possible elevation gates are utilized to draw from the upper portions of the lake to conserve deeper colder resources. During late spring and summer, the operators begin the seasonal progression of opening deeper gates as Shasta Lake elevation decreases and cold water resources are utilized. In late summer and fall, the TCD side gates are opened to utilize the remaining cold water resource below the Shasta Power Plant elevation in Shasta Lake.

Reclamation proposes to operate the Temperature Control Device at Shasta Dam to continue providing temperature management in accordance with CVPIA 3406(b)(6) while minimizing impacts to power generation. Reclamation proposes to address cold water management utilizing the following three methods, based on projected total storage and cold water pool, meteorology, Delta conditions, and habitat suitability for incoming fish population size and location. In any given year, cold water pool and storage could result in Reclamation switching between methods within the year.

1) Starting after May 15, in years when Reclamation determines that storage is sufficient, when real-time monitoring shows that winter-run Chinook salmon have spawned, based on the best available science (Martin, 2017), Reclamation proposes to operate to a daily average temperature of 53.5 F at the Sacramento River above Clear Creek (CCR) to avoid temperature dependent mortality. Reclamation proposes to operate to this temperature until 95 percent of the winter-run Chinook salmon redds' eggs have emerged, or October 31, whichever is earlier.

2) In years when storage is insufficient (for example, less than2.8 MAF of cold water pool in Shasta Reservoir at the end of May), Reclamation would optimize use of cold water by operating to life-stage-specific water temperatures, reducing the duration of time that ideal water temperature targets are met. Water temperatures at CCR would vary based on real-time monitoring of redd timing and stage-specific temperature dependent mortality models, e.g. Anderson (2017).

3) When Reclamation determines that life-stage-specific temperature targets cannot be met per (2) above (for example, less than 2.3 MAF of cold water pool in Shasta Reservoir at the end of May), Reclamation proposes to optimize cold water pool releases to maximize winter-run redd survival by increasing the targeted temperature at CCR with the least adverse effect, as determined by the latest egg mortality models, real-time monitoring, and expected and current water availability. See Appendix XX for additional details.

4) If there is less than 2.5 MAF of total storage in Shasta Reservoir at the end of May, Reclamation proposes to not operate for Sacramento River temperature compliance. Reclamation proposes to implement intervention measures (such as trap and haul, as described below) and seek technical assistance from NMFS and USFWS on operations.

During the summer, operational considerations are mainly flows required for Delta outflows, instream demands, and temperature control. In river temperatures can be controlled via two methods. First is increased releases, and the second is selective withdrawal through the temperature control device. Determination of which knob to turn is made on a daily basis as operators balance releases from multiple reservoirs to meet Delta needs.

Fall operations are dominated by temperature control and provision of fish spawning habitat. By late fall, the remaining cold water pool in Lake Shasta is usually limited. This can be a delicate balancing act in that if the early fall flows are too high then the fish may make their redds higher up on the edge of the river and they become subject to the possibility of de-watering when the flows are reduced later in the fall. Sacramento River releases cannot be too low early in the fall as there are still significant in-stream diversion demands on the mainstem of the Sacramento River between Keswick Dam and Wilkins Slough. This necessitates maintaining higher releases to support the instream demands until they fall off later in the season. At that time, Reclamation's objective is to drop Keswick releases to a lower level to conserve storage.

After September, if storage is such that a dry hydrology would not provide sufficient cold water pool to meet sufficient winter-run redd survival in the upcoming year using warm meteorology, Reclamation proposes to ramp flows down and dewater the last few Winter-run redds, if the risk/probability of mortality of this year's winter-run is less than the risk/probability of mortality of next year's winter-run population. After ramping down incorporating redd dewatering concerns, Reclamation would keep flows as low as necessary, but no lower than 3,250 cfs, to rebuild storage.

Reclamation proposes to incorporate drought protection into water supply allocations and to implement CVPIA 3406(b)(19).

Conservation Measures

Conservation measures are included to avoid and minimize or compensate for CVP and SWP project effects, including take, on the species under review in this biological assessment. These conservation measures include non-flow actions that benefit listed species without impacting water supply or other beneficial uses. These measures are designed to increase operational flexibility associated with the Proposed Action to maximize water deliveries and power generation.

- Spawning and Rearing Habitat

  Reclamation proposes to create approximately 223 acres of spawning and rearing habitat (14 acres of spawning habitat and 209 acres of rearing habitat) over 41 projects in the upper Sacramento River by 2030 to implement CVPIA 3406(b)(13). Some of these projects are included in the Upper Sacramento Anadromous Fish Habitat Restoration Projects Environmental Assessment, 2015 NMFS Biological Opinion, and 2016 USFWS concurrence letter.

- Intervention

- Conservation Hatchery

  Reclamation proposes to increase production of Winter-run Chinook salmon during drought years. Increased production during drought could help populations continue over multiple years. Increased production would offset temperature dependent mortality on the Sacramento River. Increased production during drought could help populations persist over multiple years. Reclamation would consider New Zealand or Great Lake Winter-run Chinook salmon stock for augmenting conservation hatchery stock to improve heterozygosity.

- Wild Juvenile Trap and Haul

  Reclamation proposes implementation of a downstream trap and haul strategy for the capture and transport of juvenile Chinook salmon and steelhead in the Sacramento River watershed in drought years when low flows and resulting high water temperatures are unsuitable for volitional downstream migration and survival. Reclamation proposes to place temporary juvenile collection weirs at key feasible locations, downstream of spawning areas in the Sacramento River. Reclamation will transport collected fish to a safe release location in the Delta upstream of Chipps Island.

  Juvenile trap and haul activities would occur from December 1 through May 31, consistent with the migration period for juvenile Chinook salmon and steelhead (NMFS 2014), depending on hydrologic conditions. In the event of high river flows or potential flooding, the fish weirs would be removed.

- Adult Rescue

  Reclamation proposes to trap and haul adult salmonids and sturgeon from Yolo and Sutter bypasses during droughts and after periods of bypass flooding, when flows from the bypasses are most likely to attract upstream migrating adults, and move them up the Sacramento River to spawning grounds. This would improve survival of the adults, leading to increased juvenile production in the following year and, therefore, and corresponding flexibility at salvage.

4.8.2. Trinity Division

Reclamation primarily operates the Trinity Basin Division to export water to the Sacramento River system and implement the Department of Interior's Trinity River Mainstem Fishery Restoration ROD. Trans-basin exports transfer water from the Trinity River to the Sacramento River system through Lewiston Reservoir, Carr Tunnel, Whiskeytown Reservoir and Spring Creek tunnel.

The Trinity ROD prescribes increased flows for fish to be released from Lewiston Dam down the Trinity River to support and improve conditions for the native fisheries. Specifically, it entails: (1) an alternative managed flow regime in the upper mainstem Trinity River; (2) mechanical habitat rehabilitation projects; and, (3) an adaptive management program. The ROD's release schedules vary between water year classes and were designed to address the environmental requirements of anadromous fish and fluvial geomorphic function. The following five water year

classes and associated annual water volumes for delivery to the Trinity River are identified as: Critically Dry (369,000 AF); Dry (453,000 AF); Normal (636,000 AF); Wet (701,000 AF); and Extremely Wet (815,000 AF).

Under high Sacramento River water conditions, Reclamation routes the water that would otherwise move through Carr Powerplant to the Trinity River. Total river release can reach up to 11,000 cfs below Lewiston Dam (flood criteria) due to local high water concerns in the floodplain and local bridge flow capacities. Flood criteria provides seasonal storage targets and recommended releases November 1 to March 31.

In addition, since 2003, certain fishery agencies, together with the Tribal Governments, have been requesting additional flows in the Trinity River above the ROD flows in August and September to prevent fish illness from instream crowding and warm waters. These releases have often been approved, using various authorities and legal mechanisms, under the assumption that any lost water supply would be made up with future wet hydrology. In some cases, these releases were made in successive dry years and therefore had cumulative effects year to year, leading to lower storage in Trinity Reservoir and water supply and temperature impacts in both the Sacramento and Trinity Rivers.

Whiskeytown Reservoir Operations

Reclamation proposes to operate Whiskeytown Reservoir (1) regulate inflows for power generation and recreation; (2) support upper Sacramento River temperature objectives; and (3) provide for releases to Clear Creek, as proposed below. Two temperature curtains in Whiskeytown Reservoir were installed to pass cold water through the bottom layer of the reservoir and limit warming from Carr power plant to Clear Creek or Spring Creek Power Plant.

Whiskeytown Lake is annually drawn down by approximately 35 TAF of storage space during November through April to regulate flows for power generation. Heavy rainfall events occasionally result in spillway discharges to Clear Creek. Operations at Whiskeytown Lake during flood conditions are complicated by its operational relationship with the Trinity River, Sacramento River, and Clear Creek. On occasion, imports of Trinity River water to Whiskeytown Reservoir may be suspended to avoid aggravating high flow conditions in the Sacramento Basin. Joint temperature control objectives also similarly interact among the Trinity River, Clear Creek, and Sacramento River.

Clear Creek Flows

Reclamation proposes to release Clear Creek flows in accordance with the 1960 Memorandum of Agreement (MOA) with CDFW, which established minimum flows to be released to Clear Creek at Whiskeytown Dam, and CVPIA 3406(b)(12).

In addition, Reclamation proposes to create pulse flows for both channel maintenance and spring attraction flows. For these actions, Reclamation would release two pulses of up to 900 cfs (or the safe release capacity) each for three days scheduled with CVO and could be met by storm events.

The outlet from Whiskeytown Reservoir to Clear Creek is equipped with outlets at two different elevations. Releases can be made from either or both outlets to manage downstream temperature releases. Reclamation proposes to manage Whiskeytown releases to meet a daily average water temperature of: 1) 60 degrees F at the IGO gage from June 1 through September 15; and 2) 56 degrees F at the IGO gage from September 15 to October 31.

Spring Creek Debris Dam

The Spring Creek Debris Dam (SCDD) is a feature of the Trinity Division. It was constructed to regulate runoff containing debris and acid mine drainage from Spring Creek, a tributary to the Sacramento River that enters Keswick Reservoir. The SCDD can store approximately 5,800 Acre-Feet of water. Operation of SCDD and Shasta Dam has allowed some control of the toxic wastes with dilution criteria. In January 1980, Reclamation, CDFW, and SWRCB executed a Memorandum of Understanding (MOU) to implement actions that protect the Sacramento River system from heavy metal pollution from Spring Creek and adjacent watersheds. In the operational situation when heavy rainfall events will fill SCDD and Shasta Lake will not reach flood control conditions, increased releases from CVP storage may be required to maintain desired dilution ratios for metal concentrations. Since water released for dilution of toxic spills is likely to be in excess of other CVP requirements, such releases increase the risk of a loss of water for other beneficial purposes.

4.8.2.1. Seasonal Operations

Trans-basin diversion of Trinity Basin water to the Sacramento Basin provides water supply and major hydroelectric power generation for the CVP and plays a key role in water temperature control in the Trinity River and upper Sacramento River. Trans-basin transfers are managed to support water supply and temperature objectives within the Sacramento system and are regulated by the ROD and Trinity Reservoir supply. The ROD explicitly limits trans-basin diversions to 55 percent of annual inflow on a 10-year average basis. Reducing trans-basin diversions was intended to improve the cold water pool in Trinity Reservoir to improve conditions for fall spawning down the Trinity River. This limitation on trans-basin diversions significantly impacts Reclamation's temperature operations on the Sacramento River and Reclamation's ability to satisfy senior water right holder and/or Settlement contractor commitments within the CVP system.

Trinity exports are first conveyed through Carr Power Plant which flows directly into Whiskeytown Lake, a heavily used recreation facility. From Whiskeytown Lake, the exported water continues to flow into Spring Creek Power Plant and ultimately outflows into the Sacramento River below Keswick. Although Whiskeytown Lake is primarily used as conveyance system for trans-basin transfers, operations at both Carr and Spring Power plants are done in a manner to maintain specified elevations for supporting recreation (based on season).

The amounts and timing of the Trinity exports into the Sacramento River basin are determined by subtracting Trinity River scheduled flow and targeted carryover storage from the forecasted Trinity water supply. Reclamation maintains at least 600 TAF in Trinity Reservoir, except during the 10 to 15 percent of the years when Shasta Lake is also drawn down. Reclamation proposes to address end-of-water-year carryover on a case-by-case basis in dry and critically dry water year types described in the Water Operations Governance process below.

The seasonal timing of Trinity exports is a result of determining how to make best use of a limited volume of Trinity export (in concert with releases from Shasta Lake) to help conserve cold water pools and meet temperature objectives on the upper Sacramento and Trinity Rivers, as well as power production economics.

These exports support better Trinity River temperatures by pulling from a warmer elevation within the reservoir and reducing residence time within Lewiston Reservoir. Trans-basin

diversions also typically help meet Sacramento River temperatures by providing colder water than would otherwise be released from the Sacramento River. As a result, Trinity export operations are completely integrated with the Shasta operations.

4.8.3. Feather River [DWR to review]

DWR will operate Oroville Dam consistent with the December 5, 2016 NMFS BO on FERC relicensing (FERC Project #2100-134). During the summer period, DWR is releasing water from Lake Oroville to supplement Delta inflow and allow Banks to export the stored Lake Oroville water to help meet demand. These releases are scheduled to maximize export capability and gain maximum benefit from the stored water while meeting fish flow requirements, temperature requirements, Delta water quality, and all other applicable standards in the Feather River and the Delta.

DWR must balance storage between Lake Oroville and San Luis Reservoirs carefully to meet flood control requirements, Delta water quality and flow requirements, and optimize the supplies to its entitlement holders consistent with all environmental constraints. Lake Oroville may be operated to move water through the Delta to San Luis Reservoir via Banks under different schedules depending on Delta conditions, reservoir storage volumes, and storage targets. Predicting those operational differences is difficult, as the decisions reflect operator judgment based on many real-time factors as to when to move water from Lake Oroville to San Luis Reservoir.

4.8.4. American River Division

Reclamation will operate the CVP American River Division for flood control, M&I water supplies, agricultural water supplies, hydroelectric power generation, fish and wildlife protection, and protection of the Delta from intrusion of saline ocean water. Facilities include the Folsom Dam, Reservoir (977 TAF capacity) and Power Plant; Nimbus Dam, Lake Natoma, and Nimbus Power Plant, Urban Water Supply Temperature Control Device, and the Joint Federal Project (JFP) (auxiliary spillway). The American River Division also includes the Folsom South Canal which serves water to M&I users.

Folsom Reservoir is the main storage and flood control reservoir on the American River. Numerous other small 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 reservoirs to aid in planning for Folsom Reservoir operations.

CVP water service contractors that rely on the American River Division include El Dorado County Water Agency, El Dorado Irrigation District, Sacramento Municipal Utility District, the City of Roseville, Placer County Water Agency, San Juan Water District, Sacramento County Water Agency and East Bay Municipal Utility District. The Nimbus Dam Fish Hatchery also uses water from Folsom Dam and coordinates releases for hatchery operations.

The Folsom Power Plant has a combined capacity of 198 megawatts. The Western Area Power Administration is responsible for selling federally produced power, including from Folsom Power Plant, to non-profit entities in the West.

Releases from Folsom Dam are re-regulated approximately seven miles downstream by Nimbus Dam. This facility is also operated by Reclamation as part of the CVP. Nimbus Dam creates Lake Natoma, which serves as a forebay for diversions to the Folsom South Canal. Releases from Nimbus Dam to the American River pass through the Nimbus Power Plant, or the spillway gates at flows in excess of 5,000 cfs.

Because Folsom Reservoir is more likely to refill than other reservoirs, and closest to the Delta, it is frequently the reservoir of choice for managing Delta water quality requirements under D-1641.

Reclamation proposes to meet water rights, contracts and agreements that are both specific to the American River Division as well as those that apply to the entire CVP, including the Delta Division. For the American River specifically, Reclamation proposes to implement the 2006 Flow Management Standard (FMS), subject to updates and improvements from ongoing discussions. The FMS, in which Reclamation agreed to a flow standard framework in 2006, has a formula to determine monthly Minimum River Releases (MRR). Releases are often higher in drier months (such as the summer) when needed to support in basin demands, Delta requirements, and water deliveries. The MRR is above Reclamation's minimum flow as prescribed under water rights permit D-893, however D-893 flows may still control in extreme drought conditions when the FMS has an off-ramp to the MRRs.

Temperature modeling is done at least monthly if not bi-monthly throughout the temperature control season to evaluate flows and shutter combinations required to maintain suitable in-steam temperatures. Temperature targets are dependent on cold water pool development, which occurs near the end of May. While there are temperatures that are considered optimal for different life stages, the modeling will indicate in what years the cold water pool may be insufficient to target optimal temperatures and what temperature objectives can be reasonably obtained.

4.8.4.1. Seasonal Operations

Reclamation proposes to operate Folsom Dam in a manner designed to maximize capture of the spring runoff to fill as close to full as possible. Folsom Reservoir is typically considered an annual reservoir, meaning that there is very little carryover storage from year to year and therefore low storages are often experienced in the late fall and occasionally early winter during drier winters.

In the winter and spring, flood control releases typically dominate the flow regime in the American River Division. Flood control operations occur to safely pass large storm events without exceeding the identified downstream levee capacity. This includes making dry-weather releases to ensure that the maximum storage adheres to the flood control elevation identified in the applicable Water Control Manual.

During the non-flood control operations within the fall and winter months, Reclamation proposes to operate to build storage by making minimum releases and capturing inflows, although drier conditions may also require releases for Delta requirements. To the extent possible, releases will be held relatively consistent to minimize potential redd dewatering.

Spring releases will follow the MRR, flood control or, in drier hydrology, releasing for Delta requirements and water supply. To the extent practicable, Reclamation proposes to accommodate requests for spring pulse flows by re-shaping previously planned releases; however, these requests will not be accommodated in times when they may compromise temperature operations later in the year.

Reclamation proposes to make summer releases for instream temperature control, delta outflow, and exports. These releases are typically well above the MRR flows. The temperature control plan will be consistent with the 2006 FMS.

By late October, it is typical for Folsom Reservoir to have depleted the cold water pool. The primary way to provide additional instream cooling is to release water from the lower outlet works. This operation bypasses the power penstocks and has a significant impact on power generation. In order to optimize power generation, Reclamation proposes to limit power bypass operations solely to respond to emergency or unexpected events or during extreme drought years when a drought emergency has been declared.

4.8.4.2. Conservation Measures

Conservation measures are included to avoid and minimize or compensate for CVP and SWP project effects, including take, on the species under review in this biological assessment. These conservation measures include non-flow actions that benefit listed species without impacting water supply or other beneficial uses. These measures are designed to increase operational flexibility associated with the Proposed Action to maximize water deliveries and power generation.

- Spawning and Rearing Habitat Named Projects:
    - Pursuant to CVPIA 3406(b)(13), Reclamation proposes to implement the Cordova Creek Phase II and Carmichael Creek Restoration projects, and increase woody material in the American River.
    - Reclamation also proposes to conduct gravel augmentation and floodplain work at: Nimbus main channel and side channel, Upper Sailor Bar, Lower Sailor Bar, Upper Sunrise, Lower Sunrise, Sacramento Bar, River Bend, Discovery Park Floodplain, Bank Protection Wood, and Sunrise Stranding Reduction.
- Drought Temperature Management: In severe droughts, Reclamation proposes to evaluate and implement alternative shutter configurations at Folsom Dam to allow temperature flexibility.

4.8.5. Delta

CVP and SWP facilities in the Delta provide for the transport of water through the central portion of the Central Valley, including the Sacramento-San Joaquin River Delta. The main CVP features are the Delta Cross Channel, Contra Costa Canal, Tracy Pumping Plant and Delta-Mendota Canal (DMC). The Delta Cross Channel (DCC) is a controlled diversion channel between the Sacramento River and Snodgrass Slough. The CCWD diversion facilities use CVP water resources to serve district customers directly and to operate CCWD's Los Vaqueros Project. The Jones Pumping Plant diverts water from the Delta to the head of the DMC.

The main SWP features are Suisun Marsh facilities, Banks Pumping Plant, Clifton Court Forebay (CCF) and the California Aqueduct. The Barker Slough Pumping Plant (BSPP) diverts water from Barker Slough into the North Bay Aqueduct for delivery to the Solano County Water Agency (SCWA) and the Napa County Flood Control and Water Conservation District (Napa County FC&WCD) (NBA entitlement holders). The South Bay Aqueduct conveys water from the Delta through over 40 miles of pipelines and canals to the Zone 7, Alameda County, and Santa Clara Valley Water Districts, which in turn provide service to the cities of Livermore, Dublin, Pleasanton, San Ramon, Fremont, Newark, Union City, Milpitas, Santa Clara, and San Jose.

Reclamation and DWR will operate Delta facilities for flood control, navigation, agricultural water supplies, M&I water supplies, hydroelectric generation, fish and wildlife, and protection of the Delta from intrusion of saline ocean water. Water rights, contracts, and agreements specific to the Delta include D-1641, COA, and Term 91. So that the CVP/SWP can meet health and safety needs, critical refuge supplies, and obligations to senior water rights holders, the combined CVP/SWP export rates will not be required to drop below 1,500 cfs. Reclamation and DWR propose to use the Sacramento River, San Joaquin River, and Delta channels to transport water to export pumping plants located in the south Delta.

Reclamation will transfer CVP and non-CVP water supplies through CVP or SWP facilities. Water transfers would occur through various methods, including, but not limited to, groundwater substitution and cropland idling, and would include individual and multi-year transfers.

Jones Pumping Plant

The CVP's Jones Pumping Plant, located about 5 miles north of Tracy, has six fixed-speed pumps. The Jones Pumping Plant has a permitted diversion capacity of 4,600 cfs and sits at the end of an earth-lined intake channel about 2.5 miles long. Jones Pumping Plant discharges into the upper portion of the Delta Mendota Canal that is heavily impacted by subsidence which limits the maximum pumping rates.

Banks Pumping Plant

The SWP Banks Pumping Plant, located next to the Jones Pumping Plant, has eleven variable speed pumps that allow for more control over the diversion rate. The Banks Pumping Plant has a maximum capacity of 10,300 cfs and sits at the end of Clifton Court Forebay (CCF). The maximum daily pumping rate at Banks is controlled by a combination of SWRCB D-1641, and permits issued by USACE that regulate the rate of diversion of water into CCF for pumping at Banks. This diversion rate is normally restricted to 6,680 cfs as a 3-day average inflow to CCF and 6,993 cfs as a 1-day average inflow to CCF. CCF diversions may be greater than these rates between December 15 and March 15, when the inflow into CCF may be augmented by one-third of the San Joaquin River flow at Vernalis when those flows are equal to or greater than 1,000 cfs. Additionally, the SWP has a permit to export an additional 500 cfs between July 1 and September 30.

The CCF radial gates are closed during critical periods of the ebb/flood tidal cycle to protect water levels relied upon by local agricultural water diverters in the south Delta area.

Delta Cross Channel

Reclamation operates the DCC in the open position to (1) improve the movement of water from the Sacramento River to the export facilities at the Banks and Jones Pumping Plants, (2) improve

water quality in the southern Delta, and (3) reduce salt water intrusion rates in the western Delta. During the late fall, winter, and spring, the gates are often periodically closed to protect out migrating salmonids from entering the interior Delta. In addition, whenever flows in the Sacramento River at Sacramento reach 20,000 to 25,000 cfs (on a sustained basis) the gates are closed to reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates.

Reclamation proposes to operate the DCC gates in accordance with D-1641. From October 1 to November 30, if the Knights Landing Catch Index or Sacramento Catch Index are greater than three fish per day, and real-time water quality modeling shows water quality concern level targets will not be exceeded in the next two weeks, Reclamation proposes to conduct a risk assessment to determine whether or not to close the DCC gates and for how long. From December 1 to May 20, the DCC gates will be closed, unless Reclamation determines, after a risk assessment, that an experiment to open the DCC gates for up to 5 days is acceptable. From May 21 to June 15, Reclamation may choose to close the DCC gates for 14 days during this period, if Reclamation determines it is necessary based on a risk assessment.

Water Quality Concern Level Targets (Water Quality Model simulated EC)	
Jersey Point	1700 umhos/cm
Bethel Island	1000 umhos/cm
Holland Cut	1000 umhos/cm
Bacon Island	800 umhos/cm

San Luis Reservoir

San Luis Reservoir is an offstream storage facility located along the California Aqueduct downstream of Jones and Banks Pumping Plants. The CVP and SWP share San Luis Reservoir storage roughly 50/50 (CVP has 966 TAF of storage, SWP has 1062 TAF of storage). San Luis Reservoir is used by both Projects to meet deliveries to their contractors during periods when Delta pumping is insufficient to meet demands.

San Luis Reservoir operates as a regulator on the CVP/SWP system, accepting any water pumped from Banks that exceeds contractor demands, then releasing that water back to the aqueduct system when Banks pumping is insufficient to meet demands. The reservoir allows the CVP / SWP to meet peak-season demands that are seldom balanced by Jones and Banks pumping.

As San Luis Reservoir is drawn down to meet contractor demands, it usually reaches its low point in late August or early September. From September through early October, demand for deliveries usually drops to be less than the Banks diversions from the Delta, and the difference in Banks pumping is then added to San Luis Reservoir, reversing its spring and summer decline. From early October until the first major storms in late fall or winter unregulated flow continues to decline and releases from Lake Oroville are restricted (due to flow stability agreements with CDFW resulting in export rates at Banks that are somewhat less than demand typically causing a

second seasonal decrease in the SWP's share of San Luis Reservoir). Once the fall and winter storms increase runoff into the Delta, Banks can increase its pumping rate and, in all but the driest years, eventually fill the state portion of San Luis Reservoir before April of the following year.

The Intertie is used to move water between the California Aqueduct and the Delta Mendota Canal. This structure was built to help both projects most effectively move water from the Delta into the San Luis Reservoir. This helps both projects when there are system restrictions that may prevent one party from moving water.

Tracy Fish Collection Facility

Reclamation proposes to screen fish from Jones Pumping Plant with the Tracy Fish Collection Facility (TFCF). The Tracy Fish Collection Facility uses behavioral barriers consisting of primary and secondary louvers, to guide entrained fish into holding tanks before transport by truck to release sites within the Delta. The primary louvers are located in the primary channel just downstream of the trashrack structure. The secondary louvers are located in the secondary channel just downstream of the traveling water screen.

Reclamation proposes to sample fish passing through the facility at intervals of no less than 30 minutes every two hours when listed fish are present, generally December through June. Reclamation proposes to sample fish for 10 minutes every two hours when few fish are present. Hauling trucks used to transport salvaged fish to release sites inject oxygen and contain an eight parts per thousand salt solution to reduce stress. The CVP uses two release sites, one on the Sacramento River near Horseshoe Bend and the other on the San Joaquin River immediately upstream of the Antioch Bridge.

Skinner Fish Facility

The John E. Skinner Delta Fish Protective Facility is located west of the CCF, two miles upstream of the Banks Pumping Plant. The Skinner Fish Facility screens fish away from the pumps that lift water into the California Aqueduct. Large fish and debris are directed away from the facility by a 388-foot long trash boom. Smaller fish are diverted from the intake channel into bypasses by a series of metal louvers, while the main flow of water continues through the louvers and towards the pumps. These fish pass through a secondary system of screens and pipes into seven holding tanks, where a subsample is counted and recorded. The salvaged fish are then returned to the Delta in oxygenated tank trucks.

Contra Costa Water District (CCWD) Operations

The CCWD diverts water from the Delta for irrigation and M&I uses under its CVP contract and under its own water right permits and license, issued by SWRCB for users. CCWD's water system includes the Mallard Slough, Rock Slough, Old River, and Middle River (on Victoria Canal) intakes; the Contra Costa Canal and shortcut pipeline; and the Los Vaqueros Reservoir. Reclamation completed construction of the fish screen at the Rock Slough intake in 2011 under the authority of CVPIA 3406(b)(5).

4.8.5.1. Seasonal Operations

Pumping operations generally operate to maximize exports of excess, unstored water in the winter and spring to help meet project demands later in the season and allow for the exporting of upstream stored water in the summer to meet demands through directly diversions. In order to

minimize take, actions have been taken or imposed in the past to protect fish migration and minimize fish entrainment. These restrictions limit the projects ability to export excess water in the winter and spring and therefore place a higher reliance on exporting previously stored water in the summer and fall.

Reclamation and DWR propose to operate the CVP and SWP to maximize exports while staying within the provided incidental take. Old and Middle River Reverse Flows (OMR) provide a surrogate indicator for how export pumping, inflow, and the spring-neap tidal cycle influence hydrodynamics in the south Delta. The management of OMR, in combination with other environmental variables, can minimize or avoid the entrainment of fish in the South Delta and at CVP and SWP salvage facilities. Reclamation and DWR propose to maximize exports by incorporating real-time monitoring of fish distribution, hydrodynamic models, and entrainment models into the decision support for the management of OMR to focus protections for fish when necessary and provide flexibility where possible, consistent with the WIIN Act Sections 4002 and 4003.

- Reclamation and DWR propose to operate to an index equation. An index allows for short-term operational planning and real-time adjustments rather than relying on the lagging average reported by the gauges.
- Onset of Seasonal OMR Management: Reclamation and DWR shall maximize exports up to an OMR no more negative than -5,000 cfs (Grimaldo, 2017), starting when one or more of the following conditions are true:
    - Delta Smelt (“First Flush”) - After December 1, and when 3-day average turbidity is 12 NTU or greater at Prisoner’s Point, Holland Cut, and Victoria Canal.
    - Winter-Run - After January 1 and when more than five percent (5%) of winter-run Chinook salmon have migrated past Knights Landing.
    - Spring-Run - After April 1 and when more than five percent (5%) of spring-run Chinook salmon have migrated past Knights Landing.
    - San Joaquin Steelhead - After May 15 and when more than five percent (5%) if San Joaquin Origin steelhead have migrated past Vernalis.
- Additional Real-Time OMR Restrictions: Reclamation and DWR shall establish a salvage loss threshold based on a percentage of the population. Reclamation and DWR shall manage to a more positive OMR based on the following conditions:
    - First Flush and Turbidity Bridge Avoidance: Reclamation and DWR propose to operate to an OMR index of -2000 cfs for 14 days when 3-day average turbidity is 12 NTU or greater at Prisoner’s Point, Holland Cut, and Victoria Canal or other predictors of a turbidity bridge. When water temperature reaches 12 degrees Celsius based on a three station daily mean at Mossdale, Antioch, and Rio Vista, or when Delta Smelt spawning starts (indicated by spent females in the Spring Kodiak Trawl or at Jones or Banks), this action would no longer be triggered.
    - San Joaquin Origin Steelhead Protections: Reclamation and DWR would operate to OMR of -2,500 cfs for 5 days whenever more San Joaquin River steelhead are caught in a day than the steelhead loss trigger between April 1 to May 31. The steelhead loss trigger is 10 steelhead per TAF, multiplied by the volume exported (in TAF) on that day. For example, if 20 TAF is exported on April 2, and 180

steelhead are caught, then this steelhead protection trigger has not been met and Reclamation and DWR would continue to operate as before.

    - Salvage Triggers: Reclamation and DWR may operate to a more positive OMR when the daily salvage loss indicates that continued OMR of -5,000 cfs may exceed cumulative salvage thresholds.

- Cumulative Salvage Thresholds: As a final measure to backstop real-time operations, Reclamation and DWR shall:
    - Schedule export reductions to restrict OMR to -3,500 cfs when cumulative salvage loss exceeds 50 percent of the threshold. If Reclamation desires a different restriction, Reclamation proposes to confer with USFWS and/or NMFS, depending upon species.
    - Schedule export reductions to restrict OMR to -2,500 cfs (or more positive if determined by Reclamation) when cumulative salvage loss exceeds 75 percent of the threshold. If Reclamation desires a different restriction, Reclamation proposes to confer with USFWS and/or NMFS, depending upon species.
- Storm-Related OMR Flexibility: If Reclamation and DWR are not implementing additional real-time OMR restrictions, Reclamation and DWR may operate to a more negative OMR to capture peak flows during storm-related events.
- End of Seasonal OMR Management: OMR shall no longer control operations after June 15, or when all of the following are true:
    - Delta Smelt - when the 3-day mean water temperature at Clifton Court Forebay reaches 25° C.
    - Winter-Run - When more than 95 percent of winter-run Chinook salmon have migrated past Chipps Island.
    - Spring-Run - When more than 95 percent of spring-run Chinook salmon have migrated past Chipps Island.
    - San Joaquin Steelhead - When more than 95 percent of San Joaquin Origin steelhead have migrated past Chipps Island.

Summer is generally a period of high export potential in most years. During the summer the CVP and SWP typically operate to convey previously stored water across the Delta for exporting at the Project pumps or other Delta facilities. Delta concerns during the summer are typically focused on maintaining salinity and meeting outflow objectives while maximizing exports with the available water supply.

Fall Delta operations typically begin as demands decrease, accretions increase within the system and reservoirs are decreasing to start conserving water. Exports are typically maximized to export available water in the system and may decrease if the fall remains dry. As precipitation begins to fall within the Sacramento and San Joaquin Basins, the reservoirs focus on building storage and managing for flood control. The enactment of D-1641 required higher spring releases. As a result, reservoir storage levels were lower in the fall and Reclamation and DWR had less need for flood releases. The 2008 FWS BO included requirements to increase fall flows and related salinity to mitigate this decrease.

Rather than modify fall flows, Reclamation proposes operating the Suisun Marsh Salinity Control Gates (SMSCG) to meet the physical and biological features of Delta Smelt critical habitat in below-normal and above-normal Sacramento Valley Index year types in August and September. Slater and Baxter (2014) posit that food is limited for Delta Smelt in August and September. Reclamation would increase operations of the SMSCG to direct more fresh water in Suisun Marsh, which will reduce salinities, increase food, and improve habitat conditions for Delta Smelt in the region. Reclamation would operate Suisun Marsh Salinity Control Gates on the tidal cycle to increase Delta Smelt low salinity zone habitat during the summer by pumping freshwater into the marsh during low tide and reducing saltwater intrusion during high tide. This would be combined with Roaring River Distribution System management for food production.

4.8.5.2. Conservation Measures

Conservation measures are included to avoid and minimize or compensate for CVP and SWP project effects, including take, on the species under review in this biological assessment. These conservation measures include non-flow actions that benefit listed species without impacting water supply or other beneficial uses. These measures are designed to increase operational flexibility associated with the Proposed Action to maximize water deliveries and power generation.

- Tidal Marsh: DWR proposes to restore 8,000 acres of tidal marsh in the Sacramento - San Joaquin Delta, including implementing EcoRestore projects.
- Tracy and Skinner Fish Facility Improvements: Reclamation and DWR propose to continue to implement improvements to salvage facilities including:
    - Predator Removal: Reclamation would install a carbon dioxide injection device to allow remote controlled anesthetization of predators in the secondary channels of the Tracy Fish Facility.
    - Release Sites: Reclamation proposes to work with DWR to consider flexibility in salvage release sites, using DWR's sites, or sites on a barge.

      These actions minimize the effects of salvage on listed salmonid species. See Appendix XX (Component Appendix) for a description of salvage protocols.
- Suisun Marsh Preservation Agreement: Reclamation and DWR will address salinity in the Suisun Marsh related to operations through the Suisun Marsh Preservation Agreement. Reclamation and DWR will implement the Suisun Marsh Habitat Management, Preservation, and Restoration Plan, which has separate ESA compliance.
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project: Reclamation and DWR will modify infrastructure to increase the number of juvenile salmonids that have access to floodplain habitat in the Yolo Bypass through Fremont Weir; and, to increase the ability of adult salmon and sturgeon to migrate from the Yolo Bypass to the Sacramento River.
- Delta Smelt Conservation Hatchery: Reclamation proposes to partner with DWR to construct and operate a Delta Smelt conservation hatchery. The conservation hatchery would breed and propagate a stock of fish with equivalent genetic resources of the native stock, so that they can be returned to the wild to reproduce naturally in their native habitat.

4.8.6. Stanislaus (East Side Division)

In the Stanislaus River watershed, Reclamation owns and operates New Melones Dam and Reservoir (2.4 MAF capacity). The Tri-Dam Project, a joint venture partnership that includes the Oakdale Irrigation District (OID) and South San Joaquin Irrigation District (SSJID), operates Tulloch Dam and Reservoir downstream of New Melones Dam under the 1988 Tri-Dams Operating Agreement. Downstream of Tulloch Dam, OID and SSJID operate Goodwin Diversion Dam to divert Stanislaus River water into their respective canals for distribution into their respective service areas for irrigation.

The Stanislaus River watershed is over-allocated, with more than the average annual runoff obligated in a year, due to SWRCB water rights decisions D-1641, D-1422 and D-1616, the 1987 CDFW Agreement, 1988 Oakdale / South San Joaquin Irrigation District Stipulation Agreement, and CVP water delivery contracts.

4.8.6.1. Seasonal Operations

Reclamation proposes to deliver water to OID and SSJID consistent with the 1988 stipulation agreement. Reclamation proposes to make water available to CVP contractors in accordance with their contracts.

Reclamation has worked with Stanislaus River water users and related agencies over the past decade to develop a new operating plan that creates a more predictable and sustainable operation, minimizing low storage conditions to successive drought years. Reclamation proposes to implement this Revised Plan of Operations (RPO). Reclamation proposes to operate New Melones Dam and Reservoir in accordance with the New Melones Revised Plan of Operations, which includes a base flow with a flexible block of water that varies by water year type in the spring and fall periods to meet temperature management, base flow, and pulse flow needs. If New Melones Reservoir has low storage, lower releases are required. The New Melones Revised Plan of Operations is intended to replace the operational components of D-1641, D-1422, D-1616, and other flow requirements for New Melones Reservoir. Please see Appendix XX for more information.

In wet conditions, Reclamation will operate for flood control in accordance with the USACE flood control manual. Because New Melones Reservoir is a large reservoir in a watershed with relatively low annual inflow, flood control is a relatively infrequent concern. However, Tulloch Lake, located downstream of New Melones Reservoir, is subject to high local inflows, and may be in flood control operations for brief periods, even while New Melones Reservoir is not under flood control operations. During these periods, releases from Tulloch may be used to meet the intent of the planned New Melones flow releases.

During the summer, Reclamation's New Melones water rights require that water be released from New Melones Reservoir to maintain applicable dissolved oxygen (DO) standards to protect the salmon fishery in the Stanislaus River. The current water rights permit requires this standard be met at Ripon. Reclamation proposes to operate to 7.0 mg/L dissolved oxygen at Orange Blossom or the equivalent of a 5.0 mg /L dissolved oxygen requirement at Ripon.

4.8.6.2. Conservation Measures

Conservation measures are included to avoid and minimize or compensate for CVP and SWP project effects, including take, on the species under review in this biological assessment. These

conservation measures include non-flow actions that benefit listed species without impacting water supply or other beneficial uses. These measures are designed to increase operational flexibility associated with the Proposed Action to maximize water deliveries and power generation.

- Spawning Habitat: Under the CVPIA (b)(13) program, Reclamation's annual goal of gravel placement is approximately 4,500 tons in the Stanislaus River.

4.8.7. San Joaquin

Reclamation operates the Friant Division for flood control, irrigation, M&I, and fish and wildlife purposes. Facilities include Friant Dam, Millerton Reservoir, and the Friant-Kern and Madera Canals. Friant Dam provides flood control on the San Joaquin River, provides downstream releases to meet senior water rights requirements above Gravelly Ford, provides Restoration Flow releases under Title X of Public Law 111-11, and provides conservation storage as well as diversion into Madera and Friant-Kern Canals for water supply. Water is delivered to a 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 northerly to Madera and Chowchilla Irrigation Districts. A minimum of 5 cfs is required to pass the last holding contract diversion located about 40 miles downstream of Friant Dam near Gravelly Ford.

The San Joaquin River Restoration Program implements the San Joaquin River Restoration Settlement Act in Title X of Public Law 111-11. USFWS and NMFS issued programmatic Biological Opinions in 2012 that included project-level consultation for SJRRP flow releases. Programmatic ESA coverage is provided in both the USFWS and NMFS Biological Opinions for flow releases, recapture of those flows in the lower San Joaquin River and the Delta, and all physical restoration and water management actions listed in the Settlement.

4.9. Water Operations Governance

Under the 2008 and 2009 Biological Opinions, water operations teams assess monitoring information and recommend operating criteria for the USFWS and NMFS to impose upon Reclamation and DWR during seasonal planning and real-time decision making. The water operations teams typically discuss short-term operational approaches to meet specific biological objectives. These approaches often fail to consider potential water supply effects, power generation, and the seasonal risk that could impact future biological objectives. By relying on these water operations teams for regulating the seasonal and day to day operations, the Reclamation and DWR operators are not able to use the experience, expertise, and institutional knowledge to appropriately balance risks and best meet all project purposes. The result is increased risk to all project purposes with the bulk of impacts falling to water supply and power generation.

Reclamation and DWR propose to replace water operations teams with watershed monitoring teams with, at minimum, an opportunity for a representative from each federal and state agency, that provide information on the real-time distribution of species and life-stage transitions. Reclamation would perform a risk analysis for the operation of the CVP and SWP and would confer with NMFS and USFWS, if Reclamation determines technical assistance is warranted. Annual reporting will demonstrate compliance with the ESA. Modifications to the proposed action would follow the reinitiation triggers under the ESA.

4.9.1. Monitoring

Reclamation and DWR proposes to implement monitoring programs to determine measures for the management of cold water pools, Delta hydraulics, real-time distribution of species, species life-stage transitions, species abundance, and the risk of entrainment. Monitoring programs will include reporting information in real-time to support water operations. Reclamation and DWR may accomplish the monitoring through agreements with other agencies, partnerships with local water users, and/or contracts with private entities. Appendix XX describes the proposed monitoring.

Reclamation and DWR propose to convene a monitoring team for each of the Upper Sacramento, American, Delta, and Stanislaus watersheds ("Watershed Monitoring Teams"). Each of the Watershed Monitoring Teams will be responsible for real-time synthesis of fisheries monitoring information. The Watershed Monitoring Teams will provide information on species distribution and life-stage transitions to Reclamation and DWR.

4.9.2. Risk Analysis

In the event the risk analysis performed by Reclamation and DWR identifies the need for conferencing, Reclamation and DWR propose to convene a Directors' Operation Call consisting of invitees from the USFWS, NMFS, and CDFW. Conditions identified for conferring include, but are not limited to:

- Reclamation identifies that Shasta cold water pool management cannot meet critical temperature compliance at CCR.
- Reclamation determines a need to manage OMR more negative and salvage at the export facilities has exceeded the thresholds described in the Delta OMR Reverse Flow action.

Decisions from the Directors' Operation Call shall be documented in writing via email or formal exchange of letters by the agency with the authority to make a decision. Reclamation and DWR may identify additional needs and may conference to resolve the operational needs, e.g. Temporary Urgency Change Petitions to the SWRCB, if required.

4.9.3. Reporting

On or about the end of September of each year, Reclamation and DWR propose to provide to the USFWS, NMFS, and CDFW a report on the prior year activities through the spring of each year. The annual report shall include, at minimum:

- Hydro-Meteorology: Precipitation; reservoir inflow; air temperatures; and other environmental factors affecting water availability and demands.
- Non-Flow Construction: Summary of projects initiated; ongoing; and completed.
- Water Operations Summary: Conditions from the prior year; allocations; flows; diversions; and reservoir, release, and river temperatures.
- Fisheries Performance: Results from monitoring stations; surveys; salvage; harvest; and physical factors influencing fish populations.
- Intervention Measures: Hatchery intakes; releases; and other measures.
- Predictive Tools: Summary of the performance of the risk analysis tools used during the year.

Appendix XX provides an outline of the annual report.

4.9.4. Modifications

If Reclamation determines to modify the proposed action, Reclamation will evaluate changes to one or more elements of the proposed action based on the reinitiation triggers provided by 50 CFR 402.16. These triggers include:

> (a) If the amount or extent of taking specified in the incidental take statement is exceeded;
>
> (b) If 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;
>
> (c) If 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
>
> (d) If a new species is listed or critical habitat designated that may be affected by the identified action.

Consistent with 50 CFR 402.16, the USFWS and/or NMFS may also reinitiate formal consultation.

4.10. Items Not Consulted On

This document will include context on the entirety of operations of the CVP / SWP. However, not all of these actions are being consulted on. Reclamation is not consulting on:

- Flood control (USACE control)
- Folsom Water Control Manual (USACE ongoing consultation)
- Oroville Dam operations (prior FERC consultation)
- CVP water service and repayment contract terms
- Settlement contracts and agreements
- Exchange Contractor deliveries from Friant
- SJRRP flows and recapture (prior consultation)
- TRRP flows (prior consultation)

4.11. Programmatic Adaptive Management of Water Delivery Improvements

To maximize water deliveries, in exchange for USFWS and NMFS allowing additional flexibility for water operations, Reclamation would agree to implement watershed-based adaptive management actions for non-flow construction of habitat and facility improvements. Actions would be taken to the extent Reclamation can identify increased operational flexibility through tradeoffs between water deliveries and non-flow methods of meeting fisheries requirements. Additional flexibility for water operations would include less restriction on storing, releasing, and/or diverting water. Non-flow projects decrease other stressors on listed fish species and allow populations to accommodate more adverse effects and/or allow water operations with more scientific uncertainty. Programmatic consultation in this BA evaluates the overall combination of non-flow projects and increased operational flexibility to support a programmatic evaluation of jeopardy or non-jeopardy.

Implementation will depend upon project-specific designs and coordination with other entities including state, local, and private partnerships subsequent to this proposed action. Reclamation proposes a programmatic description of the anticipated water delivery improvements governed by a watershed-based technical teams using Structured Decision Making (SDM). Over time, Reclamation would consult on one or more project-specific designs that include an Incidental Take Statement adding additional flexibility for improving water supply. If the water supply benefits warrant the costs, Reclamation would construct the project. Upon completion of construction, Reclamation would implement the additional water supply flexibility and monitor performance.

The decision support models within SDM would quantify the anticipated water supply benefits. The benefits of implementing a project would occur at the same time as the construction is completed. Adaptive management of the programs would monitor the effectiveness and refine the decision support models to improve the assessments of water supply benefits on subsequent consultations. If the performance of the non-flow project differs substantially from the expectations developed under SDM, the standard triggers for reinitiation would apply.

The following actions identify the scope of the adaptively managed projects to be implemented over time. Adaptive management would be anticipated to allow for less conservative increases in water supply benefits as more experience is gained in non-flow projects. These actions replace the studies and actions within the 2008 and 2009 RPAs that are not related to water operations.

4.11.1. Upper Sacramento Adaptive Management Projects

- Increased Operational Flexibility for Shasta Cold Water Management: Under these programmatic elements of this consultation, Reclamation proposes to further the flexible operation of the cold water pool behind Shasta reservoir with measures to conserve cold water for the next temperature management season. The alternative measures below would offset the need for cold water pool actions that restrict water supply.
    - Fall and Winter Base Flow (Rice Decomposition Smoothing and Options to Rebuild Storage): Reclamation would spread out late summer and early fall Sacramento River Settlement Contractor diversions for rice decomposition to lower peak rice decomposition demand. With lower peak flows, fall-run are less likely to spawn in shallow areas that would be subject to dewatering later in the winter. Reductions must balance the potential for dewatering late spawning

winter-run redds. Reclamation would determine fall ramping rates based on the location and timing of late-spawning winter-run, fall-run dewatering curves, and storage for the next year's cold water pool. Base flows would continue to be 3,250 cfs. The authority for this action is CVPIA 3406(b)(1)(B)(3); Reclamation proposes to "provide flows of suitable quality, quantity, and timing to protect all life stages of anadromous fish, from other sources which do not conflict with fulfillment of the Secretary's remaining contractual obligations to provide Central Valley Project water for other authorized purposes". See Appendix XX for additional information.

- Spawning Habitat: Reclamation would implement up to 350 acres of spawning habitat. Spawning habitat closer to Keswick shifts the distribution of winter-run to areas easier to cool. Higher quality spawning habitat may lower the necessary dissolved oxygen requirement by improving water flow and improve survival at higher water temperatures. The CVPIA Science Integration Team (SIT) models show that this acreage would increase the inundated area of suitable gravel substrate for spawning habitat from supporting 21,000 adult returns to supporting 114,000 adult returns. Reclamation may partner with local water users, NGOs, RCDs, and others to accomplish this task. The authority for this action is 3406(b)(13).
- Lower Intakes near Wilkins Slough: Due to temperature requirements, Sacramento River flows at or near Wilkins Slough can drop below the 5,000 cfs minimum navigational flow set by Congress. As many of the fish screens at diversions in this region were designed to meet the 5,000 cfs minimum, they may not function properly at the lower flows and as a result, not meet state and federal fish screening requirements during the lower flows (NCWA 2014). This could result in take of state and federally protected species that use this section of the river. This action would provide grants to water users within this area to install new diversions and screens that would operate at lower flows, which would allow Reclamation to have greater flexibility in managing Sacramento River flows and temperatures for both water users and wildlife, including listed salmonids (NCWA 2014).This would reduce demands on Shasta to maintain river elevations and allow for conserving cold water during drought. The increased ability to manage cold water in the summer would be accounted for in temperature management planning and reduce the need for actions to build and conserve cold water pool. The authority for this action is 3406(b)(21).
- Shasta Temperature Control Device Improvements: Depending upon the type of dam raise proposed, the TCD would be either modified or replaced by Reclamation. For relatively small raises of Shasta Dam, the existing TCD structure would be retrofitted to account for additional dam height, and to reduce leakage of warm water into the structure, but no new structure would be needed. However, modifications to, or replacement of, the existing structure are more likely to be necessary for increasingly higher dam raises. TCD modifications would support the objective of increasing the survival of anadromous fish populations by: 1) Increasing the ability of operators at Shasta Dam to meet downstream temperature requirements for anadromous fish, 2) Providing more

flexibility in achieving desirable water temperatures during critical spawning, rearing, and out-migration, and 3) Extending the area of suitable spawning habitat farther downstream in the Sacramento River. The ability to manage cold water in the summer would be accounted for in the summer and end of September Temperature Management planning. The authority for this action is 3406(b)(6).

- Increased flexibility for Delta Exports: Under the programmatic elements of this consultation, Reclamation and DWR propose to operate to more negative levels of OMR reverse flows, and manage exports to minimize and avoid entrainment of listed species based on a salvage threshold representing a proportion of the total population, adults for Delta Smelt, and juveniles at Chipps Island for salmon and steelhead. Increasing production and survival through the following projects increases the salvage threshold.
    - Rearing Habitat In-Channel: Reclamation would implement up to 750 acres of rearing habitat for salmonids. The CVPIA SIT models show that these acreages would increase the inundated area of suitable depths and velocities for spawning habitat from supporting 3.7 million fry to 310 million salmon fry. The authority for this action is 3406(b)(13).
    - Sacramento Weir: Sacramento Weir is operated to allow flows into the Yolo Bypass under high flow conditions. Reclamation and DWR, in coordination with USACE would provide fish passage at Sacramento Weir. This structure would allow for fish passage when adults enter the bypass, especially when conditions are not amenable for passage at Fremont Weir. This action would be done in coordination with the Lower Elkhorn Levee Setback project, which would widen and expand the Sacramento Bypass by moving the northern levee of the Sacramento Bypass Wildlife Area and a portion of the eastern levee of the Yolo Bypass
    - Putah Creek: Putah Creek empties into the Yolo Bypass. Reclamation and DWR would complete stream realignment and floodplain restoration along the lower Putah Creek that also increases the available floodplain rearing habitat for juveniles. The realignment could include multiple channels in the Yolo Bypass Wildlife Area that would allow for increased rearing habitat on public land and reduce inundation of private lands to the south.
    - Sutter Bypass: Sutter Bypass is a floodplain off the east side of the Sacramento River between the Colusa and Verona area. Tisdale Weir releases overflow waters of the Sacramento River into the Sutter Bypass. The weir is fixed crest reinforced concrete and 1,150 feet long. A four-mile leveed bypass channel (Tisdale Bypass) connects the river to the Sutter Bypass. Typically, the Tisdale Weir is the first of the five weirs in the Sacramento River Flood Control System to overtop and continues to spill for the longest duration. Tisdale Weir is 30 years past its engineered life and in need of rehabilitation. As part of the Sacramento River Flood Control Project, the California Department of Water Resources (DWR) is investigating options for rehabilitation of the weir. The project also includes a fish passage facility. Options under consideration currently include an operable gate or a notch that would allow flow and fish to enter and leave the Sutter Bypass at lower Sacramento River elevations. The Sutter Bypass provides valuable habitat

for migrating adult salmon, particularly spring-run Chinook salmon, to Butte Creek. Providing fish passage at Tisdale Weir would facilitate adult migration and increasing inundation of the Sutter Bypass would increase rearing habitat for juveniles.

- Colusa Basin Drain Food Web Routing: Historically, the slow-moving wetlands and waterways of the Delta generated prodigious amounts of the microscopic plants and animals—phytoplankton and zooplankton—that support Delta Smelt. In the current Delta, Delta Smelt face a shortage of food, particularly during summer and fall. The project will augment flow in the Yolo Bypass by closing Knights Landing Outfall Gates and route water from Colusa Basin into Yolo Bypass in July and/or September to promote food production and export into areas where Delta Smelt are known to occur. Zooplankton produced on the Yolo Bypass would move downstream into an area where juvenile and adult Delta Smelt are known to occur at a time of year when food availability may be a limiting factor. Food web enhancement flows will also be considered for additional months in ways that will not conflict with agricultural and waterfowl management actions based on the availability of water to augment flows in the Yolo Bypass. The project could also increase outflow from the Yolo Bypass during the spring. The project is a collaboration between DWR, Reclamation, Glenn-Colusa Irrigation District, Reclamation District 108, USGS, Knaggs Ranch, and Conaway Preservation Group. Increasing food availability for Delta Smelt may increase the area with other habitat parameters already in place that meets the physical and biological features for Delta Smelt critical habitat.
- Flooded Rice Fields: Flooding rice fields can increase floodplain habitat, as well as provide increased food reserves, which can be flushed into the Sacramento River to benefit listed salmonids. This component would increase the area of inundated rice fields in the Sacramento Valley for juvenile salmonid rearing habitat. Specific projects would allow juvenile salmonids to enter flooded rice fields to use as rearing habitat, then return to the Sacramento River to continue migration. Projects could incorporate volitional fish passage into and out of the Sacramento River, or could incorporate trap-and-haul to transport juveniles on and off the property.
- Non-CVP Tributary Restoration for Spring-Run: Reclamation would implement up to 10 acres of spawning habitat in Deer Creek to support 6,500 Spring-Run adult returns, an increase from the current habitat supporting 1,700 Spring-Run adult returns. Reclamation may implement up to 60 acres of spawning habitat to support 4,500,000 Spring-Run fry, an increase from 1,500,000 Spring-Run fry. Reclamation would implement up to seven acres of spawning habitat in Mill Creek to support 4,400 Spring-Run adult returns, an increase from the current 1,800 Spring-Run adult returns. Reclamation may implement up to 66 acres of spawning habitat to support 5,000,000 Spring-Run fry, an increase from 1,600,000 Spring-Run fry. This action aims to protect and restore habitat for natural, self-sustaining populations by funding design and construction of fish passage improvements that increase access to upstream spawning, holding, and rearing habitat.

- Battle Creek Restoration: Reclamation would accelerate implementation of the Battle Creek Salmon and Steelhead Restoration Project, which is intended reestablish approximately 42 miles of prime salmon and steelhead habitat on Battle Creek, and an additional six miles on its tributaries. Winter-run Chinook salmon are currently limited to a single population that spawns in a 5-mile stretch of the Sacramento River, but they are being reintroduced to Battle Creek (around 200,000 juveniles were released in Battle Creek in 2018), and this new population would benefit from the restoration efforts. An additional population of Winter-run Chinook salmon on Battle Creek would provide temperature compliance flexibility.

4.11.2. Feather River Adaptive Management of Additional Projects

- Passage: DWR would remove the Sunset Pumps rock weir, as described in the Salmon Resiliency Strategy (SRS), to improve adult Spring-run Chinook salmon and Green Sturgeon passage on the Feather River. This could improve passage efficiency during certain flows, and reduce juvenile predation at the structure. This would be expected to increase survival and increase juvenile outmigrants, with a corresponding flexibility at Jones and Banks Pumping Plants for salvage.
- Rearing Habitat: DWR would create additional floodplain rearing habitat restoration within existing levee setbacks on the Lower Feather River, as described in the Lower Feather River Corridor Management Plan (LFRCMP). This would improve juvenile survival, leading to more juveniles captured at Jones and Banks Pumping Plants and corresponding flexibility in salvage.

  DWR would implement up to 260 additional acres of spawning and rearing habitat to support 150,000 Fall-Run adult returns, an increase from current habitat which supports 3,000 Fall-Run adult returns. DWR may implement up to 215 acres to support 16,000,000 Fall-Run fry, an increase from 12,500,000 Fall-Run fry.
- Sutter Bypass: DWR would increase connectivity of the Sutter Bypass with the Feather River to increase juvenile salmonid rearing habitat. Increasing inundation of the Sutter Bypass can increase food and floodplain habitat for listed salmonids.

4.11.3. American River Adaptive Management of Additional Activities

Reclamation would move temperature compliance upstream and relax storage requirements. Accomplishing biological objectives in different manners, through habitat creation rather than flow releases, would accomplish this operational flexibility without additional fish adverse effects. The following actions would offset this flexibility:

- Spawning Habitat: Reclamation proposes to conduct restoration projects that include gravel augmentation to better support and create spawning habitat in the American River for 245 acres. This effort would focus on the maximum amount of effort needed to create and restore habitat for listed salmonids. Increased temperature flexibility would result from additional area with appropriate substrate in the cold area. This changes from supporting 74,000 adults to supporting 160,000 adults.

  Reclamation would implement up to 2,600 acres of rearing habitat for salmonids. The CVPIA SIT models show that these acreages would increase the inundated area of suitable depths and velocities for spawning habitat from supporting 525,000 fry to 200 million salmon fry.

- Rearing Habitat: Reclamation would conduct rearing habitat projects to improve juvenile growth and survival, including large woody debris placement. Corresponding flexibility would be provided in allowed salvage, if habitat is limiting.

4.11.4. Delta Adaptive Management of Additional Activities

Reclamation would operate to a more negative OMR and adjust salvage loss calculations based on the anticipated population size of the species. If Delta Smelt habitat can be created with food or other efforts (below), Reclamation would remove the Suisun Marsh Salinity Control Gate fall operation.

- Increased use of Joint Point of Diversion (JPOD): Reclamation and DWR propose several scenarios that would benefit from JPOD and would present a Fish Plan for each of those scenarios for programmatic SWRCB approval.
- Additional Delta Smelt Critical Habitat Adaptive Management
    - Introduce Dredge Material for Turbidity (Pilot Action)

      Reclamation would study introducing dredging material to increase turbidity for three years, not necessarily consecutively. The Pilot Action would be taken after the First Flush OMR action. Along with increasing turbidity, Reclamation would also increase monitoring of upstream Delta Smelt movement. Sedimentation could be added to Liberty Island or Suisun Bay, to increase food.
    - Low Salinity Zone - X2 Isohaline for LSZ from D-1641 to Fall X2

      If none of the non-flow Delta Smelt habitat actions above are taken in an above-normal or below-normal water year type year, Reclamation and DWR would release flow in the fall to move the low salinity zone to an area of Delta Smelt habitat. Reclamation proposes to implement the fall habitat adaptive management plan, investigating components of habitat and their importance for Delta Smelt, including productivity, temperature, turbidity and salinity, within a range of flow volume between the fall outflow flow volume from D-1641 and the 2008 USFWS BO Fall Habitat RPA action.
- DCC Improvements: Reclamation would modernize DCC's gate materials and mechanics to include adding industrial control systems, increasing additional staff time, and improve physical and biological monitoring associated with the DCC daily and/or tidal operations as necessary to maximize water supply deliveries. Modernization could allow diurnal operation during closure periods in the 2009 NMFS BO.

  The DCC is more than 65 years old and its gates rely on remote operators to travel to the facility to change their position. When the gates are open, they provide a critical diversion structure for freshwater reaching the CVP South Delta pumping station. The gates are closed to prevent scouring (during high flows), reduce salinity intrusion in the western Delta, and protect Sacramento River ESA-listed and non-listed salmonids. Frequent use of the DCC increases its risk of failure and causes recreational concerns. Additional DCC operation would allow for improved exports and water quality without additional adverse effects on salmonids.
- Tracy Pumping Plant Improvements: Reclamation would consider increasing the flexibility of the pumps at the Tracy Pumping Plant to allow more rapid adjustments.

- Salvage Improvements: Reclamation would improve the Tracy Fish Collection Facility to reduce loss by: 1) incorporating additional fish exclusion barrier technology into the primary fish removal barriers, 2) incorporating additional debris removal systems at each trash removal barrier, screen, and fish barrier, 3) Constructing additional channels to distribute the fish collection and debris removal among redundant paths through the facility, 4) Construct additional fish handling systems and holding tanks to improve system reliability, and 5) Incorporate SCADA into the design and construction of the facility.

  Facility improvements will improve survival of fish salvaged and potentially reduce the loss factors to allow for additional certainty on OMR management with low impacts from salvaging salmonids.
- Skinner Fish Facility Improvements: DWR would work to reduce predation at Clifton Court and reduce pre-screen loss.
- Old River Habitat Improvements: Reclamation would address the predation caused by scour at the Old River / San Joaquin River junction. This would change local hydrodynamics to favor juvenile survival. Reclamation and DWR propose to fill the scour hole in the San Joaquin River just downstream of its junction with the Head of Old River. The scour hole is over 30 feet deep and would be filled with sufficient materials such as rip rap in order to achieve a river bottom elevation similar to the remaining bathymetry of the junction. This action would increase juvenile production and adjust salvage thresholds for OMR management.
- Food Web Augmentation
    - Colusa Basin Drain: Reclamation would work with partners to flush agricultural drainage (i.e. nutrients) from the Colusa Basin Drain through Knight's Landing Ridge Cut and the Tule Canal to Cache Slough, improving the aquatic food web in the North Delta for fish species. Reclamation may work with DWR and partners to augment flow in the Yolo Bypass in July and/or September by closing Knights Landing Outfall Gates and routing water from Colusa Basin into Yolo Bypass to promote fish food production. Zooplankton produced on the Yolo Bypass would move downstream into an area where juvenile and adult Delta Smelt are known to occur at a time of year when food availability may be a limiting factor. Salvage flexibility would be increased corresponding to the effects on the juvenile population, if food is limiting.
    - Sacramento Deepwater Ship Channel: Reclamation proposes to repair or replace the West Sacramento lock system to hydraulically reconnect the ship channel with the main stem of the Sacramento River. When combined with an ongoing food web study, the reconnected ship channel has the potential to flush food production into the north Delta. An increase in food supply is likely to benefit Delta Smelt and their habitat. Salvage would be adjusted in accordance with the anticipated increase in juvenile abundance and Delta Smelt abundance, if food is limiting.
- Delta Habitat Restoration: Reclamation and DWR would work to increase Delta pelagic habitat by 3,000 acres. The restoration could shrink water weeds, grow fish food, create habitat for Delta Smelt and salmonids, and prevent salinity intrusion into the south Delta.

Increases in growth and survival would lead to increased future year abundance, with a corresponding adjustment in future year salmonid salvage, if rearing habitat is limited.

- Diversion Screening: Operating water divisions without screening can result in the entrainment of juvenile fish into the diversions and impact listed and special fish populations in these river systems. Most of the larger diversions in the Central Valley have been screened or are currently proposed for screening. Reclamation and DWR propose to continue screening diversions in the Central Valley under the CVPIA 3406(b)(21) authority to reduce entrainment of salmonids. This may increase juvenile survival, with a corresponding flexibility at Jones and Banks Pumping Plants for salvage.
- Georgiana Non-Physical Barrier: Emigrating salmonids, departing the Sacramento main stem, often enter into the interior Delta at Georgiana Slough, where they undergo high rates of predation and entrainment. Reclamation, in coordination with DWR, may conduct a barriers project similar to the pilot studies conducting by DWR in 2011, 2012, and 2014. DWR proposes to setup a bioacoustic fish fence at Georgiana Slough, along with a combination of different barriers (e.g. floating fish guidance structure) to direct fish into Sutter and Steamboat slough. The action would reduce the entrainment of fish into the Central / South Delta, and increase abundance of juveniles outmigrating in several years. Salvage would be adjusted accordingly.
- North Delta Arc Routing into Sutter and Steamboat Sloughs: The north Delta contains an "Arc" of suitable habitat for salmonid species in areas such as; Yolo Bypass, the Sacramento River, and Suisun Marsh. Reclamation would manage and implement barriers throughout the "Arc" to maximize the benefits of these habitats and direct listed salmonids into these habitats. The action would reduce the entrainment of fish into the Central / South Delta, and increase abundance of juveniles outmigrating in several years. Salvage would be adjusted accordingly.

4.11.5. Stanislaus River Adaptive Management of Additional Activities

- Rearing Habitat: Reclamation may create another 171 acres of side channel and floodplain rearing habitat, to increase rearing habitat to support the progeny of 22,000 adult salmon.
- Spawning Habitat: By 2024, Reclamation may place approximately 75,000 tons of spawning gravel in the Stanislaus River. After reaching this goal, Reclamation would place approximately 12,000 tons of gravel per year in the Stanislaus River. Reclamation may also create another 34 acres of spawning habitat.
- Trap and haul juvenile steelhead to Chipps Island: Reclamation proposes to trap juvenile steelhead in the Stanislaus River and haul them to Chipps Island, bypassing the South Delta.

4.11.6. San Joaquin Adaptive Management of Additional Activities

- Lower SJR Spawning and Rearing Habitat (Steady Finance): Reclamation may create a regional partnership to define and implement a large-scale floodplain habitat restoration effort in the Lower San Joaquin River. This stretch of the San Joaquin River is cut-off from its floodplain due to an extensive levee system, with two notable exceptions at Dos Rios Ranch (1,600 acres) and the San Joaquin River National Wildlife Refuge (2,200

acres). In recent years, there has been growing interest in multi-benefit floodplain habitat restoration projects in the Central Valley that can provide increased flood protection for urban and agricultural lands, improved riparian corridors for terrestrial plants and wildlife, and enhanced floodplain habitat for fish. The resulting restoration could include thousands of acres of interconnected (or closely spaced) floodplain areas with coordinated and/or collaborative funding and management. Such a largescale effort along this corridor would require significant support from a variety of stakeholders, which could be facilitated through a regional partnership.

- Acceleration of the SJRRP: Reclamation may accelerate rearing habitat restoration under the San Joaquin River Restoration Program.

4.11.7. Adaptive Management Governance

Reclamation would modify the charters of the water operations groups under the current RPA to implement the watershed based technical teams for adaptive management on non-flow projects as described in Attachment XX.

5. Effects

This section will include the direct and indirect effects of the Proposed Action on the species or critical habitat, together with the effects of other activities that are related to the action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species [50 CFR 402.02].

6. Conclusion

This section will describe whether the Proposed Action is likely to adversely affect each of the evaluated species. Likely to adversely affect is the appropriate finding in a biological assessment if any adverse effect to listed species may occur as a direct or indirect result of the proposed action and the effect is not discountable, insignificant or wholly beneficial.

7. References